Corporate Accounting and Accountability for Water in a Chinese Context

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Abstract

Water is one of the most vital natural resources, essential for sustaining ecosystems, human well-being, and economic development. Yet freshwater is exceedingly scarce, with less than 1% of the earth's water readily accessible for human use. Industrial pollution further strains these limited resources, underscoring the urgency of corporate accountability in water management. Against this backdrop, this thesis investigates water-related information disclosures and corporate water accountability in China. Five research questions guided this study, which related to (1) the extent of water-related disclosure by Chinese companies; (2) motivations for disclosure; (3) stakeholder expectations; (4) whether disclosures meet these expectations; and (5) challenges to corporate water accountability. China provides an ideal context for such an investigation given its global economic role and persistent water issues. A mixed-methods approach was adopted. First, content analysis was used to examine disclosures by 190 listed Chinese companies across their annual reports; corporate social responsibility reports and sustainability reports; and websites. A novel water-specific disclosure index and scoring system were developed to measure the comprehensiveness of the information disclosed. To complement this, 54 semi-structured interviews were subsequently conducted with corporate managers, government officials and policymakers, and a wide range of stakeholders exert influence on corporate actions and disclosures, including shareholders, labour union managers, academics, the media, and an environmental non-governmental organisation (NGO) manager. The findings reveal substantial shortcomings in current water-related disclosures by Chinese companies. Many companies provided only generalised statements lacking quantitative data and detailed explanations. Disclosure quality varied widely, indicating significant room for improvement. The interviews highlighted that stakeholder demands are a key driver of disclosure. Perspectives differed: academics, media representatives and the NGO manager noted a gap between current practices and their expectations, whereas shareholders, regulators, and policymakers generally viewed disclosures as sufficient. Challenges to corporate accountability identified include the absence of standardised reporting frameworks. Without clear guidelines, voluntary disclosures lack consistency, reliability, and credibility. This research contributes to the literature in several ways. First, it analyses the water disclosure practices of 190 Chinese listed companies, filling a gap in corporate water accountability studies. Second, it introduces an innovative water-specific disclosure index, advancing tools for assessing reporting practices. Third, through extensive interviews, it captures diverse stakeholder views, providing nuanced insights into the drivers, expectations, and barriers of corporate water accountability. Practical contributions are equally significant. The proposed index offers Chinese companies a context-specific tool to enhance disclosure comprehensiveness and consistency. It also provides regulators and standard setters with evidence to guide future water reporting policies. By addressing the urgent need for more transparent and reliable water information, this research advances both academic understanding and practical solutions for corporate water accountability in China and beyond.

Keywords

water accounting, water information reporting and disclosure, water disclosure index, corporate water accountability

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Abbreviations

ACFTU	All-China Federation of Trade Union
CDP	Carbon Disclosure Project
CSR	corporate social responsibility
CSRC	China Securities Regulatory Commission
EIA	Environmental Impact Assessment
ESG	environmental, social and governance
GRI	Global Reporting Initiative
IT	information technology
NGO	non-governmental organisation
PDP	Pollutant Discharge Permit
SEA	social and environmental accounting
SSE	Shanghai Stock Exchange
SZSE	Shenzhen Stock Exchange

Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgments), nor used artificial intelligence tools or generative artificial intelligence tools (unless it is clearly stated, and referenced, along with the purpose of use), nor materials which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

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Chapter 1. Introduction

1.1 Introduction

This chapter serves as an introduction to the thesis, providing an overview of the key components and guiding the reader through the subsequent sections. This chapter is organised into three main sections. Section 1.2 addresses the rationale and significance of the study. It establishes the importance of the research within its broader context by identifying the existing problem and explaining why the chosen topic was investigated. Section 1.3 then outlines the research objectives and research questions. Section 1.4 describes the design of this research, which includes an overview of the research methods employed, detailing their relevance and suitability for addressing the identified problem. Section 1.5 outlines the thesis structure, offering readers a clear roadmap to navigate the document with ease and ensuring a logical flow of ideas throughout the work. Collectively, these sections establish a foundation for the thesis, introducing its purpose, approach, and structure while preparing the reader for the detailed discussions that follow.

1.2 The rationale and significance of the research

Water resources are indispensable for sustaining life, fostering economic development, and preserving ecological balance. They are important to agriculture, where irrigation is essential for food production to meet the demands of a growing global population. Similarly, water underpins industrial processes, serving as a vital input for manufacturing, cooling, and cleaning operations, thereby contributing significantly to economic activities. Beyond these practical applications, water is fundamental to maintaining natural ecosystems, regulating climate patterns, and preserving biodiversity. However, the availability and quality of freshwater resources face escalating threats due to overexploitation, pollution, and the multifaceted impacts of climate change. These pressing challenges underscore the urgent need for effective water management, conservation strategies, and governance frameworks to safeguard this finite and invaluable resource, ensuring its availability for current and future generations.

The challenges and complexities associated with water resources, which we currently face, form the foundation of this research and are derived from three interconnected aspects. The primary motivation stems from an acute awareness of escalating water-related issues, such as water scarcity and pollution. These concerns are not merely environmental in nature but are deeply intertwined with social dimensions, reflecting the multifaceted implications of water management and accountability. Addressing these issues requires understanding water as both an environmental resource and a social necessity. More specifically, water scarcity and pollution are not isolated environmental problems; they represent broader accountability challenges that arise from the interplay of human activity, resource management, and ecological sustainability.

Accountability for these issues extends beyond traditional domains, encompassing the responsibility of various stakeholders, including governments, companies, and communities. Conventional accounting and financial reporting, however, are limited in their capacity to capture and address social and environmental concerns. Social and environmental accounting (SEA) offers an alternative framework, enabling researchers to explore and analyse water-related challenges through a lens that integrates environmental and societal considerations.

The second motivation arises from how accounting can contribute to addressing global water challenges. Despite its importance for ecosystems, communities, and industries, water has traditionally been overlooked in accounting. The corporate sector significantly impacts water-related issues through overconsumption and pollution, posing threats to clean water availability. This highlights the urgent need for corporate accountability for water stewardship. While environmental reporting has gained attention and serve as a mechanism for companies to discharge their accountability, corporate water disclosure remains underexplored, presenting an opportunity for research in this domain. Therefore, this study focuses on corporate water disclosures and accountability challenges.

The third motivation for this research arises from the observation that most existing studies on social and environmental reporting, particularly corporate water disclosure, are predominantly focused on Western contexts (Bennear & Olmstead, 2008; Burritt & Christ, 2016; Kleinman et al., 2017). In contrast, limited attention has been given to water reporting and accountability in China, despite its significant global economic and environmental influence. Therefore, focusing on China not only addresses this gap but also contributes valuable insights to the growing field of water accounting and accountability.

1.3 Research objectives and research questions

The overarching aim of this research is to investigate corporate water disclosure and water accountability practices among Chinese listed companies. Specifically, the study pursues two primary objectives. The first objective is to examine the current state of corporate water disclosure, focusing on the content and comprehensiveness of the disclosed information, as well as the underlying motivations driving these disclosures. The second objective is to explore stakeholder expectations and perceptions regarding water-related information disclosure, providing a broader understanding of the stakeholder expectations and how different stakeholders can influence water information disclosure practices. To address these objectives, five research questions have been formulated and are presented in Table 1.1, each tailored to provide a response to the study's aims. More specifically, the first research question focuses on understanding the current status of water-related information disclosure in Chinese companies, as there is limited research on this aspect in the existing literature. Since water disclosure in

China is voluntary, the second research question explores the motives behind voluntary disclosure practices, aiming to uncover the motivations that prompt companies to engage in water information disclosure. Corporate accountability and transparency involve meeting stakeholder expectations. Hence, research questions three and four investigate stakeholder expectations regarding water-related disclosures and assess whether current disclosures align with their expectations. This understanding is essential for evaluating how well companies are fulfilling their water accountability. Finally, the fifth research question examines the challenges faced by Chinese companies in discharging water accountability. By identifying these challenges, the research aims to identify barriers that hinder effective reporting and accountability, providing insights to improve practices in the future. Consequently, these research questions are designed to guide the analysis and are discussed in more detail in Chapter 3, the literature review.

It is important to note that issues related to water supply chain impact constitute a recognised research direction within the broader field of water accounting in the business context. However, this study focuses specifically on examining current corporate water disclosure practices in China, as well as the motivations and expectations of a wide range of stakeholders. Consequently, matters concerning the water supply chain fall outside the scope of this research. Instead, this study adopts a holistic perspective, emphasising water disclosure and water accountability within the Chinese business context. While specific water-related issues, such as those concerning the water supply chain, are acknowledged as significant, they are not the focus of this thesis. Nevertheless, they present a promising avenue for future research.

Table 1.1 Research questions

RQ1	To what extent are companies in China currently disclosing water-related information in their reports and websites?
RQ2	What are the motivations for Chinese companies to disclose corporate water information?
RQ3	What are the expectations of stakeholders regarding water disclosure in China?
RQ4	To what extent are Chinese companies currently meeting stakeholder expectations concerning water-related aspects?
RQ5	What are the challenges for corporate water accountability in China?

1.4 Research design

Guided by the research objectives, this study adopted a qualitative research method within the exploratory research paradigm to guide the researcher to explore water information disclosure and corporate water accountability in the Chinese business context. Stakeholder theory and

accountability theory are used to explain why companies are expected to disclose water information.

This study uses content analysis and semi-structured interviews to answer the research questions (see Table 1.2). Content analysis was used to analyse secondary data collected from Chinese listed companies' reports, including their annual reports; corporate social responsibility reports; sustainability reports; and environmental, social and governance reports for 2019, and relevant information from their websites at the year-end 2019. The sample comprises 190 companies listed on the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE), providing a broad and representative dataset for analysis.

More importantly, this research develops a specific water disclosure index to evaluate the water-related information disclosed by Chinese listed companies. The development of such an index is motivated by several reasons. First, water-related information disclosure in China is currently voluntary, resulting in substantial variation in both the extent and quality of disclosure across companies. In this context, to effectively investigate the current state of corporate water disclosure, a structured evaluation tool – a disclosure index must be designed and applied to systematically measure and compare the comprehensiveness of disclosures. Second, the disclosure index also serves as a communication tool during the interview process. It is presented to interviewees to illustrate how companies are assessed based on their water-related disclosures.

After the content analysis, 54 semi-structured interviews were conducted to gain additional insights. Following a multi-stakeholder approach informed by stakeholder theory and the concept of holistic accountability, these interviews involved participants from eight distinct stakeholder groups (not only the financial stakeholders), including corporate managers, government officials, shareholders, policymakers from the SSE and SZSE, academics, employee union managers, journalists, and representatives from environmental non-governmental organisations (NGOs). This diverse participant pool ensured that wide-ranging perspectives on corporate water disclosure and accountability were explored, to develop an understanding of the stakeholder expectations and their impact on corporate water disclosure practices.

To conduct the content analysis of water disclosures, a water-specific disclosure index was developed for this research, as well as a scoring system to measure the comprehensiveness of water-related information disclosed by Chinese companies (see Chapter 5 for details on the index development and scoring system design). This index was further refined based on insights gathered from interviews. Participants shared their perspectives on corporate water disclosure,

including their expectations of the information companies should provide and the gaps in existing disclosures. Consequently, a revised disclosure index is proposed, tailored to suit the specific needs and context of corporate water information disclosure in China (see Chapter 8 for a detailed discussion). This index can be used by companies to improve their water-related disclosures and by regulators to develop Chinese-specific water disclosure regulation. The index and the resulting scoring scale will also be useful for academic research on water disclosures.

Table 1.2 Research methods used to answer each research question

RQ1	To what extent are companies in China currently disclosing water-related information in their reports and websites?	Content analysis
RQ2	What are the motivations for Chinese companies to disclose corporate water information?	Semi-structured interviews
RQ3	What are the expectations of stakeholders regarding water disclosure in China?	Semi-structured interviews
RQ4	To what extent are Chinese companies currently meeting stakeholder expectations concerning water-related aspects?	Semi-structured interviews
RQ5	What are the challenges for corporate water accountability in China?	Semi-structured interviews

1.5 Structure of the thesis

The reminder of the thesis is structured into eight chapters. Chapter 2 offers a detailed background of the Chinese business environment and national water challenges, aiming to provide readers with the contextual knowledge necessary to understand the research. This chapter introduces the SSE and SZSE, covering their historical evolution and distinctive features within the contemporary Chinese stock market. Additionally, the chapter examines water-related regulations and legislation, shedding light on the frameworks governing corporate practices in water management. It also discusses the socio-political characteristics unique to China, which shape the roles and influences of social stakeholders such as media, labour unions, and environmental NGOs. These stakeholders exhibit differences in structure and operation compared to their counterparts in Western countries, reflecting China's distinctive governance and societal context. Chapter 3 provides a comprehensive literature review on the field of SEA, with a particular focus on water accounting. This chapter systematically examines the existing body of research, identifying key trends, advancements, and limitations within the literature. Through this process, significant gaps are highlighted, particularly in the context of corporate water disclosure and accountability, which remain underexplored in non-Western settings such

as China. Building on this, the chapter outlines the research questions that have been carefully designed to address these gaps. Chapter 4 outlines the theoretical framework underpinning the research, employing stakeholder theory and accountability theory as foundational lenses. Stakeholder theory provides insights into the interconnected relationships between companies and stakeholders, emphasising the importance of meeting the expectations and interests of all stakeholders. Accountability theory complements this perspective by focusing on the mechanisms through which companies are held accountable for their social and environmental impacts. Together, these theories inform the research by framing corporate water disclosure as a means of addressing stakeholder demands for information transparency and enhancing corporate accountability. Chapter 5 provides a detailed description of the research methods employed in this study, focusing on content analysis and semi-structured interviews as the primary methods for addressing the research questions and objectives. These methods have been carefully selected to ensure a comprehensive exploration of the research problem, allowing for a robust analysis of both quantitative and qualitative dimensions of corporate water disclosure. Moreover, a significant component of this chapter is the development of a unique and specific corporate water disclosure index, which serves as a key contribution of this study. Also, a scoring system is designed for measuring the comprehensiveness water-related information disclosed by companies. Chapters 6 and 7 presents the results of the content analysis and the findings from interviews. The findings from the content analysis and interviews collectively contribute to addressing the research questions. Specifically, the content analysis provides a clear understanding of the current state of water-related information disclosure among Chinese companies, shedding light on its extent and comprehensiveness. The interviews supplement this by offering additional insights into the motivations driving Chinese companies to disclose water-related information, as well as the expectations of various stakeholder groups. Additionally, the interviews explore the challenges surrounding corporate water accountability, which are addressed in the subsequent chapter by proposing a revised index as the solutions that suitable for companies in China. Chapter 8 provides a comprehensive discussion synthesising the findings from both the content analysis and the semi-structured interviews. By integrating these cross-findings, this chapter evaluates the alignment, discrepancies, and intersections between the quantitative data on corporate water disclosures and the qualitative insights from stakeholder perspectives. This discussion highlights the strengths and shortcomings of existing practices and addresses key challenges and opportunities for improving water-related reporting in Chinese companies. More importantly, a revised corporate water disclosure index is presented in this chapter as a significant contribution of this research. This index incorporates insights gained from both research methods and is tailored to the specific socio-political, economic, and environmental context of China. Designed as a practical and actionable tool, the index aims to guide Chinese companies in enhancing the comprehensiveness, transparency, and relevance of their water-related disclosures. By aligning corporate practices with stakeholder expectations

and regulatory demands, the index represents an important step towards fostering greater water accountability and sustainable water management in the corporate sector. Chapter 9 concludes this research thesis by highlighting its key academic and practical contributions. The chapter also identifies the limitations of the research and outlines the opportunities for further research.

Chapter 2. The Chinese Business Context

2.1 Introduction

The objective of this chapter is to explore the intricacies of the Chinese business environment, providing readers with the background necessary for navigating the subsequent chapters. From this contextual information, readers will gain the insights needed to understand the unique Chinese setting of this research.

The Chinese government has historically played a dominant role in shaping regulatory frameworks, enforcing compliance, and directing corporate behaviour in China, particularly in relation to environmental protection. However, the stakeholder landscape in the country has evolved in recent years, reflecting a gradual but noticeable shift towards broader stakeholder engagement. The Chinese context therefore offers a unique lens through which to explore the issues at the heart of this thesis, particularly given the country's ongoing transition from a government-cantered regulatory regime towards a model that increasingly incorporates broader stakeholder concerns.

China also presents a distinct business environment compared to many Western and other Asian contexts. Notably, the country operates two major stock exchanges, the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE), both of which are characterised by unique structural, governance, and regulatory features. These exchanges exert a substantial influence on the domestic corporate landscape. Unlike in more liberalised markets, the Chinese government maintains a strong presence in the operation of these exchanges and frequently utilises them as instruments of macroeconomic control. Consequently, listed companies are often encouraged or required to enhance their corporate governance, transparency, and information disclosure practices, including environmental reporting. Nevertheless, the enforcement of such regulations and the standardisation of disclosure practices remain in a developmental phase, especially when compared to more mature markets in the West.

This chapter therefore provides a clear overview of the distinctive characteristics and the influence of China's two stock exchanges on the national business environment. It also introduces other key stakeholders in the Chinese business context, including the media, labour unions, and environmental NGOs. While these groups play influential roles in shaping corporate behaviour globally, relatively little is known about their specific functions and influence within China. This gap in understanding is particularly relevant given that representatives from these stakeholders groups are included as participants in the semi-structured interviews conducted for this research. Therefore, gaining insights into their unique roles and constraints in the Chinese

context is essential, particularly as their experiences may diverge significantly from the expectations set by Western literature.

This chapter begins with an overview of the two major stock exchanges in mainland China, followed by a discussion on the evolution of voluntary environmental information disclosure, including changes in practices and the inclusion of water-related information. The chapter then delves into China's water-related regulations and laws, with particular emphasis on the recently implemented Pollutant Discharge Permit (PDP) mechanism, which significantly impacts corporate water use and management. Furthermore, the chapter explores the broader influence of the government on the Chinese business environment, alongside the roles of media, labour unions, and environmental NGOs.

2.2 The Shanghai and Shenzhen Stock Exchanges

The purpose of this section is to provide an overview of the two stock exchange markets operating in mainland China, namely the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE). This background is necessary as the participant sample for this research comprises companies listed on both exchanges, allowing for a comprehensive understanding and holistic assessment of the current state of water-related information disclosure among Chinese listed companies. Further details regarding the sample selection process are provided in Chapter 5.

The SSE is now the fifth-largest stock exchange in the world. Stock trading stated in Shanghai as early as 1860. In 1891, the Shanghai Sharebrokers Association was established, regarded as a primitive form of stock bourses in China. Later in 1920 and 1921, the Shanghai Security Goods Exchange and the Shanghai Chinese Security Exchange commenced operations, respectively. By the 1930s, Shanghai had emerged as the financial centre of the Far East, where both Chinese and foreign investors could trade stocks, debentures, government bonds and futures (SSE, n.d.). However, share trading faced a setback after 1949.[1] It was not until the 1980s, with the implementation of reform and opening-up policies, that China's securities market experienced a revival. This led to the establishment of the SSE on November 26, 1990. Regulated by the China Securities Regulatory Commission (CSRC), the SSE plays a crucial role in capital raising and securities trading, emphasising transparency and efficiency to support China's economic growth.

[1] After 1949, the Chinese share market experienced a significant setback due to the establishment of the People's Republic of China and the subsequent shift towards a socialist economic model. Under the new communist government led by the Chinese Communist Party, the economy moved towards state ownership and central planning, which diminished the role of private enterprise and share trading.

The SZSE, meanwhile, was established on 1 December 1990, and is a key stock exchange in China located in Shenzhen, a city adjacent to Hong Kong. It is a self-regulated legal entity under the supervision of the CSRC and plays a crucial role in the nation's financial markets. The SZSE serves as a platform for trading shares, bonds, and various securities issued by publicly traded companies, facilitating capital raising and investment activities. It focuses on promoting innovative and technology-driven enterprises, particularly those in the Shenzhen-Hong Kong Greater Bay Area known for its technological advancements.

Both stock exchanges play an important role in the Chinese business context. The listings of SSE and SZSE are generally similar in most aspects but differ in specific details. First, the SSE focuses more on a company's market value, profitability, and historical performance, with greater requirements for company size and stability, while the SZSE pays more attention to a company's growth potential, being more open to high-tech and growth-oriented companies. For example, companies aiming to list on the SSE are required to have total assets of no less than 3 billion Chinese yuan[2] (equivalent to $421,259,565 USD or $706,216,800 NZD) and a cumulative net profit in the last three years of no less than 30 million yuan (equivalent to $4,212,595 USD or $7,062,168 NZD). Conversely, companies seeking to list on the SZSE must have total assets of no less than 2 billion yuan (equivalent to $280,839,710 USD or $470,811,200 NZD) and a cumulative net profit in the last three years of no less than 20 million yuan (equivalent to $2,808,397 USD or $4,708,112 NZD). This distinction is important, as prior literature suggests that company size is a significant determinant influencing the extent of environmental information disclosure (X. Liu & Anbumozhi, 2009; S. X. Zeng et al., 2010). Given that the sample in this research includes companies listed on both stock exchanges, this study also examines whether differences exist in the level of water-related information disclosure between firms of varying sizes.

Secondly, the SSE and SZSE have a different industry focus when attracting listed companies. The SSE tends to focus more on traditional industries such as finance and manufacturing. Shanghai's status as a financial centre grants it distinct advantages and resources in the financial sector. Consequently, the SSE attracts many financial institutions and traditional manufacturing companies to list, which typically have higher market values and stable profitability. Additionally, the SSE attracts some large companies with long histories that play important roles in the Chinese economy, making them favoured by investors. In contrast, the SZSE concentrates more on technology, internet and emerging industries. As one of the pioneers of

[2] A billion in China is 1,000 million.

China's reforms and opening-up,[3] the city of Shenzhen has a more flexible and innovative economic environment, attracting many technology and growth-oriented companies. The SZSE has taken a series of measures to attract these companies to list, such as launching the ChiNext Board and the Small and Medium Enterprises (SME) Board and providing more convenient and flexible financing opportunities.[4] The SZSE also encourages internet and emerging industry companies to list, given their substantial potential in the Chinese market. The literature suggests that companies operating in water-sensitive industries are expected to disclose more water-related information compared to those in less water-intensive sectors (Burritt et al., 2016; H. Zeng et al., 2020). In this context, it is anticipated that there may be observable differences in the level of water disclosure between companies listed on the SSE and those listed on the SZSE. In summary, the SSE and SZSE exhibit different industry focuses in attracting listed companies, with the SSE prioritising traditional industries and the SZSE emphasising technology, the internet, and emerging sectors. This divergence mirrors the distinct economic structures and developmental trajectories of the two regions, affording investors a diverse range of investment avenues.

Thirdly, the SSE and SZSE are influenced by variations in their respective cities' historical, geographical and economic conditions. Shanghai, as one of China's largest cities, has been an economic and financial hub since the 19th century. Located at the mouth of the Yangtze River, Shanghai boasts excellent waterway transportation, making it one of China's crucial seaport cities and a pivotal hub for foreign trade. Also, Shanghai serves as a cultural and technological centre with a high level of internationalisation and significant influence in capital markets. These factors make Shanghai an ideal location for the SSE. On the other hand, Shenzhen is located in the Pearl River Delta Economic Zone[5] and faces Hong Kong across the sea. It is one

[3] 'Opening-up' refers to the series of economic reforms and policies initiated by the Chinese government in the late 1970s under the leadership of Deng Xiaoping. It marked a transformative shift from a centrally planned economy to a more market-oriented economy. Consequently, this initiative fundamentally changed China's relationship with the global economy and laid the foundation for its rapid economic growth over the following decades.

[4] ChiNext is a share market board launched by the SZSE and designed specifically for innovative, high-growth companies, particularly in sectors such as technology, biotech, and new energy, providing a platform for these companies to raise capital through public offerings. Overall, it plays a vital role in supporting China's tech sector and start-up ecosystem and offering investors opportunities to invest in high growth and high potential companies. The SME Board is a distinct section of the SZSE established in 2004 to provide a platform for small and medium-sized enterprises to rise capital and trade shares.

[5] The Pearl River Delta Economic Zone is one of the most economically dynamic regions in China. It includes the Pearl River Delta, which is formed by the Pearl River and its tributaries in Guangdong Province, as well as the special administrative regions of Hong Kong and Macau. The zone is known for its rapid economic growth, particularly in the fields of manufacturing, technology, and finance. It is a major hub for trade and investment, attracting businesses from around the world.

of China's most developed economic regions and since the 1980s has experienced rapid development, particularly in the fields of technology and manufacturing, achieving remarkable success. The city's economic growth and innovative atmosphere have attracted many technology and growth-oriented companies, making Shenzhen a preferred listing location for these companies. Consequently, Shanghai status as China's economic and financial centre, with high internationalisation and influence in capital markets, contrasts with Shenzhen's position as a pioneer of reform and opening-up characterised by high-tech and growth-oriented business atmosphere.

Lastly, a company can be listed on both the SSE and SZSE, and this situation is commonly referred to as 'dual listing'. This practice is often pursued to expand financing options, enhance visibility, attract more investors, and reduce dependence on a single market. However, dual listing entails challenges. For example, it requires compliance with different listing requirements and regulations, demanding additional time and resources. Companies must also adapt to distinct market environments and investors bases, potentially necessitating changes to business strategies and communication approaches. At the same time, managing regulatory and legal issues across regions requires careful consideration of risks and challenges. To further clarify the concept of dual listing, a dual-listed company refers to an entity that is simultaneously listed on two different stock exchanges, often located in separate countries or regions. This arrangement allows the company's shares to be traded on both exchanges, increasing its accessibility to a broader investor base. Within the context of this research, all participant companies were exclusively listed on the SSE and the SZSE. Furthermore, none of the sample companies maintain simultaneous cross listings on domestic Chinese stock exchanges and foreign exchanges. The percentage of dual-listed companies on the SSE and SZSE is very low. These stock exchanges primarily operate independently, focusing on different industrial sectors, and dual listings between them are rare. Also, there is no clear data on the percentage of companies dual-listed on domestic (SSE or SZSE) and overseas markets.

Furthermore, the SSE and SZSE permit foreign investment, enabling overseas investors to engage through avenues such as the Qualified Foreign Institutional Investors (QFII/RQFII) programmes.[6] These channels facilitate overseas investors' participation in China's domestic stock market, offering prospects to leverage its market development potential. Nevertheless, adherence to regulations and approval processes outlined by the CSRC and the State

[6] RQFII stands for Renminbi Qualified Foreign Institutional Investor, a programme which allows foreign institutions to invest directly in the Chinese mainland share market through Renminbi channels. The implementation of the RQFII scheme expands the pathways for overseas investors to enter the Chinese capital market and promotes the international use of the Renminbi, which is the official name of the currency (yuan).

Administration of Foreign Exchange is necessary for overseas investors. From this perspective, there is an observable trend indicating that the Chinese government and capital markets are becoming increasingly open to foreign investment. This openness may result in greater expectations from overseas investors for transparency and more comprehensive information disclosure. Consequently, such expectations may influence domestic companies to adopt more transparent practices and enhance their overall level of corporate disclosure.

2.3 Corporate environmental disclosure

In the context of environmental information disclosure, the trend towards voluntary environmental disclosure began in 2001 when the former State Environmental Protection Administration issued the Notice on Doing a Good Job in Checking the Environmental Protection of Listed Companies. This notice encouraged companies applying for listing on the SSE to voluntarily disclose their environmental performance. It marked a significant milestone in fostering environmental transparency within the corporate sector. In 2008, the SSE introduced its Guidelines on Environmental Information Disclosure for companies listed on the exchange, which specifically targeted high-polluting industries such as thermal power generation, iron and steel production, cement manufacturing, electrolytic aluminium manufacturing, and mineral exploitation. These companies were required to disclose environmental information either in their annual reports or in standalone corporate social responsibility (CSR) reports. However, companies not classified as high-polluting were exempt from the required disclosure. Additionally, the guidelines fall short in providing comprehensive instructions or standardised frameworks on how companies should prepare their reports, including water-related disclosures.

In 2009, both the SSE and SZSE issued their social responsibility indices, encouraging top performing companies to disclose their CSR practices. In 2024, new guidelines were introduced: the Guidelines No. 14 of SSE for Self-Regulation of Listed Companies – Sustainability Report (Trial); and Self-Regulatory Guidelines No. 17 for Companies Listed on the SZSE – Sustainability Report (Trial), which require companies to disclose sustainability-related information.

Water information disclosure in the Chinese business context remains voluntary, as there are no regulatory requirements compelling companies to disclose water-related information (C. Liu et al., 2021; Z. Zhou et al., 2018). The above guidelines only mention the disclosure of total water consumption (in metric tons), water usage intensity (per unit of output), water conservation goals, actions taken, and any challenges encountered in water recycling and resource management. However, the mandatory scope of these guidelines is limited to companies listed on major indices such as the SSE 180 and STAR 50 on the SSE, and the SZSE 100 and ChiNext

Index on the SZSE.[7] Other companies, not covered by these indices, are still only encouraged to voluntarily disclose water-related information. This leaves significant gaps in the consistency and comprehensiveness of water disclosure across various sectors in China.

Overall, environmental information disclosure in China has evolved significantly since the early 2000s, with key regulatory milestones that have shaped corporate practices. From the first notice calling for environmental transparency to the introduction of specific disclosure guidelines in 2008 to the 2024 expansion of disclosure requirements and the mandatory scope, these developments have had a substantial influence on how Chinese companies disclose their environmental impact. Although water issues remain a relatively small part of these guidelines, this research aims to address this gap by introducing a comprehensive corporate water disclosure index, which will contribute to improving and enhancing the comprehensiveness of water-related information disclosure. Moreover, the evolution of corporate disclosure practices over the past decades reflects a broader trend towards enhanced information transparency in China. This progression is closely linked to regulatory reforms and the continuous promotion of disclosure guidelines introduced by the relevant authorities. These initiatives represent an institutional effort to strengthen corporate accountability by encouraging companies to provide more information to stakeholders. The observed improvements in disclosure practices further highlight the role of transparency as a critical mechanism through which firms are encouraged, or in some cases compelled, to discharge their corporate accountability.

2.4 Water-related regulation and law in China

In recent years, China has implemented significant changes in its policies and regulations regarding water resource management and protection. The government has introduced measures to address water pollution and scarcity issues, emphasising the importance of water environmental protection. The most important revisions and reforms of water-related regulations and laws affecting Chinese companies are now discussed.

In November 2016, the State Council of the People's Republic of China introduced the Implementation Plan for the Pollutant Discharge Permit (PDP) System to advance

[7] The SSE 180 Index is a stock index of SSE, representing the top 180 companies by float-adjusted capitalisation and other criteria. The STAR 50 Index is a stock index that tracks the top 50 companies listed on the Science and Technology Innovation Board of the SSE, including companies from sectors such as biomedicine, information technology, renewable energy, and other high-tech industries. It aims to represent the overall performance of the most representative and influential companies listed on the SSE, which can be seen as a benchmark for investors who are interested in China's emerging technology and innovation-driven companies. SZSE 100 Index is a free-flow capitalisation-weighted equity index and comprises the 100 largest and most liquid companies listed on the SZSE.

environmental governance reform and enhance environmental quality. This initiative was developed in accordance with key environmental legislation, including the Environmental Protection Law of the People's Republic of China and the Overall Plan for Ecological Civilization System Reform. The plan represents a pivotal step in implementing the PDP system in China, signifying a significant milestone in the country's environmental policy and regulatory framework.

The PDP system has had a substantial impact on companies engaged in industrial wastewater discharge. This system mandates that companies report pertinent information to the Ministry of Ecology and Environment to secure the permit.[8] Such information includes the types of pollutants contained in wastewater, concentrations, quantities, and discharge locations of wastewater. The ministry retains the discretion to publicise this information, which would be available on their official website. Companies are required to publicly display a valid PDP, but they can choose to voluntarily disclose the detailed information.

In 2017, the Water Pollution Prevention and Control Law of the People's Republic of China underwent revisions and was officially enacted. This reform aimed to enhance the protection and management of the water environment. The impact on companies includes increased penalties for corporate water pollution and heightened standards for penalties to address the increasingly serious water pollution issues caused by companies. Specifically, the revised law has several key aspects affecting companies. First, it imposes higher penalties for illegal wastewater discharge, requiring companies to cease such activities, and establishes higher fines, with provisions for the administrative detention of responsible personnel. Secondly, it mandates stricter requirements for water environmental protection, heightened supervision of the water environment, and an elevated standard for water environment protection. Thirdly, it necessitates the enhancement of water resource development and utilisation, as well as the promotion of sustainable water resource use. Lastly, it mandates the construction and management of sewage treatment facilities, the enhancement of sewage treatment rates, and the reduction of sewage's impact on the water environment. Overall, this revised law establishes a legal framework for China to bolster water environment governance, which is crucial for enhancing water environment quality, protecting water resources, and fostering sustainable economic development.

[8] The Ministry of Ecology and Environment, formerly the Ministry of Environmental Protection of the People's Republic of China, is the nation's environmental protection department charged with the task of protecting China's water, air, and land from pollution and contamination. Directly under the State Council, it is empowered and required by law to implement environmental policies and enforce environmental laws and regulations.

The reform of China's water resources management system represents a significant stride towards environmental preservation and sustainable development in recent years. The primary objective of this reform is to establish a robust water resource management framework, ensuring the judicious use and sustainable development of water resources. Two key aspects of this reform have had a significant impact on corporate water management. First, since the PDP system was enacted, companies involved in discharging industrial wastewater must apply for a PDP to legally discharge their wastewater. This mandate requires companies to provide relevant information to the ministry, and failure to comply can result in severe penalties. Secondly, China has increased efforts to curb illegal water extraction, particularly targeting the business sector. This aims to improve the management of water resources, ensuring the integrity and stability of water ecosystems, and promoting the ecological preservation of its water resources. Thirdly, China has intensified its routine supervision of the water environment through regular inspections of sewage treatment plants, industrial enterprises, and other relevant facilities to ensure compliance with prescribed discharge standards. These measures are instrumental in enhancing targeted and effective regulation of the water environment, thereby providing robust support for the protection of water resources and the overall health of the water environment.

In summary, China has implemented several proactive policies and measures to improve water environmental governance, yielding significant results. At the same time, amendments to China's laws and policies concerning water environments have intensified efforts to combat water pollution, protect water resources, and enhance the sustainability of water environments. Prior literature suggests that the corporate sector is a major contributor to water-related environmental degradation, including both water pollution and the overconsumption of freshwater resources. Although increasing regulatory stringency has led to improvements in the overall water environment, there remains a notable absence of formal mandates or legal requirements compelling companies to publicly disclose water-related information. According to accountability theory, companies should be held accountable for the environmental consequences of their operations, including their impact on water resources. In this context, voluntary disclosure can serve as a mechanism through which companies discharge their water-related accountability. However, in the absence of mandatory disclosure requirements, an important question arises as to what actually motivates companies to voluntarily disclose water-related information under the current regulatory and institutional landscape.

2.5 Government influence in the Chinese business context

The Chinese government plays an influential role in the local business context, and it can be considered the most impactful stakeholder in the Chinese business environment (W. Li & Zhang, 2010; Marquis & Qian, 2014). There are several reasons for this. First, the Chinese government's involvement in regulating and influencing national economic activities is

extensive and multifaceted (Y. Luo, 2007; M. Xu et al., 2018). One key aspect is its control over market entry and competition (W. Long et al., 2020). The government implements regulations and policies that dictate which industries are open to private investment, the level of foreign ownership allowed, and the conditions for market entry, which can be seen in sectors like energy, telecommunications, and finance (Fei, 2021; Song & Wang, 2018). At the same time, the government's role in setting industry standards and policies is crucial. For example, initiatives developed by the government, such as Made in China 2025, outline strategic goals for developing key industries such as advanced manufacturing, robotics, and biotechnology (Agarwala & Chaudhary, 2021). These policies not only guide the direction of economic development, but also influence national resources allocation, research priorities, and technology development. In addition, the Chinese government is actively involved in enforcing environmental regulations (Y. Liu et al., 2021). More specifically, stringent environmental laws require companies to comply with relevant pollution control measures and meet strict discharge standards. Non-compliance with these regulations and laws can result in fines, production shutdown, or even legal consequences, which emphasises the government's influence over business operations (R. Li & Ramanathan, 2018; B. Zhang et al., 2017). Consequently, the Chinese government's regulatory and interventionist approach in economic activities is pervasive and has a significant impact on how businesses operate in the country.

Secondly, the Chinese government has exclusive control over the management of national resources, including water resources, has a significant impact on businesses operating in the country. Water is one of the fundamental natural resources for almost every business, and the Chinese government's control over water resources manifests in several ways that can affect business operations and strategies. For example, companies need to comply with regulations and policies related to water usage, conservation, and pollution control (H. Cheng & Hu, 2012). Also, the government controls the availability and cost of water for certain types of companies. For instance, companies operate in regions experiencing water shortage or scarcity may face restrictions on water use or higher prices for water, which will consequentially reflect on the production costs and profitability (Z. Chen et al., 2013; Zhong & Mol, 2010). As a result, the Chinese government's control over water resources is a key factor that Chinese companies need to consider.

Overall, the Chinese government's control over the legal system, market competition, and access to critical resources positions it as the most influential stakeholder for companies operating in China. According to instrumental stakeholder theory, companies are primarily accountable to powerful stakeholders who can affect their strategic objectives and business performance. Under this view, if the government holds the greatest influence, then corporate accountability would logically be directed primarily towards regulatory authorities. This raises

the key question of why companies would voluntarily disclose water-related information to the broader public or other stakeholder groups when such disclosures are not legally mandated. In contrast, normative stakeholder theory asserts that companies have ethical responsibilities to all stakeholders, not just the powerful ones. From this perspective, the normative branch of stakeholder theory offers a more compelling explanation for voluntary water-related disclosure because it recognises that the expectations and interests of a broader range of stakeholders, including customers, employees, NGOs, and the media are also holding significance. Given this, it is important to consider the roles and influence of multiple stakeholders in shaping corporate disclosure behaviour. Subsequent sections discuss the different stakeholder groups involved in China, focusing on their defining characteristics and the unique nature of their influence within the Chinese socio-economic and regulatory environment.

2.6 Freedom of the Chinese media

The extent of media freedom in China has been a consistent target for criticism from other nations, particularly the Western world (Anderson, 2009). In the Western context, China is often characterised as one of the most repressive countries in terms of media control. This perception is supported by China's ranking of 177 out of 180 countries in (media) freedom, as reported in the 2021 World Press Freedom Index (Tang & Zhang, 2023). More specifically, the Chinese government has been subjected to sustained scrutiny due to its imposition of constraints on the freedom of expression for Chinese citizens and journalists.

The Chinese government's control and restrictions on domestic media are viewed as instrumental in maintaining political stability and controlling public opinion (Gamso, 2021). Critics argue that these restrictions stifle dissenting voices and limit the flow of information and information transparency, resulting in a narrative that aligns with the government's interests (Anderson, 2009). Consequently, journalists and media outlets face pressure to self-censor and adhere to government guidelines, limiting their ability to report freely on sensitive topics.

The control of media in China can be attributed to a fundamental divergence between Chinese and Western liberal traditions concerning the interplay between individual rights and the collective good (Tang & Zhang, 2023). This contrast in philosophical underpinnings has led to a distinct approach to media governance, with China prioritising social harmony and stability over individual freedoms, in contrast to Western democracies where freedom of expression is often upheld as a cornerstone of democratic governance (Cannie & Voorhoof, 2011). In Chinese cultural tradition, the primacy of the group or nation's interests over those of the individual is a deeply ingrained principle. This principle dictates that in situations of conflict between individual and group or national interests, the latter should be prioritised. The Chinese government is thus tasked with the responsibility of discerning and safeguarding the nation's

best interests, asserting that these interests inherently align with the collective will of the majority of the populace (Tang & Zhang, 2023).

It is evident from prior studies that the media plays a pivotal role in shaping public opinion and influencing policy outcomes (Okechukwu, 2023; Robinson, 2001). In this context, the Chinese government, with its control over the media, utilises it as an instrument to achieve several key objectives. First, the media is used to disseminate information that aligns with the government's agenda and portrays its policies as being in the best interests of the nation. This helps in shaping public perception and garnering support for government initiatives. Secondly, the media is instrumental in mobilising public participation in the policymaking process. Through propaganda and persuasive messaging, the government encourages citizens to actively engage with its policies and contribute to their implementation. This not only enhances the legitimacy of the government's actions but also creates a sense of ownership among the populace. Thirdly, the media is utilised to rally political support for the ruling regime by portraying the government as the custodian of the nation's best interests and highlighting its achievements (Brady, 2009; Hong, 2013). This contributes to maintaining political stability and continuity.

2.7 Labour unions in China

In China, the All-China Federation of Trade Union (ACFTU) serves as the national trade union centre and people's organisation. It is organised into 31 regional federations and 10 national industrial unions. The ACFTU holds the distinction of being the world's largest trade union and is China's sole legally mandated trade union, to which all types of union, including unions at the company-level, must be affiliated. In other words, labour institutions or independent unions in China are illegal, with only the ACFTU permitted to operate (Tylor & Li, 2007; Zhu et al., 2011).

In China, a labour union operates differently from its Western counterpart in several key aspects. First, Chinese unions lack political independence, being controlled by the State-Party through a unique hierarchical system. This system comprises three levels: the ACFTU at the top, followed by industrial and regional unions at the middle level, and numerous workplace unions at the bottom level embedded within companies. This structure ensures that the ACFTU, as the apex body, maintains control over all lower-level unions, aligning their activities with government and Party directives. This centralised control distinguishes Chinese unions from Western models, where unions typically operate independently from government control, advocating for workers' rights and interests autonomously.

Secondly, union leaders or officials in China are typically appointed by the State-Party rather than elected by union members. These leaders often have a background in government

administration, further aligning the union's actions with State-Party's interests. As a result, Chinese unions often prioritise following directives from higher levels over representing the voices of workers at the grassroots level. This dynamic shifts the allegiance of union leaders and officials towards the State-Party rather than towards the union members they are meant to represent and protect. Consequently, Chinese unions have less bargaining power compared to their Western counterparts when engaging in collective consultations with companies or management (B. Taylor et al., 2003; Warner, 2000).

Overall, Chinese unions are unique labour institutions that operate within a distinct social and economic framework. They primarily function to assist the State-Party in maintaining social and political stability. Additionally, they collaborate with company managers to enhance production efficiency and represent and protect the interests of employees. This dual role reflects the unions' position as both an administrative arm of the State-Party and a representative body for workers. This unique arrangement underscores the complex relationship between the unions, the government, and the workforce in China's socio-political environment.

2.8 Environmental NGOs in China

The concept and role of NGOs vary significantly among countries due to differences in culture and political systems (Ma, 2002). In China, the regulatory environment shapes the functions of NGOs, leading to distinct practices compared to Western countries. Chinese NGOs primarily act as intermediaries between the state and society, aiding the government in engaging with its constituents. This unique role reflects the Chinese government's approach to governance and its efforts to manage social and political dynamics. Additionally, Chinese NGOs are constrained by their limited capacity, especially in relation to policy advocacy (Zhan & Tang, 2013). Therefore, most NGOs in China, including foreign NGOs, tend to focus on social services, community development, and advocacy within the boundaries set by the state, highlighting their dual function of supporting government initiatives while also addressing societal needs. There is a wide range of NGOs, with varying focuses and objectives. This section, however, primarily focuses on introducing the environmental NGOs in China because they have potential influence in advocating for environmental protection, sustainable practices, and corporate responsibility in managing water resources.

Domestic environmental NGOs in China are predominantly run by private citizens and operate at the grassroots level. In contrast to their Western counterparts, Chinese environmental NGOs tend to be less engaged in advocating for public policy changes and organising large-scale social movements (Y. Lu, 2007). Therefore, Chinese environmental NGOs often adopt a non-confrontational approach, refraining from directly challenging the authoritarian system (Ho, 2007). This phenomenon can be attributed to several factors. First, environmental NGOs in

China operate within a unique socio-political environment characterised by stringent regulations and a sensitivity to political dissent. This environment tends to discourage active engagement in policy advocacy by these NGOs. Secondly, many environmental NGOs in China face constraints in terms of organisational capacity, primarily due to limited material and financial support. As a result, a considerable portion of their funding comes from overseas foundations, which are often avoid of funding activities that could be deemed politically sensitive in China.

In recent years, the number of environmental NGOs in China has grown due to several factors (Y. Li et al., 2021; Pien, 2020). First, increased political transparency has allowed NGOs to operate more openly, mobilising grassroots support (T. Johnson, 2011; Y. Tan, 2014). Additionally, China's open-door reforms and market economy development have created a more pluralistic society with diverse public preferences, fostering a conducive environment for domestic NGOs. The government's focus on social stability has led to greater support for NGOs, viewing them as partners in addressing social and environmental issues (X. Gao & Teets, 2021; Grano & Zhang, 2016). Finally, the decentralisation of political authority has created opportunities for NGOs to participate in policy formulation, particularly in environmental protection, and act as watchdogs over local governments and polluting businesses (Y. Tan, 2014; Y. Xia, 2024).

Despite the increasing presence of domestic environmental NGOs in China, existing literature highlights the challenges these organisations face in establishing and sustaining themselves, particularly in a developing, authoritarian state where civil society tends to be weak (Böhmelt, 2014; Bondes & Johnson, 2017). In Western contexts, international NGOs are typically seen as having greater influence on environmental policies due to their broader networks, greater access to public media, and better resource allocation (Teets, 2018). However, the situation in China presents a unique case. Pien (2020) found that domestic environmental NGOs in China have a more significant impact on environmental information disclosure than international NGOs. The study suggests that grassroots organisations, being deeply embedded in the local context, are more effective in influencing environmental disclosures through their connections with diverse local actors, mobilisation of residents, and active participation in environmental campaigns. This grassroots influence, facilitated by strong ties with local communities, plays a crucial role in influencing environmental policies, while international NGOs, despite their greater resources, have had relatively insignificant effects on disclosure practices in China (Qing, 2022). These findings underscore the importance of local context in determining the impact of environmental NGOs in China.

Environmental NGOs exert influence on corporate practices through various channels, one of the most impactful being the publication of their independently produced reports. During this

research conducted for this thesis, a manager from an environmental NGO provided examples of publicly accessible reports that demonstrate how NGOs influence corporate information disclosure. These reports address a broad range of corporate environmental issues, including climate change, industrial water and air pollution, carbon emissions, and environmental concerns within supply chains, and are mainly targeted at Chinese listed companies.

The scope and analysis of these reports vary. For example, some focus on individual companies (i.e., normally using a case study on a specific company), while some focus at the industry level, the stock exchange level, or the overall level which includes all listed companies in China. At the same time, these reports provide diverse information, such as analytical data on the impact of new environmental policies and regulations on corporate practices, the extent of policy adoption within sectors, and records of penalties imposed on companies for non-compliance (with company names disclosed when relevant).

These reports are published primarily on the open-access platform of the Institute of Public and Environmental Affairs, a non-profit environmental research institution headquartered in Beijing. Their preparation often involves collaboration, with academic researchers contributing to their analytical rigor. Notable examples include *A&H Shares Climate Information Disclosure Survey, 2020* and *Observation on Environmental Information Disclosure of Listed Companies, 2021*. Sector-specific reports, such as *Observation on Environmental Information Disclosure of Listed Companies – Environmental Disclosure of Listed Pharmaceutical Companies Has Improved, 2022*, provide insights into both industry practices and the evolving standards of corporate environmental disclosure in China. Collectively, these reports not only serve as a resource for the public and stakeholders but also exert pressure on companies to enhance their environmental awareness and information transparency. The majority are primarily written in Chinese, with a select portion available in both Chinese and English.

Overall, Chinese environmental NGOs play a vital role in raising awareness about environmental issues, providing education on environmental conservation, and implementing localised environmental protection initiatives. Their efforts contribute significantly to addressing environmental challenges and promoting sustainable development at the local level.

2.9 Supply chain in the Chinese business context

Most Chinese companies source the majority of their raw materials and components from domestic manufacturers rather than relying heavily on overseas suppliers. China possesses a highly developed and diversified manufacturing sector, encompassing industries such as steel, chemicals, textiles, electronics, packaging, and machinery. Domestic manufacturers in these sectors are capable of producing a broad range of products with competitive costs, high

efficiency, and consistent quality. This extensive domestic manufacturing capacity allows Chinese companies to meet their production and operational requirements without relying on long, complex, or geographically dispersed supply chains, thereby reducing dependence on imported materials. At the same time, this domestic sourcing approach mitigates the exposure of companies to risks commonly associated with global supply chains, including shipping delays, customs restrictions, tariffs, currency fluctuations, and geopolitical uncertainties. By sourcing locally, companies are able to establish and maintain closer, more collaborative relationships with their suppliers, which enhances coordination across production processes, facilitates more effective quality control, and ensures closer monitoring of environmental practices.

While many Chinese industries are largely self-sufficient in sourcing raw materials and components domestically, long and complex supply chains remain prevalent in certain high-value and technologically advanced sectors. Industries such as electronics, automotive manufacturing, and other high-tech fields often depend on intricate supply networks that integrate both domestic and international suppliers. For instance, although China has a robust manufacturing base capable of producing a wide range of components, certain specialised and high-precision parts, such as advanced semiconductor chips, precision-engineered machinery, and specialised optical equipment, are still predominantly sourced from technologically leading countries, including Japan, South Korea, Germany, and the United States. These imported components are often critical to the performance, safety, or functionality of final products and are not easily substitutable by domestically produced alternatives due to technological, quality, or intellectual property constraints. The nature of these industries means that their supply chains can span multiple tiers, involving primary suppliers, subcontractors, assemblers, and logistics providers. As a result, these extended supply chains may be less transparent, with limited visibility into the practices of upstream suppliers. This complexity can present challenges for quality assurance, cost control, and regulatory compliance. The reliance on international suppliers further exposes these industries to risks such as trade disputes, export controls, geopolitical tensions, and disruptions caused by global crises. Consequently, managing such supply chains requires more sophisticated oversight mechanisms, robust supplier audits, and coordinated sustainability initiatives to ensure that environmental and social standards are maintained throughout the value chain.

2.10 Conclusion

This chapter has provided an overview of the distinctive Chinese context to put the thesis into context. It began by outlining the background of the two major stock exchanges in mainland China – the SSE and SZSE – and discussing the current state of water-related information disclosure within the Chinese business landscape. The differences between the SSE and SZSE were examined, including the types of companies and their respective industry focuses, as this

research draws its sample from companies listed on either exchange to provide a more comprehensive and holistic understanding of corporate water disclosure practices in China. According to existing literature, there are variations in disclosure levels between the two exchanges, and this study will assess whether the findings from the content analysis (see Chapter 6) align with those of the prior literature.

Additionally, this chapter explored the regulatory landscape concerning water-related laws and policies, the Chinese government's role in shaping corporate behaviour, and the influence of other stakeholder groups, such as the media, employees, and environmental NGOs. Given that these stakeholder groups may act differently in other contexts, it is necessary to understand their unique functions within China. More importantly, these stakeholders are gaining increasing prominence, and their perspectives and influence on corporate water disclosure are further investigated through the interviews conducted for this study.

Traditionally, the Chinese government has been regarded as the most powerful stakeholder in the Chinese economy. However, with evolving social dynamics, it is critical to reassess whether this power dynamic has shifted and whether the existing literature's findings still apply. This research argues that although the government remains the most influential stakeholder, there are emerging indications of a shift towards a broader stakeholder orientation. This evolving trend is explored in Chapters 8 and 9.

The next chapter reviews the literature on water accounting and accountability within the accounting discipline.

Chapter 3. Literature Review

3.1 Introduction

This chapter provides a review of the literature on water accounting and corporate water information disclosure, positioning these topics within the broader framework of social and environmental accounting. Given the critical role that water accounting plays in this field, the chapter begins by introducing the concept of social and environmental accounting, establishing a foundation for understanding the specific nuances of water-related issues.

It is essential to emphasise that water is inherently both a social concern (i.e., overconsumption, limited accessibility to clean water, and water scarcity) and an environmental concern (i.e., water pollution). The implications of this are explored through a review of existing literature. In doing so, the chapter also considers the Chinese context, which presents a unique case for study due to the country's rapid economic growth coupled with significant water-related challenges. China serves as the context for understanding broader global water issues, thereby underscoring its relevance as a focal point for this research.

Furthermore, this chapter delves into the impact of business activities on natural water resources, emphasising the critical importance of corporate water information disclosure. This discussion leads to the formulation of research questions designed to address gaps in the existing literature, particularly in the context of Chinese business practices. Consequently, addressing the research questions will ultimately contribute to the corporate water accounting and corporate water information disclosure literature.

3.2 Water and its social and environmental implications

The global demand for freshwater sources has reached unprecedented levels, making the availability of clean water one of the most pressing concerns in modern society (Albert et al., 2021; Baggio et al., 2021; B. K. Mishra et al., 2021). Despite considerable efforts from multiple disciplines, including engineering, meteorology, geography and hydrology, the global water supply remains insufficient to meet the combined human and environmental requirements (F. Johnson et al., 2021; Vogel et al., 2015; Workman et al., 2021; J. Xia et al., 2022).

Current demand for freshwater is outstripping supply in several countries (Shoko et al., 2017; M. Xu et al., 2018). Y. Gao et al. (2012) highlighted that water shortages are prevalent in China, with the water availability level for the capital significantly far below United Nations standards for water per capita. Furthermore, countries such as South Africa, India and Australia have also been marked as water scarcity regions (Lange et al., 2007; McFarlane et al., 2012).

Water scarcity is not entirely a natural phenomenon. While studies have shown that geographical differences and climatic change may influence the natural distribution of water resources (Alcamo et al., 2007; Beck & Bernauer, 2011; Gilbertson et al., 2011; McCluney et al., 2012; Van Oel et al., 2009), human impact and overexploitation are the dominant causes of water shortages (Krueger et al., 2017; Van Dijk et al., 2013). Research by Ercin and Hoekstra (2014) indicated that the increase in the world population is a driving force behind the issue of water scarcity. Postel (2000b) argued that population growth will reduce the renewable water supply, with 38% of the global population projected to live in water-stressed regions by 2025. More importantly, the agriculture sector is the largest user of freshwater sources, accounting for over 70% of global freshwater withdrawal. Consequently, water shortages can have a significant impact on agricultural production, potentially leading to critical issues regarding food scarcity (Fogel & Palmer, 2014; Jiang, 2009; B. K. Mishra et al., 2021; Rosegrant et al., 2009; Signori & Bodino, 2013).

Many issues that human beings are currently facing are related to water quality, and this is expected to become more crucial in the future (L. Lin et al., 2022; Schwarzenbach et al., 2010; Y. Zhou et al., 2014). Notably, only 3% of the global water on Earth is freshwater and available for human use (Baggio et al., 2021; R. K. Mishra, 2023). With this limited amount of freshwater, poor water quality and water pollution are significant issues. Prior literature has consistently highlighted water quality issues as one of the most pressing challenges facing humanity in the 21st century (Giri & Qiu, 2016; Gleick, 2000a). The increasing global chemical pollution of natural water sources poses severe risks to both aquatic ecosystems and human health (Schwarzenbach et al., 2010). Studies have demonstrated that rising levels of water contamination, largely driven by the discharge of untreated effluents, are a key factor contributing to water pollution (Jayaswal et al., 2018; Preisner, 2020). Within this context, the business sector, particularly the industrial sector, plays a significant role in exacerbating water pollution through the release of industrial wastewater (Edokpayi et al., 2017; Roy & Shamim, 2020; Singh et al., 2018; Tariq & Mushtaq, 2023; Yin et al., 2021). As a result, water quality concerns are not only a social issue but also a critical environmental challenge that demands urgent attention.

3.3 Water situation in China

China and the rest of the world is increasingly connected, both economically and environmentally (Jin et al., 2016; J. Liu & Diamond, 2005; Z. Wang & Sun, 2021). China's water problems have drawn a vast amount of attention both domestically and internationally (X. Han et al., 2021; X. J. Wang et al., 2018; S. Wong, 2007; H. Yang et al., 2003; Yardley, 2007; Zevenbergen et al., 2018). Prior studies investigating water pollution on a national scale have

found that major Chinese rivers, including the Mudan, Haihe, and Yangtze Rivers, exhibit severe levels of pollution (J. Huang et al., 2021; She et al., 2019; X. Zhang et al., 2021). Insufficient wastewater treatment and rapid economic growth have been identified as two key contributors to water pollution in China (H. Cai et al., 2020; Tang et al., 2022). Additionally, the literature emphasises that rapid industrialisation and urbanisation are significant factors contributing to water shortages and the degradation of water quality, resulting in large-scale water pollution (Y. Fan & Fang, 2020). As the world's largest developing country, China is undergoing various social and environmental transformations (H. Huang, 2020; Kalsie & Arora, 2019; H. Long et al., 2011; Rui et al., 2019). Among these transformations, water has always been a crucial issue. Despite China's relative abundance of natural resources, water is becoming an increasingly precious resource.

Selecting China as the research context provides an important reflection on the global water situation. First, China is the world's most populous country, with a population exceeding 1.4 billion inhabitants and representing approximately 20% of the global population (Bai & Lei, 2020; Jing et al., 2020; Xiao et al., 2022). Simultaneously, it is also the fourth-largest country in the world, covering 9.6 million km^2 in geographical units (J. Fan et al., 2019; S. Guo et al., 2019; F. Liu et al., 2022). Given its vast land area, water resources should theoretically be abundant. Unfortunately, China is also facing multiple global water challenges, such as water scarcity and pollution (B. Cai et al., 2019; He et al., 2021; J. Huang et al., 2021; Tang et al., 2022). From this perspective, the insights obtained from water accounting in China can also be generalised to other contexts.

Secondly, since the implementation of the Reform and Open-door Policy[9] in the late 1970s, China has achieved remarkable economic success at a rapidly increasing rate, surpassing the growth of many other major countries (Goldstein, 2020; S. C. Majumder & Rahman, 2020; Y. Zhang & Yu, 2021). Due to its astonishing economic growth, China has become one of the most economically influential countries worldwide (J. Guo et al., 2022; Higgins et al., 2016; J. Jian et al., 2021). For instance, China is now the largest trading nation and the second-largest economy globally, serving as the primary or secondary trading partner for nearly every country in East, Central, and South Asia. Contributing over 30% of global economic growth, China's economic

[9] The Reform and Open-door Policy, introduced in 1978 by Deng Xiaoping, represented a significant turning point in the nation's economic and social development. The policy sought to shift China from a centrally planned economy to a more market-oriented system, while maintaining the political framework of the Communist Party. Key components of this policy included economic reforms, the opening of China to foreign trade and investment, agricultural and industrial reforms, as well as the promotion of foreign direct investment and global integration. The policy played a crucial role in China's emergence as one of the world's largest economies, lifting millions out of poverty and driving rapid industrialisation and urbanisation.

ties with the rest of the world are vast and deeply influential, underscoring its significant role in the global economy (Kastner & Pearson, 2021; D. Zhang et al., 2019). Moreover, China leads the world in several key industries, including manufacturing, steel production, textile, solar energy, and electronics production (L. Li, 2018; X. Li et al., 2021; Müller & Voigt, 2018; Prăvălie et al., 2019; X. Zhang et al., 2021; L. Zhou & Zhou, 2019).

This economic success, however, is characterised by a high level of heavy industry and largely achieved by competing for resources at the expense of the ecological environment and increased environmental pollution (Abbasi et al., 2022; L. Shao et al., 2019; G. Xu et al., 2020; W. Zheng & Walsh, 2019). Among many environmental degradation issues, water pollution is one of the most critical issues leading to the current dilemma (T. Ma et al., 2020). Prior literature consistently emphasises that poor water quality can cause significant environmental damage (T. Ma et al., 2020; Nong et al., 2020). In this regard, water quality has suffered immensely due to the discharge of industrial and municipal wastewater (Z. Shi et al., 2021; Tang et al., 2022).

In general, surface water and groundwater are the two primary water supply sources that sustain normal water usage and consumption (Smakhtin et al., 2004; Tso, 2004; Wada et al., 2014). However, studies have shown that 80% of the major rivers in China suffer from high levels of contamination, making them no longer habitable for aquatic life (R. K. Mishra, 2023; Yin et al., 2021). Approximately 40% of surface water in China is polluted, with 20% being so contaminated that the water is too toxic for human contact (B. Chen et al., 2019; D. Han et al., 2016; Y. Jian, 2012; Q. Wang & Yang, 2016). Studies have also revealed that more than 200 million Chinese citizens rely on unsafe water sources to sustain their daily life (D. Han et al., 2016; Tao & Xin, 2014). Safe drinking water is closely related to public health, and the failure of industrial wastewater disposal and ineffective wastewater treatment has resulted in many regions struggling to access safe drinking water and sanitation,[10] with waterborne diseases[11] in many areas reaching alarming rates (Y. Ji et al., 2020; P. Li & Wu, 2019; Ward et al., 2018).

In addition to water pollution, China has also encountered water shortages since the early 1980s (Liu et al., 2017; J. Wang et al., 2020). Water shortage has become a critical social concern in China due to several reasons. First, China has an exceptionally low per-capita amount of water

[10] According to a survey conducted by *China Youth Daily* (2013), over 70% of people in China are experiencing threats derived from the current water pollution situation.

[11] Tao and Xin (2014) found that approximately 190 million people fall ill and about 60,000 people die from diseases caused by water pollution in China every year. Banister (1998), meanwhile, found that China's rising cancer rate is heavily associated with poor drinking water quality. More importantly, waterborne disease is a universal issue which not only affects China but also significantly impacts many other countries (see also Blackburn et al., 2004; Charron et al., 2004; Kramer et al., 2001).

resources due to its large population, making it one of the countries with the most severe water shortages in the world (Barlow & Clarke, 2017; Oki & Kanae, 2006). Secondly, the dominance of the monsoon climate causes the temporal and spatial distribution of water resources in China to be extremely uneven, which is the main cause of floods and droughts across the country (Piao et al., 2010; T. Zhang et al., 2012). Thirdly, the highly uneven spatial distribution of water resources does not align with the distribution of the population and agricultural land (Chang et al., 2016; Smil, 2016). Studies have shown that the northern and northwestern parts of China face extreme water shortages, whereas the majority of available water resources are concentrated in the southern regions (Jun & Chen, 2001; J. Liu et al., 2008; C. Zheng et al., 2010). Despite this, a large portion of the population and agricultural land is located in the north, where only a small fraction of the water resources is accessible. Additionally, the north serves as the political and cultural centre of China. Therefore, water scarcity has always been a pressing concern in the country.

Furthermore, Y. Zhou et al. (2014) signalled that among 662 cities in China, 300 were facing insufficient water supplies and 110 were experiencing significant hardship in accessing usable water sources. At the same time, 30 out of the 32 metropolitan regions with a population exceeding 1 million inhabitants were struggling to meet water demands. As in many other countries, the allocation of available water resources in China is inconsistent with social needs. Jiang (2009) highlighted that rapid economic development, urbanisation, and population growth are the primary reasons of the increasing demand for water (see, e.g., L. R. Brown & Halweil, 1998; Clarke, 2013). These factors significantly affect the sustainable use of water in China, causing many cities to be in a situation where the available water sources have exceeded the sustainable limits. Consequently, it has become increasingly challenging to meet essential water usage requirements.

Overall, water is of paramount concern, making it a social and environmental issue of unparalleled importance. While water is no longer considered a free good, the responsibility for sustainable water use across all sectors of society has become critical. It is now a matter of survival.

3.4 Water in the business sector

Water is one of the defining challenges both for now and the future. The reliability and availability of useable water resources associated with water scarcity and pollution are posing threats not only to the ecological environment but also to the business sector (Gasbarro et al., 2016; Lambooy, 2011; Larson et al., 2012).

Water use by businesses has been brought into the spotlight by increased uncertainty surrounding global water supplies and competing demands (Chapagain & Hoekstra, 2008; Miller, 2006; Oki & Kanae, 2006; Vörösmarty et al., 2000). Studies have found that the business sector is one of the largest freshwater users in modern society and is regarded as a significant contributor to water pollution (Christ & Burritt, 2017b, 2018; Larson et al., 2012).

From a business perspective, companies across almost all industrial sectors are dependent on freshwater for their ongoing survival. In this context, water is a vital part of natural capital, and it is also one of the prominent resources utilised as a substantial input for companies to enhance industrial processes and maintain business activities (Hoekstra, 2009).[12] The importance of water within the business context has been demonstrated by many past studies, with findings covering a wide range of industries, including energy, mineral, red meat, food and beverage and wine industry (Christ, 2014; Cote et al., 2009; Egan, 2018; Egan & Frost, 2010; Ercin et al., 2011; Peters et al., 2010; Timms & Holley, 2016; Waye, 2008). Although water is a crucial element for business operations, overuse and mismanagement of water resources by companies have frequently been criticised as major contributors to water pollution (Chapagain & Tickner, 2012; Miao et al., 2015; Sakamoto et al., 2019; Tevapitak & Helmsing, 2019).

The implications of water use by the business sector is a crucial topic for researchers. This is because water-related issues extend beyond being merely environmental concerns; they also have significant social and economic implications. Water scarcity and pollution present serious challenges to businesses, impacting their operations, supply chains, and long-term sustainability. This is particularly evident in China, where rapid industrialisation and urbanisation have exacerbated water-related problems. Given the global interconnectedness of economies and the environment, the insights gained from examining water issues in China can provide valuable lessons that are applicable to other contexts worldwide.

Furthermore, the link between geographical concerns about water scarcity and organisational water accounting lies in the fact that China is currently facing significant freshwater shortages. The corporate sector, as both a major consumer of freshwater resources and a key contributor to water pollution, should play a central role in addressing these issues. Consequently, the implementation of comprehensive water accounting and strengthened water-related information disclosure and transparency within organisations becomes imperative to address the growing environmental and sustainability challenges associated with freshwater management.

[12] Many studies have demonstrated that water is not only important for industrial production but also significant to many other economic-related activities such as mining, oil, gas, food production activities, and the generation of electricity (see, e.g. Signori & Bodino, 2013).

3.5 Water accounting and accountability

Research devoted to social and environmental issues has a history of more than 50 years in the accounting literature (Bebbington et al., 1999; Deegan & Soltys, 2007; Gray et al., 1992, 2002; Mathews, 1997; Parker, 2005). Academic studies from various fields have established social and environmental accounting (SEA) as an important topic in accounting research (Deegan, 2002; Gray et al., 1995b; Lehman, 1999; Owen, 2008; Parker, 2014; Perego & Kolk, 2012).

Over the past decades, there has been a growing awareness of social and environmental issues in accounting research (J. Brown & Fraser, 2006). At one level, there appears to be a universal agreement that the corporate sector is one of the main contributors to the current social and environmental situation (Andrade et al., 2015; Kolcava & Bernauer, 2021). In this context, accounting research plays an important role in exploring and theorising the relationship between companies and their impact on society and the environment (J. C. Chen & Roberts, 2010; Chung & Cho, 2018; Deegan, 2017; Nicholls, 2020).

SEA is a broad field encompassing various branches of research, including accounting for sustainable development, management accounting for social and environmental issues, accounting for human rights and biodiversity, and social accountability (Chung & Cho, 2018). Given the maturity of SEA research, the research direction has gradually become more focused and analytical. Among several current SEA topics, one stream of research is specifically focused on social and environmental information reporting in an attempt to understand the relationship between companies and their corporate impact on society and the natural environment (Gray et al., 1995b; Hackston & Milne, 1996; Tagesson et al., 2009; Uddin et al., 2018; Van Staden & Hooks, 2007). In this respect, a body of empirical studies has explored the social and environmental information disclosed by companies under certain themes, including human rights disclosures (Hess, 2019; McPhail & Adams, 2016; McPhail & Ferguson, 2016), corporate carbon disclosure associated with climate change (Bebbington & Larrinaga-Gonzalez, 2008; Datt et al., 2019; Depoers et al., 2016; Kolk et al., 2008), biodiversity (Addison et al., 2019; Adler et al., 2017; Boiral, 2016; Gaia & Jones, 2017; Haque & Jones, 2020), employee-related matters (Dias et al., 2019; Vithana et al., 2021; S. J. Williams & Adams, 2013), and other societal-related disclosures (Axjonow et al., 2018; Birkey et al., 2018; Reverte, 2012; Riyadh et al., 2019; D. E. Taylor et al., 2019; Yekini et al., 2017).

Among the many SEA research streams, water is a major focus (Christ & Burritt, 2017b; Fogel & Palmer, 2014; Egan & Schaltegger, 2023; Ercin et al., 2011; Hazelton, 2015; Morris et al., 2023). Notably, water is widely recognised as a natural resource that sustains all life forms on

earth (Cosgrove & Loucks, 2015). It is one of the essential elements for maintaining our ecosystem and serves as a crucial resource that businesses heavily rely on to support their daily operations and activities (Antonelli & Ruini, 2015; Christ & Burritt, 2017a; Cosgrove & Rijsberman, 2000). This understanding is deeply embedded in our cultural background. However, as a gift of nature, water is a finite resource in terms of its availability (Fogel & Palmer, 2014; Koehler, 2008). As noted earlier, only approximately 3% of the earth's water is freshwater, including rivers, lakes and underground aquifers (Kılıç, 2020). The remaining 97% exists as saltwater in the oceans. However, of that 3% of freshwater, 2.7% is stored in glaciers, ice caps, and deep groundwater, making it largely inaccessible for direct human use (Musie & Gonfa, 2023). Consequently, less than 1% of the world's total freshwater is readily available for human consumption, highlighting the importance of sustainable freshwater management and conservation. Recent studies indicate that the rate of freshwater withdrawal and exploitation has surpassed its capacity of naturally replenishment through the hydrological cycle, leading to over 1 billion people currently facing the threat of water scarcity with inadequate access to safe drinking water (He et al., 2021; Ungureanu et al., 2020; D. Yang et al., 2021).

Overconsumption and water scarcity with respect to quantity, and water pollution with respect to quality, are the key water sustainability issues that our world is currently facing (Bhaduri et al., 2016; Gleick & Palaniappan, 2010; Maté-Sánchez-Val & Aparicio-Serrano, 2023; Nydrioti & Grigoropoulou, 2023; Sakamoto et al., 2019; Signori & Bodino, 2013). Furthermore, problems such as increasing population, urbanisation, socioeconomic change, biodiversity loss, evolving energy needs, global warming, and rapid economic growth are considered as interrelated factors that threaten the availability of freshwater for life in general (M. J. Jones & Solomon, 2013; Milne & Grubnic, 2011; B. K. Mishra et al., 2021). In this context, issues related to water are not merely environmental problems but also exist as significant social concerns. Therefore, the United Nations Educational, Scientific and Cultural Organization signifies that water is one of the greatest challenges of this century (Connor, 2015).

The concept of 'water accounting' is inherently flexible and adaptable, allowing it to be defined and utilised differently depending on various contexts and research objectives (Christ & Burritt, 2017b; Morrison et al., 2010). Initially, the term was predominantly applied within the scientific community, primarily to investigate and examine specific environmental issues such as drought, flood and water scarcity (Molden & Sakthivadivel, 1999; Pedro-Monzonís et al., 2015; Seckler et al., 1999). Over time, it has evolved into a valuable tool for analysing and measuring the consumption, depletion, and production of water within a defined geographical area (Molden, 1997). This adaptability enables water accounting to serve diverse purposes, from informing policy decisions to enhancing the sustainability practices of businesses and communities.

In the business context, water has often been treated as a free commodity rather than a valued asset and/or a resource to be managed with care (Christ, 2014; Martinez, 2015). While water is a significant environmental concern, it is also a vital resource for companies. J. A. Allan (1998) posited that when water is consumed during the production process, the trade of the finished goods can be seen as trade in water, which needs to be accounted for. Hazelton's (2014) research echoed this perspective, suggesting that labelling the water footprint of products is an important measure. Such labelling can enhance public water literacy by indicating the amount of water used in the production, thereby increasing transparency in water consumption and support informed decision-making among customers regarding the water impact of their purchases (see also Morrison et al., 2009, 2010).

Corporate water accounting is an emerging topic in SEA research and is also a relatively new subject for business entities and professional bodies (T. Allan et al., 2015). Although a range of studies have been labelled as 'water accounting' or 'corporate water accounting', there is no universally agreed-upon definition (Hazelton, 2015; Morrison et al., 2010). However, corporate water accounting can be broadly defined as a systematic process by which companies measure, monitor, and disclose information about their water use, wastewater discharge, and water-related impacts throughout their operations. This comprehensive approach encompasses quantifying metrics such as water withdrawals, consumption, wastewater treatment, and discharge, along with evaluating the quality and environmental implications of discharged wastewater (Christ & Burritt, 2017b; Morrison et al., 2010; Tingey-Holyoak, 2014; Tingey-Holyoak & Pisaniello, 2019).

Furthermore, corporate water accounting extends to offering comprehensive and systematic water-related information to both internal and external users, facilitating decision-making and evaluation (Christ & Burritt, 2017b; Hewawithana et al., 2023; L. Zhang et al., 2021). Moreover, corporate water accounting enables companies to discharge their water accountability to important stakeholders by reporting or disclosing water-related information (Botha & Middelberg 2016; Hazelton, 2013; Kleinman et al., 2017; Tello et al., 2016; H.C. Yu, 2022). This transparency allows stakeholders to make informed decisions with regard to their interactions with the company, fostering greater trust and alignment regarding water sustainability (Handmaker et al., 2021; Jacobs et al., 2016; Megdal et al., 2017).

The corporate water accounting literature can be categorised into several streams. The first stream focuses on using case studies to explore accountability from the water industry

perspective[13] (Crowther et al., 2006; Hepworth et al., 2022; Jiménez et al., 2018; Larrinaga-Gonzélez & Pérez-Chamorro, 2008; Lewis & Russell, 2011; McDonald-Kerr, 2017; Moyo & Liebenberg, 2015; Mutiganda et al., 2021; Ogden, 1995, 1997; Ogden & Clarke, 2005; Ogden et al., 2006; L. K. Tan & Egan, 2018; Von Schwedler, 2011). Although the findings of these studies are diverse, they collectively provide a solid foundation confirming the existence and significance of different accountability within the private water industry and public water sector. This evidence suggests that the information disclosed by water-related industries holds substantial value for both internal (managers and employees) and external stakeholders (the public).

The second stream of literature focuses on water accounting from the managerial perspective, particularly at the industry level, including the wine, food and beverage industry (Aivazidou et al., 2018; Burritt & Christ, 2017; Christ, 2014; Christ & Burritt, 2017b; Ercin et al., 2011; Lyu et al., 2023; Olusanmi et al., 2021; Pawsey, 2015; Turner et al., 2010; Weber & Saunders-Hogberg, 2018) and the notion of water management efficiency (Egan, 2014).

The third stream of literature focuses on water information disclosure. From a global reporting practice perspective, Morikawa et al. (2007) conducted a comprehensive review of the reporting practices of 139 global companies across 11 water-intensive industry sectors. Their findings revealed that while 97% of these companies provided information related to water management and performance, only 18% disclosed information at the local or facility level. Additionally, the quality of the disclosed water information varied significantly across companies, indicating inconsistencies in transparency and reporting standards. Barton and Morgan-Knott (2010) subsequently found that among 100 public companies in water-intensive industries, only 63% reported information on water consumption, with just 14 companies providing quantitative data on water withdrawal. Similarly, Morrison and Schulte (2010) highlighted the poor state of global water reporting practices. Although over 80% of companies in their study claimed adherence to the Global Reporting Initiative (GRI) guidelines, their disclosures frequently omitted key indicators, such as stakeholder engagement and materiality assessment.

[13] 'Water industry' generally refers to a sector focused on the management, treatment, and distribution of water resources for various purposes, including water supply, agriculture, industrial processes, and sanitation. The water industry may be operated by private companies, public entities, or through public-private partnerships. Existing literature on the water industry, often explored through case studies, has examined diverse forms of accountability within the sector and how these accountabilities are communicated to relevant stakeholders. Among these methods, water information disclosure has emerged as a key mechanism for fulfilling accountability. Furthermore, incorporating this body of research into the review process enhances the completeness of the water accounting literature review.

Additionally, numerous errors were identified in the reporting of water quantity and quality, further undermining the accuracy and reliability of corporate water disclosures.

The findings on global water reporting practices have been mirrored at the national level in countries such as China, Australia, the United States, and various European contexts. For instance, Frost et al. (2005) reviewed the water disclosures of Australia's 100 largest companies against the prevailing GRI guidelines. Their study revealed a generally low level of environmental disclosures, with only 14% of companies providing very basic information related to water themes, such as water consumption. Similarly, water-related risk disclosures among Australia's largest companies revealed that physical water risks, such as availability, were more critical than costs. Shortages in water quantity, which can disrupt supply chains and significantly impact production, were deemed more urgent than rising water costs, which companies could more easily absorb. Despite the significance of water supply risks, few companies disclosed relevant information on this issue (see also Egan & Frost, 2010), suggesting there is significant room for improvement. More recently, Botha and Middelberg (2016) conducted a content analysis of 37 public companies in South Africa to evaluate water-related reporting against disclosure requirements. Their findings indicate significant variation in the level of water information disclosed, with companies providing different levels of detail and depth in their reporting. Notably, the mining sector outperformed other industries in terms of water-related disclosures (see also Dennis et al., 2015; Leong et al., 2014; Mudd, 2008, 2012; Talbot & Barbat, 2020).

Gibassier (2018) analysed the annual reports, sustainability reports, and CDP[14] water responses of French CAC 40 companies to assess their water reporting practices. Her findings indicate that French multinational corporations exhibit relatively immature practices in water-related reporting. Additionally, her research highlights that some existing frameworks, such as the European Water Stewardship Standard, are too advanced for many companies given their current level of reporting maturity. Morris et al. (2023) subsequently examined the water-related disclosures of 35 FTSE 100 companies, finding that water sustainability reporting is largely concentrated within a few industrial sectors, including energy, materials, and consumer staples. Their analysis revealed that most companies focus their water disclosures on operational aspects, such as water consumption, while offering limited insight into the broader water challenges they face. This suggests significant potential for further improvement in constructing a more comprehensive narrative around water-related risks and other sustainability efforts.

[14] CDP, formerly known as the Carbon Disclosure Project, is an international non-profit organisation that provides an environmental impact disclosure system for use by both the private and public sectors.

H. C. Yu et al. (2020) conducted an empirical analysis of water information disclosure practices among 247 US companies across various industry sectors. Their findings reveal that the overall level of water disclosure is relatively low, leading to a significant gap between stakeholder expectations and the companies' water reporting performance. This insufficiency in water-related transparency highlights a disconnect between corporate practices and the rising demands for robust water stewardship (see also Fung et al., 2007). H. C. Yu (2022) and Z. Zhou et al. (2020), meanwhile, examined water information disclosure practices among Chinese listed companies and identified several factors influencing corporate water information transparency. Their research reveals that companies operating in highly water-sensitive industries were more likely to voluntarily disclose water-related information. Additionally, companies with greater market power[15] were more inclined to engage in voluntary water disclosures, often positioning themselves as industry benchmarks for water sustainability practices.

An increasing number of studies utilising quantitative approaches are beginning to explore the potential impact of corporate water information disclosure on the cost of capital in China (C. Liu et al., 2021; H. Zeng et al., 2020; Z. Zhou et al., 2018). Recent research has also examined factors such as the association between gender diversity on corporate boards and voluntary water information disclosure (C. Liu et al., 2023). These studies suggest that both financial and corporate governance factors play important roles in shaping water disclosure practices among Chinese companies. However, this body of literature remains in its early stages, with relatively few studies focused on water-related information disclosure compared to other environmental topics (L. Zhang et al., 2021). This indicates a gap in the research and highlights the need for a deeper understanding of corporate water reporting practices in the Chinese business context.

The last stream of literature focuses on the development of water accounting tools aimed at addressing the diverse needs of corporate water accounting and reporting (Chalmers et al., 2012; Morrison et al., 2010; Russell & Lewis, 2014). Molden and Sakthivadivel (1999) first introduced the concept of water balance approach, and aimed to use common language to communicate water-related actions carried out in water use sectors, including irrigation, municipal, industrial, environmental and other uses of water. They also classified water balance components into water-use categories that reflect the consequences of human interventions in the hydrological cycle.

[15] In the study by Z. Zhou et al. (2020), the term 'market power' refers to a company's ability to influence product prices, reflecting its position within the market. The authors measured market power based on profit margins and categorised it into three levels: weak, medium, and high. Companies with weak market power are forced to become followers, companies with medium market power have more opportunities for making decisions, and companies with high market power can set market prices and obtain excess profits.

Morrison et al. (2010) reviewed several prominent water accounting frameworks, including the Water Footprint Standard by the Water Footprint Network (see Aldaya et al., 2012; Hoekstra, 2011), the Life Cycle Assessment (Berger & Finkbeiner, 2010), the Global Water Tool from the World Business Council for Sustainable Development, and the Water Sustainability Planner developed by the Global Environmental Management Initiative. Their findings underscore three critical challenges: first, a lack of coordination and standardisation among key stakeholders; second, a deficiency in watershed-related data, especially when compared to direct water accounting for operations; and third, limited attention to supply chain water accounting.

Chalmers et al. (2012) introduced the Australian Water Accounting Standards, which were developed based on the principles of internationally accepted financial accounting standards. The framework aims to provide accurate and transparent water information to users, enabling informed decision-making about the allocation and management of water resources (Chalmers et al., 2012; Tello et al., 2016). Numerous water accounting systems have been initiated over the past decades. However, many of these tools have been developed in isolation, often as standalone systems with unique features and functions (Chalmers et al., 2012; Chapagain & Tickner, 2012; Daniel & Sojamo, 2012). Despite these differences, a common objective among these water accounting tools is to provide high-quality, relevant water-related information that supports the achievement of corporate water sustainability and accountability (Chalmers et al., 2012; Russell & Lewis, 2014; Signori & Bodino, 2013).

Water is a crucial component of environmental information disclosure. Notably, water-related disclosures are primarily voluntary, reflecting an absence of mandatory regulatory frameworks in many jurisdictions (Ben-Amar & Chelli, 2018; Burritt & Christ, 2016; C. Liu et al., 2021). Voluntary disclosure of water information offers several benefits. First, companies that engage in such practices tend to exhibit greater ethical consideration towards stakeholder expectations, fostering long-term sustainable relationships over short-term profit maximisation (Buallay, 2019). Secondly, voluntary disclosure also enhances transparency concerning corporate water management, providing stakeholders with clearer insights into companies' environmental accountability (X. J. Wang et al., 2018; H. C. Yu et al., 2020; H. Zeng et al., 2020).

Nevertheless, voluntary disclosures may not accurately reflect a company's environmental performance (Bewley & Li, 2000; Clarkson et al., 2011). The literature suggests that management might strategically disclose information, shaping environmental narratives to align with organisational interests (Cormier et al., 2011; Dye, 1985; Kim & Lyon, 2011; Y. Li et al., 1997; A. Solomon & Lewis, 2002). The absence of regulatory requirements and oversight allows managers discretion over the extent and place of disclosed information, leading to

considerable variability in both the quantity and quality of environmental disclosures (C. De Villiers & Van Staden, 2011; O'Donovan, 2002; J. F. Solomon & Solomon, 2006;). As C. Liu et al. (2021) report, only about 23% of Chinese listed companies disclosed water-related information between 2010 and 2018, which is largely attributable to the lack of enforceable regulations and monitoring mechanisms (Qiu et al., 2016; Ramanathan, 2018; H. Zeng et al., 2020). Thus, it becomes essential to more closely examine the motivations driving corporate water disclosure practices in China.

As noted earlier, in China corporate water information disclosure is voluntary, resulting in a lack of standardised reporting guidelines for companies to follow. This absence of unified disclosure and evaluation standards has substantial implications for the quality and comparability of disclosed information (Z. Zhou et al., 2020). Research identifies the GRI as one of the most widely recognised frameworks for voluntary social and environmental disclosure on a global scale (H. S. Brown et al., 2009; Nikolaeva & Bicho, 2011; Overell et al., 2008). As a multi-stakeholder network, the GRI has facilitated the development and application of sustainability reporting guidelines since the late 1990s (Dennis et al., 2015). However, while the GRI is a prominent framework internationally, its application by Chinese companies remains limited (Dong et al., 2014; Y. Yang et al., 2021). Given the relatively low number of Chinese companies currently disclosing water-related information, there is a clear need for water-specific disclosure standards and guidelines that can support comprehensive and transparent reporting. Recognising this gap, this research will propose a unique and specific disclosure index designed to provide practical guidance for companies, enabling them to achieve a more thorough and consistent approach to water-related information disclosure.

Overall, regardless of which stream of research is being considered, the findings consistently highlight the critical importance of water accounting information. This information plays a vital role in shaping the flow of accountability between businesses, society, and the natural environment. By providing accurate and relevant water-related data, water accounting facilitates more informed decision-making and strengthens the connection between corporate water practices and broader social and environmental responsibilities.

3.6 Corporate water information disclosure and reporting

Corporate water accounting serves as a critical tool for decision-makers and corporate managers by providing them with essential water-related data and information to account for, measure, and assess sustainable water usage. This, in turn, helps them to identify and mitigate potential water-related risks, including financial, operational, product, reputational, regulatory, and supply chain risks (Chalmers et al., 2012; Christ & Burritt, 2018; Hoekstra, 2017; Morrison et al., 2009).

Corporate water accounting emerged in response to growing concerns over the mismanagement of water resources by businesses, a practice that contributes to global water scarcity. To address this concern, companies need water-related information to ensure effective water resource management (Chapagain & Tickner, 2012; Christ & Burritt, 2017b). Consequently, academic research in corporate water accounting, particularly in water-related information reporting, has expanded significantly as the value of such information is increasingly recognised (Christ & Burritt, 2017b; Hazelton, 2013, 2015; Morrison et al., 2010; Ogbeide & Ugbogbo, 2023; Z. Zhou et al., 2018). A review of the corporate water accounting literature shows that a substantial portion of these studies are conducted by Australian academics, positioning the country as a global leader in leading research in the water accounting domain. This prominence is likely influenced by Australia's own experiences and challenges with water resources, as well as its development of national water accounting standards (Chalmers et al., 2012; Gibassier, 2018). Building on their established frameworks and expertise, corporate water accounting can be more specifically defined as "a systematic process of identifying, recognising, quantifying, reporting, and assuring information about water, the rights and other claims to that water, and the obligations against water" (Water Accounting Standards Board, 2009).

This definition offers a clearer and more distinct understanding of corporate water accounting by emphasising its role in reporting water-related information and water rights to external stakeholders. These stakeholders might otherwise lack access to such crucial information but require it to make informed decisions regarding the allocation of resources. According to the Australian Water Accounting Standards Board (2010), corporate water accounting serves as a vital tool in bridging this information gap, thereby facilitating more effective decision-making in resource management.

Prior literature has identified several key aspects that underscore the importance of corporate water information. First, accounting information is widely recognised as critical due to its significant influence on the decision-making processes of both internal and external stakeholders (Bushman & Smith, 2001; Hopwood, 1972, 1974; Lev, 1989; Parsons, 2003; Wall & Greiling, 2011). From this perspective, corporate water accounting information plays an essential role by offering structured guidance that enable decision-makers to access and utilise relevant data (Christ & Burritt, 2017b; Daniel & Sojamo, 2012). This, in turn, facilitates the formation of informed corporate water-related decisions, ultimately contributing to the promotion of more sustainable water usage practices (Christ & Burritt, 2018; Morrison et al., 2010). In addition, this viewpoint aligns with long-standing ideas on the role of accounting. For example, Beams and Fertig (1971) state that "accounting provides information upon which decisions are made – decisions that result in economic and social actions. If the resulting

activities disrupt the environment, then accounting is, at least in part, accountable for that disruption" (p. 37).

Secondly, access to fresh and clean water is not merely a privilege but a right of every human being (Larson et al., 2012). In this context, the disclosure of corporate water information is integral to upholding the rights of individuals to access essential information. Hazelton (2013) brought the concept of modern human rights agreements into the discussion of corporate water disclosures, arguing that the right to water is an extension of the right to life. Following Hazelton's analysis, the availability and accessibility of water-related information can therefore be viewed as a human rights issue. This viewpoint has also been supported by the work of other researchers (see, e.g., C. Cooper et al., 2011; Gray & Gray, 2011; Islam & McPhail, 2011). Consequently, this perspective underscores the ethical responsibility of companies to transparently disclose water information, ensuring that individuals are informed and empowered to exercise their rights concerning water access and usage.

Thirdly, corporate water reporting has emerged as a critical tool for shaping public perceptions of a company's environmental performance and its commitment to sustainable practices (Fialho et al., 2021; C. Liu et al., 2021; H. C. Yu et al., 2020). Empirical evidence from past studies suggests that companies leverage corporate water information disclosure to construct a positive social image. In an era of increasing global water scarcity, such disclosures not only highlight a company's efforts to mitigate water-related risks (Z. Zhou et al., 2018) but also build its reputation as a responsible corporate citizen (C. Liu et al., 2021; H. C. Yu et al., 2020). By disclosing detailed water-related information, companies provide stakeholders with the necessary data to evaluate the potential social and environmental risks associated with their decision-making.

Fourthly, disclosing water-related information plays a pivotal role in a company's accountability practices (Hazelton, 2013; Signori & Bodino, 2013). Corporate water reporting serves as part of a broader strategy of discharging corporate water accountability, and this can be practised through communicating water-related information to various stakeholders (S. M. Huang et al., 2022; Tello et al., 2016). By publicly sharing their water-related information, companies invite scrutiny and engage in accountability dialogues that can strengthen their relationships with stakeholders and enhance accountability between the company and its stakeholders (Rodrigue, 2014; Wehn et al., 2020). Therefore, disclosing water-related information not only enhances transparency, but also demonstrates a company's commitment to continuous improvement in water sustainable practices, which is increasingly important in the context of current global water situation (Lambooy, 2011; H. C. Yu et al., 2020).

Although the literature highlights several compelling reasons for companies to disclose corporate water information, this practice is still emerging and evolving in many contexts (H. C. Yu, 2022). Empirical evidence from past studies reveals that companies in various countries are only beginning to engage in water-related information disclosure, with the level and consistency of such disclosures varying significantly (Gibassier, 2018; H. C. Yu, 2022; L. Zhang et al., 2021). For instance, Burritt and Christ (2017) examined water-related information disclosure among 100 listed Japanese companies. Their findings suggest that larger companies with heightened sensitivity to water risks are more likely to disclose water-related information and respond proactively to stakeholders' concerns about water-related issues. Botha and Middelberg (2016) found comparable results in their study of corporate water disclosure across different business sectors in South Africa. They observed that although different sectors exhibited varying levels of water-related information disclosure, those in highly water-sensitive sectors provided more detailed and comprehensive disclosures.

In addition, Northey et al. (2019) found that the advent of corporate sustainability reporting and water accounting standards has encouraged the disclosure of water-related information in the mining industry. They also noted that the quality of disclosure has improved significantly over time. However, because corporate water reporting is still an emerging practice, the findings from empirical studies are not necessarily generalisable or representative of the global business landscape. For example, Remali et al. (2016) found that even among companies in Malaysia with higher water risks, water-related information disclosure remains an uncommon reporting practice. This suggests that the extent and quality of water-related information disclosure varies considerably across different countries and sectors (see also H. C. Yu, 2022; L. Zhang et al., 2021).

Given the absence of a unified standard for water information disclosure and the voluntary nature of such practices in most countries, conducting an exploratory study on corporate water information disclosure could yield valuable insights into the topic and make a significant contribution to the existing water accounting literature. China, as one of the fastest-growing economies in the world, is uniquely positioned in this discourse due to its severe water-related challenges and its ongoing attempts to disclose water-related information. Also, there has been a marked surge in research dedicated to corporate water information disclosure, as an increasing number of academics have begun to explore the intricate relationship between water resources and business practices. This growing interest has positioned corporate water information disclosure as a prominent focus within the current academic and business landscape (D. Pan & Fan, 2021; H. C. Yu, 2022; L. Zhang et al., 2021; Z. Zhou et al., 2018; Z. Zhou et al., 2020). As a result, China offers a good context for reflection on the global water crisis, and as the world's largest-growing economy, investigating corporate water accountability in China through the

lens of water-related information disclosure is very important, with implications that extend across economic, social, and environmental dimensions. Furthermore, the insights derived from examining China's approach to water information disclosure could offer valuable lessons for other regions, especially those facing with similar water-related challenges. Under this overarching premise, the first research question was designed to understand the current status quo for corporate water information disclosure within the Chinese business context:

> RQ1: To what extent are companies in China currently reporting and disclosing water-related information?

Previous research has examined the motivations behind corporate water information disclosure and reporting, with the majority of theoretical and empirical studies focusing on Western contexts (Burritt & Christ, 2017; Morris et al., 2023). The factors driving such practices within Chinese companies have received comparatively less attention in the literature, resulting in a significant gap in understanding the unique motivations in this context. Despite some early studies attempting to uncover the factors driving Chinese companies to disclose environmental information (see, e.g., X. Liu & Anbumozhi, 2009; S. X. Zeng et al., 2011), these efforts yielded only minimal insights. Moreover, it is crucial to recognise that the context and motivations surrounding corporate environmental disclosure have evolved significantly since those earlier studies were conducted. The environmental landscape, regulatory pressures, stakeholder expectations, and the desire for legitimacy in the eyes of the public have all changed over time, necessitating a re-examination of the factors influencing corporate environmental disclosure practices in the contemporary setting.

It is important to stress again that corporate water information disclosure in the Chinese business context is predominantly voluntary. There are no disclosure standards nor mandatory disclosure requirements for companies to publicly disclose water information (C. Liu et al., 2021; L. Zhang et al., 2021). In the literature, such a situation is said to bring about a "dearth of neutrality",[16] where corporate managers may be incentivised to selectively disclose information that aligns with the company's interests, rather than provide a comprehensive and balanced view

[16] The "dearth of neutrality" in voluntary information disclosure refers to the lack of impartiality or objectivity in the information that companies choose to disclose voluntarily (Einhorn, 2007; Einhorn & Ziv, 2012; Fallan & Fallan, 2009; Lee & Hutchison, 2005). Since regulatory authorities do not mandate these disclosures, companies may have incentives to present information in a way that reflects positively on their operations, potentially downplaying negative aspects or omitting unfavourable details (Roychowdhury & Sletten, 2012; Solomon & Lewis, 2002). This can lead to biased or selective reporting, where companies highlight achievements and successes while withholding or minimising issues related to their environmental or social performance (Kim & Lyon, 2011; Rezaee & Tuo, 2019). In the context of environmental information disclosure, the dearth of neutrality can result in incomplete or misleading information, making it difficult for stakeholders (i.e., investors, regulators, and the public) to accurately assess the company's actual impact on the environment or their performance (Fabrizio & Kim, 2019; Raiborn et al., 2011).

of water-related performance (Bergh et al., 2019; Criado-Jiménez et al., 2008). This strategic approach to disclosure raises concerns about transparency and the reliability of the information provided to stakeholders (Arena et al., 2015; Depoers et al., 2016; Hughes & Pae, 2004). The motivation for corporate water information disclosure in the Chinese business context remains unclear. Therefore, after evaluating the current state of water information disclosure among Chinese companies, it is crucial to delve into the motivations underlying these disclosure practices. To address this gap, the second research question was designed to explore these motivations in depth:

> RQ2: What are the motivations for Chinese companies to disclose water-related information?

Past literature suggests that the disclosure of social and environmental information is often employed as a strategy by companies to obtain and maintain legitimacy, thereby ensuring the company's ongoing survival (Deegan et al., 2002; Mousa & Hassan, 2015; O'Donovan, 2002; Van der Laan, 2009). As a natural consequence of voluntary disclosure, there is increasing social pressure on companies to be more accountable for their interactions with, and impacts on, society and the natural environment, compelling them to provide various forms of reporting. For this reason, discharging corporate water accountability to stakeholders could be the primary driving force behind corporate water disclosure. Islam and Deegan (2008) underscore that meeting the information demands of powerful stakeholders is another significant factor influencing corporate social and environmental reporting behaviour, particularly in developing countries. This suggests that the motivations for corporate water disclosure may also be rooted in the need to address the expectations and concerns of influential stakeholders. Building on the discussions and arguments presented, the third and fourth research questions were designed to delve deeper into the insights gathered from the second research question. Specifically, these questions aim to explore the perspectives of stakeholders concerning corporate water disclosures. Through this exploration, the expectation gap related to water disclosures can be identified and analysed.

> RQ3: What are the expectations of stakeholders with regards to water disclosure in China?
>
> RQ4: To what extent are Chinese companies currently meeting stakeholder expectations with regards to water-related aspects?

Accountability serves as one of the fundamental elements underpinning information flows (discharge and receive accounts) between a company and its stakeholders. Accountability is a subjective concept which is sustained and given extra dimensions of meaning by its context (Sinclair, 1995). Prior literature indicates that accounting information can provide can be used in decision-making and in establishing related accountability dialogues (Lehman, 2001). For example, in the Western context, corporate disclosure represents a way or form of providing an account to stakeholders to whom a company is accountable (Brennan & Solomon, 2008; S. M.

Cooper & Owen, 2007). Also, studies have investigated how accountability mechanisms can be drawn from related management and accounting practices (Bebbington et al., 2007). In this regard, Egan (2009) pointed out that water accountability is a specific issue of social concern that has received little attention.

Currently, several international reporting frameworks provide guidelines for companies to disclose water-related information comprehensively. For example, the GRI has established a dedicated disclosure standard: GRI 303: Water and Effluents (2018), which assists companies in reporting their impacts on water resources. However, these guidelines have predominantly gained popularity in Western contexts, and it remains unclear in the existing literature whether Chinese companies are also utilising these tools to guide their corporate water information disclosures.

As globalisation increases and China becomes more integrated with the global economy, it is reasonable to assume that Chinese companies would, at the very least, be familiar with these internationally recognised reporting frameworks. Furthermore, they might be expected to adopt these frameworks to enhance their corporate water information disclosure practices as a means of discharging corporate water accountability. If Chinese companies are not utilising these frameworks, it would be valuable to investigate the challenges or barriers they face in applying Western-based reporting frameworks for water information disclosure. Understanding these difficulties could provide insights into the feasibility and applicability of international standards in different cultural and regulatory environments, thereby contributing to the current literature on corporate water accounting and water information disclosure in a Chinese business context. For this reason, the fifth research question was designed to address this concern:

> RQ5: What are the challenges and/or barriers faced by Chinese companies in adopting international-based reporting frameworks (i.e., GRI, ISO and ESG) for corporate water disclosure?

3.7 Water disclosure indices

A disclosure index is a composite measure that integrates multiple indicators or items to produce a score or ranking, and is commonly used to assess or compare performance, conditions, or trends (Ayadi et al., 2024). Within the domain of corporate water accounting, a water disclosure index serves as a valuable evaluative tool by assigning scores based on the extent to which companies disclose specific types of water-related information, such as water consumption, wastewater discharge, treatment processes, and water reuse initiatives. This enables a systematic assessment of disclosure practices and facilitates cross-company and cross-sector comparisons in terms of transparency and environmental accountability (Z. Liu et al., 2023; Sousa & Fouto, 2024).

Previous studies have employed disclosure indices to measure corporate water-related information disclosure (Ben-Amar & Chelli, 2018; Burritt et al., 2016; Farooq et al., 2025; C. Liu et al., 2021; Morikawa et al., 2007; Wicaksono & Setiawan, 2022; H. C. Yu, 2022; N. Yu et al., 2025; H. Zeng et al., 2020). Many of these studies relied on existing reporting frameworks (i.e., GRI; environmental, social and governance [ESG]; and CDP guidelines), while others adopted the disclosure index developed by Morikawa et al. (2007), which aims to guide companies towards more sustainable water practices.

It is important to note that in these studies, disclosure indices were primarily used as checklists to assess whether specific water-related information was disclosed. The evaluation was often based on a binary scoring system (i.e., 1 for disclosed; 0 for not disclosed). While useful for identifying the presence or absence of information, such binary measures offer limited insight into the comprehensiveness or depth of the disclosure provided. To address this limitation, a more comprehensive scoring system is needed that captures the quality and detail of the disclosed water-related information. This study proposes such an approach, and the development of this enhanced scoring system is outlined in detail in Chapter 5.

Moreover, the scope of existing water reporting frameworks is often limited. For instance, GRI 303 focuses mainly on water withdrawal, consumption, and discharge, while omitting other important aspects such as water reuse, wastewater treatment, water-related risks, and assurance of disclosed information. Similarly, although the index developed by Morikawa et al. (2007) has been adopted in subsequent research (e.g., Burritt et al., 2016; Wicaksono & Setiawan, 2022), it does not account for information relating to wastewater treatment.

Given these shortcomings, there is a clear need for a more comprehensive and dynamic water disclosure index, one that not only encompasses a broader range of relevant water-related categories but is also adaptable to emerging themes and contextual variations. The index developed in this research addresses this need by incorporating seven core categories of water-related disclosure and an additional category designed to capture new insights observed during the examination of water-related information disclosure. This approach will not only assist information providers in effectively communicating water-related information to stakeholders, particularly in cases where existing reporting frameworks may lack relevant disclosure items, it will also offer researchers the flexibility to capture emerging or context-specific insights that have not been comprehensively examined in previous studies. Therefore, a new water-specific disclosure index is needed to advance the current literature. Such an index could serve as a valuable tool for future studies seeking to explore water information disclosure within specific

contexts, enabling a more accurate assessment of both the extent and comprehensiveness of the disclosed information.

3.8 Conclusion

In conclusion, this chapter has provided a comprehensive review of the literature on water accounting and corporate water information disclosure. Through this review, a significant gap in knowledge has been identified. Despite the critical role that water accounting plays within the broader domain of SEA, it has not received sufficient attention in the current academic research. Furthermore, the business sector – a primary consumer of water and a major source of water pollution – has not been thoroughly examined, particularly in non-Western contexts. Given that China faces many of the same water-related challenges as other countries, and considering its massive economic impact on the global stage, the country emerges as an appropriate and compelling context for investigating corporate water accounting and accountability.

The existing literature reveals that corporate water accounting and water-related information disclosure are not yet widespread practices in China. However, there is a growing trend, particularly since 2020, of increasing corporate engagement in water disclosure and a corresponding rise in academic attention to this area (Liu et al., 2024; Pan, 2021; H. C. Yu, 2022; N. Yu et al., 2025; H. Zeng et al., 2020; Z. Zhou et al., 2020). Despite this emerging interest, a key outstanding puzzle remains that there are currently no systematic, holistic examination of corporate water disclosure practices within the Chinese context. This study seeks to address this gap by investigating how Chinese companies report and disclose water-related information, thereby contributing new insights to the existing literature on water accounting and water information disclosure.

The Chinese context offers a unique lens through which to explore these issues, particularly given the country's ongoing transition from a government-centred regulatory regime towards a model that increasingly incorporates broader stakeholder concerns (see Chapter 2). This transition raises important questions about how corporate water accountability is shaped and performed in an emerging economy experiencing shifting stakeholder dynamics. Moreover, while water accounting is evolving, and this is not only in developing countries but also in developed countries, China's rapid economic development and institutional transformation make it a particularly salient case. The findings from this study should therefore be not only relevant to the Chinese setting but may also offer transferable insights for other emerging economies facing similar environmental and governance challenges.

In summary, this research aims to fill the identified gap in the existing literature by exploring corporate water practices in China. To this end, five research questions have been formulated,

each motivated by insights from prior studies. Addressing these research questions will contribute to a deeper understanding of corporate water accounting and accountability within the Chinese business context, thereby enriching the current body of knowledge in this important field.

Chapter 4. Theory

4.1 Introduction

This chapter presents the theories used to inform this research. Two key theories – stakeholder theory and accountability theory – were employed to guide the analysis.

Stakeholder theory provides a comprehensive lens for examining the relationships between companies and their diverse stakeholders. This theory has been extensively applied in the social and environmental accounting (SEA) literature, underscoring its relevance and suitability for this research. It provides a robust lens for analysing water disclosure practices in China. It captures the dynamic interplay between corporate behaviour, stakeholder expectations, and institutional constrains, and its application is especially relevant in contexts where environmental risks are high, and governance structures are complex. Moreover, the theory's normative foundation emphasises the ethical obligations of companies to consider the interests of all stakeholders, making it particularly applicable to the study of corporate water-related information disclosures. Additionally, stakeholder theory's normative core intersects with the concept of accountability, which holds that companies and their managers are not only responsible but also accountable for their actions and decisions to all their stakeholders. This intersection leads to the integration of accountability theory, which will be used to explore corporate water accountability within the Chinese business context. Accountability theory, with its focus on transparency and ethical governance, provides a framework for examining how companies discharge their environmental responsibilities, particularly in the realm of voluntary water information disclosures. Therefore, the combination of these two theories provides a robust theoretical foundation for this research, establishing a rationale to investigate corporate water information disclosure and the role of accountability in corporate water reporting practices.

4.2 Stakeholder theory and its implications

Stakeholder theory is a well-established and widely applied framework in business studies (Friedman & Miles, 2002; Parmar et al., 2010). The term 'stakeholder' was first introduced in a 1963 internal memorandum at the Stanford Research Institute (Freeman, 1984), challenging the traditional notion that shareholders are the sole group to whom managers are accountable. Freeman (1984) later developed the concept of stakeholder theory, emphasising the complexity of relationships between businesses and the individuals or groups who can affect, or are affected by, corporate actions. From this perspective, stakeholder theory focuses on three interconnected issues: (1) the problem of value creation and trade, (2) ethical dilemmas within capitalism, and (3) the managerial mindset of how managers should think about management, such as how to solve the former two problems (Freeman, 2010).

Stakeholder theory posits that a company has responsibilities to a range of *stake*holders, not solely to its *share*holders. This creates a distinction between maximising economic returns for shareholders and addressing the needs/interests/concerns of all stakeholders. Donaldson and Preston (1995) argue that companies have a moral obligation to consider the interests of all stakeholders, contending that doing so contributes to long-term profitability. They identify three distinct branches of stakeholder theory: (1) descriptive, (2) instrumental, and (3) normative, each with its own characteristics and methodology. However, their categorisation has been debated. For example, T. M. Jones and Wicks (1999) assert that significant interconnections exist within various aspects of stakeholder theory, and that the perceived differences are neither as distinct nor as categorical as originally portrayed. Similarly, Freeman (1999) contends that all three branches should be considered collectively, as they contribute to the broader narrative of stakeholder theory, emphasising that each branch incorporates elements of the others. This notwithstanding, the foundation of stakeholder theory is the need to address the diverse interests of various stakeholders. Its essence is rooted in a normative framework which highlights the ethical obligation and/or moral aspects of considering all stakeholder interests in strategic management and management decision-making (Friedman & Miles, 2002). On the other hand, the instrumental and descriptive perspectives focus more on the strategic importance of stakeholders to the companies and the empirical relationships between companies and stakeholders (Mahajan et al., 2023). As such, stakeholder theory offers a foundational framework for understanding and considering the interests of diverse stakeholder groups (Freudenreich et al., 2020). Stakeholder theory has been applied to various research areas such as corporate social responsibility (CSR), business ethics, and sustainability, offering valuable insights into how businesses can align their operations with broader societal and environmental goals (Dmytriyev et al., 2021; Phillips et al., 2003).

China, as a socialist country with a centralised governance structure, has long positioned the government as the most powerful and influential stakeholder in corporate and environmental matters (Y. Lu & Abeysekera, 2014; J. Wang et al., 2013). The government has historically played a dominant role in shaping regulatory frameworks, enforcing compliance, and directing corporate behaviour, particularly in relation to environmental protection. However, as discussed in Chapter 2, the stakeholder landscape in China has evolved in recent years, reflecting a gradual but noticeable shift towards broader stakeholder engagement. Chapter 2 highlighted the growing influence of a diverse range of stakeholders, including the media, employees, and domestic environmental NGOs. These stakeholders are increasingly contributing to public discourse, raising awareness, and exerting pressure on companies to enhance transparency and accountability. The evolution of stakeholder influence from a predominantly government control to a broader stakeholder focus indicates multiple voices now have influence in shaping

corporate practices in China. In addition, prior literature indicates that external stakeholders (i.e., customers, shareholders, investors, creditors, and environmental NGOs) are playing an increasingly influential role in shaping voluntary environmental information disclosure. These stakeholder groups are progressively demanding greater transparency and accountability, thereby motivating companies to disclose more comprehensive and reliable environmental information. This shift suggests a reconfiguration of stakeholder dynamics in the Chinese business context, wherein non-governmental actors are no longer peripheral but are becoming integral to the accountability mechanisms that impact on corporate conduct. As such, the recognition of these emerging stakeholders is crucial for understanding the current and future direction of corporate water disclosure in China.

It is also important to regularly examine the evolving dynamics of stakeholder power in the Chinese context. Traditionally, the government has been recognised as the most dominant and influential stakeholder. However, as time changes, the influence of stakeholders may shift, potentially diverging from traditional understandings of their roles and relative power (See more details in Chapter 2). This study therefore takes into account a range of stakeholder groups and examines their respective influences on corporate water accountability (further details regarding different stakeholders' impact on corporate water disclosure can be found in Chapter 7). By including perspectives from not only government officials but also shareholders, managers, employees, academics, media representatives, and environmental NGOs, this research explores a broader and multifaceted understanding of stakeholder power in the current Chinese business context. Also, this study seeks to examine whether the government continues to be the most influential stakeholder in shaping corporate water information disclosure.

Building on the previous discussion, stakeholder theory has been extensively employed as a theoretical foundation in business studies, particularly in relation to the ethical dimensions of corporate responsibility (El Akremi et al., 2018; Gibson, 2000). R. W. Roberts (1992) applied stakeholder theory to explore the factors influencing CSR disclosure, underscoring the importance of incorporating a wide range of non-financial considerations into corporate decision-making. Banerjee et al. (2003) further extended the application of stakeholder theory to corporate environmentalism, demonstrating that stakeholder pressure significantly affects both corporate environmental practices and financial performance. Similarly, Artiach et al. (2010) emphasise that stakeholders play a pivotal role in the implementation and development of corporate sustainability practices. Van der Laan Smith et al. (2005), meanwhile, argue that stakeholder influence compels companies to disclose more information about their social activities and performance. However, they also note that the degree of such disclosure varies, depending on the economic, social, and cultural contexts within which the companies operate. Hörisch et al. (2014) subsequently examined the application of stakeholder theory to

sustainability management, focusing on how sustainability management can be approached with a stakeholder mindset. Through empirical examples, they identified the connection between stakeholder theory and sustainability management, as well as the similarities and dissimilarities, suggesting that stakeholder theory and sustainability management shared a lot of ideas, and that stakeholder theory can be successfully applied in the context of sustainability management.

Stakeholder theory has been regarded as one of the most important theoretical frameworks in SEA, as evidenced by numerous studies in the field (e.g., Cormier et al., 2004; Deegan & Rankin, 1997; Gray et al., 1995a; Neu et al., 1998; R. Roberts, 1992; Ullmann, 1985; Van der Laan Smith et al., 2005). Stakeholder theory is widely used in research on environmental information disclosure, primarily because such disclosures are voluntary in many countries, with no legal obligation for companies to provide this information. Stakeholder theory posits that stakeholders contribute resources essential for a company's operations. As a result, companies have a responsibility to provide information to stakeholders which can be valuable for them to evaluate corporate actions and make informed decisions. In addition, the ethical branch of stakeholder theory emphasises that all stakeholders are equally important to the company. This perspective argues that managers should not focus solely on stakeholders who offer financial investment but should instead treat all stakeholder requests for information with equal consideration. This branch has been found very useful as it encourages companies to recognise the broader societal and environmental implications of their operations and to respond to the information needs of all stakeholders. Consequently, the ethical branch of stakeholder theory provides an understanding of corporate behaviour and motivation in voluntarily disclosing social and environmental information. It highlights how companies can address stakeholder concerns and enhance transparency, even in the absence of legal requirements. Therefore, this theoretical lens has been widely applied in academic research to explore the drivers and impacts of corporate disclosure practices (Caputo et al., 2021; Farneti et al., 2019; Vitolla, 2019).

On the other hand, the managerial branch of stakeholder theory is also widely used in voluntary disclosure research. It focuses on identifying and managing the relationships between a company and its stakeholders in a way that aligns with the company's goals and objectives (Phillips et al., 2003). This branch is practical and operational, as opposed to being primarily normative or ethical. It seeks to integrate stakeholder management into strategic decision-making processes to ensure the company's success and sustainability. Consequently, managers will manage stakeholders like a resource and treat stakeholder engagement as a tool for achieving corporate goals, over the intrinsic rights or ethical consideration of all stakeholders (Donaldson & Preston, 1995; Jensen, 2002). This theoretical lens has also been widely applied in academic research to explore the drivers and impacts of corporate disclosure practices.

In the Chinese business context, scholars have similarly employed stakeholder theory to analyse corporate environmental information disclosures (see, e.g., Y. Lin et al., 2021; Y. Luo et al., 2022). In the specific context of corporate water information disclosure, C. Liu et al. (2021) applied stakeholder theory to examine the relationship between water information disclosure and financial reporting quality, while H. C. Yu (2022) integrated stakeholder theory with the concept of *guanxi*[17] to investigate the determinants of water information disclosure among Chinese companies.

Based on the discussions and studies outlined above, stakeholder theory (both the managerial and normative branches) offers plausible explanations for voluntary disclosures. Voluntary water-related information disclosures serve as a key mechanism for fostering dialogue and strengthening relationships between companies and all stakeholders who seek such information. This highlights the need for a more comprehensive examination of the relationship between corporate water-related information disclosure and stakeholder expectations and offering insights into how corporate disclosures align with, and respond to, the needs of all stakeholders – in this way companies move towards a normative stakeholder view.

4.3 Accountability theory

Accountability is a complex and multifaceted concept and its meaning often varies depending on the context and perspective (Bovens, 2007). It encompasses a range of ideas, including transparency, responsibility, answerability, liability, and integrity. These terms collectively position accountability as not only a discipline-specific concept but also as an organisational or personal virtue, reflecting a willingness to act fairly and equitably (Bovens, 2007; Sinclair, 1995). J. Roberts and Scapens (1985) offer a narrower definition of accountability as a relationship involving the giving and demanding of reasons for conduct. In this sense, accountability focuses on the provision of information by one party to another, explaining actions taken or planned. This relationship typically involves a transfer of responsibilities or resources from the account provider to the receiver, accompanied by expectations surrounding this transfer. Accountability can be further categorised into hierarchical and holistic forms (J. Roberts, 1991). Hierarchical accountability emphasises accountability to stakeholders with

[17] The Chinese term *guanxi* refers to interpersonal relationships and connections and gained prominence in the 1980s in the business literature advising on cultural factors essential for conducting business in China (Alston, 1989). *Guanxi* embodies the practice of leveraging personal networks to secure favour or advantages in relational exchange (Luo, 1997). It is often regarded as a vital component in navigating business negotiations in China, offering significant strategic benefits such as enhanced trust, access to resources, and smoother interactions (Brunner et al., 1990; Davies et al., 1995; Y. Fan, 2002).

power or control over resources critical to the organisation. This approach tends to prioritise relationships with influential stakeholders, often sidelining less powerful groups (O'Dwyer & Unerman, 2007). Conversely, holistic accountability is driven by a sense of morality, asserting that all individuals and communities impacted directly or indirectly by corporate actions deserve consideration, regardless of their power or influence (Unerman & Bennett, 2004). This perspective emphasises inclusivity and explicitly accounts for the interests of multiple stakeholders (J. Roberts, 1991). Gray et al. (1988) define accountability as the "onus, requirement, or responsibility to provide an account (by no means necessarily a financial account) or reckoning of the actions for which one is held responsible" (p. 2). This indicates that accountability is also aimed at enhancing social relationships by reassessing and expanding traditional rights to information (Gray, 1992; Gray et al., 1988). Also, it indicates that accountability extends beyond financial disclosures, encompassing a broader scope that includes ethical, social, and environmental dimensions wherever a company's activities impact stakeholders (Messner, 2009; Stubbs & Higgins, 2018). Accountability, at its core, entails recognising a company's responsibilities and ensuring that relevant information is accessible to those stakeholders with a legitimate right to know (Gray, 2001; Owen et al., 1997). This framework highlights the dynamic nature of accountability, particularly in relation to corporate social and environmental obligations, emphasising the importance of transparency, honesty, and a willingness to disclose information that allows stakeholders to make informed judgments about the behaviour and performance of a company (S. M. Cooper & Owen, 2007). As J. Roberts (1991) states regarding the power of accounting information, "Part of this visibility lies in accounting's capacity to present information as it were objective fact; the detail can be contested but not its basic capacity to reflect the truth" (p. 359).

Accountability theory can be applied across various contexts, including public institutions, non-profit sectors, and even at the individual level (Bovens et al., 2008; Dhanani & Connolly, 2012; Gray et al., 2006; Hall et al., 2017). In a business context, it serves as a framework to analyse how companies are held responsible and/or accountable for their actions and decisions (Bergsteiner & Avery, 2010). Specifically, it focuses on the processes of assigning responsibility, requiring explanations or justifications (answerability), and evaluating performance against established standards or stakeholder expectations (Choudhury, 1986; Shoemaker, 2011; A. P. Williams & Taylor, 2013). Additionally, accountability theory addresses the consequences or sanctions that arise from these evaluations, ensuring that mechanisms promote responsible behaviour, transparency, and ethical conduct (Kolk, 2008; Swift, 2001).

Consequently, accountability is an important part of stakeholder relationships, in which its notions align with the normative (ethical) branch of stakeholder theory. Accountability theory posits that the company and its managers are accountable for their actions and should be held

responsible not just to shareholders, but also to all stakeholders. By providing a foundation for ethical behaviour and responsible decision-making, accountability theory reinforces the importance of transparency. Gray et al. (1983) emphasise that the discharge of accountability can be effectively achieved by making information accessible to the public. Building on this notion, voluntary information disclosure serves as a vital mechanism for enhancing corporate transparency, thereby enabling companies to discharge their accountability to a broad range of stakeholders. In this context, voluntarily disclosing water-related information can be regarded as an effective way of addressing corporate water accountability. Such disclosure reflects a company's acknowledgement of its responsibility to provide stakeholders with relevant and reliable information about its water-related activities. Moreover, it gives an account to stakeholders to evaluate the company's commitment to sustainable water practices and its overall accountability in managing water resources, regardless of their rights to such information.

Accountability theory has been widely adopted in studies examining corporate environmental accountability through information disclosure and reporting. This positions the theory as a vital framework for understanding how businesses communicate their environmental responsibilities and meet their accountability to stakeholders (Caputo et al., 2021; Cormier & Gordon, 2001; Deegan & Rankin, 1997; Gray, 2005; Gupta, 2008; Harte & Owen, 1991; Larrinaga et al., 2002). In the Chinese business context, accountability theory has been applied to explain the voluntary environmental information disclosure practices of companies. For example, X. Liu and Anbumozhi (2009) highlighted that environmental information disclosure plays a significant role in discharging corporate accountability. L. Zhang et al. (2016) subsequently showed that environmental information disclosure serves as a pivotal mechanism to enhance corporate accountability and information transparency, which in turn positively influences environmental performance. More recently, C. W. Wong et al. (2021) developed a framework to examine how environmental transparency and stakeholder governance foster environmental accountability. They introduced four accountability criteria – (1) identifiability, (2) awareness of monitoring, (3) expectations of evaluation, and (4) social pressure – to analyse corporate environmental transparency practices. Their findings indicate that leading companies enhance the 'what', 'how', and 'how much' aspects of environmental information dissemination by adhering to these accountability criteria.

Various studies have approached accountability from different perspectives, but their overarching conclusions suggest that accountability theory provides a robust argument for motivating corporate environmental disclosure practices. In particular, voluntary information disclosure has been widely seen as a way for companies to discharge their accountability to its stakeholders (Van der Laan, 2009; William & Adams, 2013). This approach reflects the broader

principle that companies bear a responsibility to provide relevant and transparent information about their activities to stakeholders who are affected by or have an interest in those activities. From this perspective, it is reasonable to expect voluntary disclosure of water-related information as a mechanism through which companies can discharge their corporate water accountability to their stakeholders.

4.4 Conclusion

This chapter has discussed the application and relevance of stakeholder theory and accountability theory in this research. Both theories share ethical commonalities, emphasising corporate responsibilities towards stakeholders. While financial reporting is mandatory, water-related information disclosure remains voluntary. Both the managerial and normative branches of stakeholder theory provide useful motivations as to why companies are expected to disclose water information. Similarly, accountability theory highlights that companies should provide an account of their actions to stakeholders, making voluntary water disclosure a way to fulfil corporate water accountability. Together, these theories offer a strong foundation for supporting the expectation that companies will voluntarily disclose water-related information as part of their commitment to sustainable water practices and corporate water accountability. The following chapter provides a detailed explanation and discussion of the research methods employed in this study.

Chapter 5. Research Methods

5.1 Introduction

This chapter explains the research methods used for data collection and analysis in this study. This research is characterised as exploratory as it aims to contribute to the existing water accounting literature and make original contributions to corporate water information disclosures. To achieve this goal, this research was designed using a mixed-methods approach that combines qualitative and quantitative research methods to collect and analyse data. More specifically, quantitative content analysis was used to evaluate companies' water-related information disclosures, and qualitative semi-structured interviews were used to collect firsthand information from key stakeholders. This approach aims to further explore companies' perceptions on the current state of corporate water information disclosure, their expectations regarding water-related information disclosures, and, more importantly, how various stakeholders can influence corporate water information disclosure.

This chapter is structured as follows. First, the method for selecting companies and sectors is presented, along with a general statistical overview. Second, the chapter discusses the content analysis, and the development of a unique, water-specific disclosure index designed to measure the comprehensiveness of water-related information disclosed by companies. Third, the semi-structured interviews used to uncover the motivations behind corporate managers' decisions regarding water-related disclosures are described. This mixed-methods approach also aims to provide insights into the diverse perspectives and expectations of key stakeholders concerning corporate water information disclosure and the current state of corporate water accountability within the Chinese business context. The design of the interview questions and the stakeholder selection process is also addressed.

5.2 Sample selection

5.2.1 Sector identification and justification

This research focuses on Chinese companies listed on both the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE) to explore the primary objective of this research, which is to delve into corporate water accounting and accountability within a Chinese business context. Selecting companies from both stock exchanges enhances the comprehensiveness of the research scope. Conversely, selecting companies exclusively from either stock exchange could potentially yield inaccurate results and fail to present a holistic view of corporate water accounting and accountability in the Chinese business context. As noted in earlier in the thesis, none of the companies in the sample were cross-listed on both stock exchanges.

The SSE and SZSE each encompass 10 specific sectors, with both markets adhering to the same sector classification system. This research selected companies from all 10 sectors from both stock exchanges, comprising the energy, materials, industrials, consumer discretionary, consumer staples, healthcare, information technology (IT), telecommunication services, utilities, and financial sectors. Existing literature suggests that an industry's nature significantly influences the quality and quantity of information companies produce (D'Amico et al., 2016; Sinclair-Desgagné & Gozlan, 2003). Businesses operating in environmentally sensitive sectors with a high impact on the natural environment tend to disclose more environmental information (Cowen et al., 1987; Deegan & Gordon, 1996; X. Liu & Anbumozhi, 2009; Patten, 2002). Stray and Ballantine (2000), meanwhile, demonstrate that the energy industry has a significant impact on water resources, and their findings suggest similar impacts from the automobile and food and beverage industries. L. Pan et al. (2012) highlights the coal industry as a major water user in China, particularly within the broader energy sector. Additionally, Bijl et al. (2016) and Feeley et al. (2008) assert that many utility companies depend heavily on water resources for power generation and electricity production.

5.2.2 Company selection

Ten companies were selected from each sector of both stock exchanges, with the exception of the financial sector, from which five companies were chosen from each exchange. The rationale for this variation lay in the differing nature of the companies on the exchanges, which influenced their environmental engagement and, subsequently, their impact on the water environment. Many studies in the field of corporate environmental information disclosure have tended to exclude financial companies from their analyses (Ben-Amar & Chelli, 2018; D'Amico et al., 2016; Khlif et al., 2015; Sun et al., 2010). For example, Ortas et al. (2019) and Stray and Ballantine (2000) suggested that companies in the financial sector, such as those in banking, insurance, and securities, were often perceived to have a lesser environmental impact. Additionally, most financial companies were subject to high levels of regulation and oversight by the central government. Consequently, the limited accessibility to data or information from these entities may have potentially influenced the outcomes of the research. While studies have suggested that financial companies might not have a direct impact on water resources, it was considered important to empirically test this notion in a different context. Moreover, given that this research aimed to provide insights into the general situation in China, including financial companies in the study was deemed necessary. Therefore, a total of 10 financial companies (five from each stock exchange) were selected.

In total, 190 of the largest listed companies, based on market capitalisation (market value),[18] were selected for this study. Specifically, the 10 largest companies from each sector (excluding the financial sector) were chosen across both stock exchanges, resulting in 180 companies. Additionally, the five largest financial companies were selected from each stock exchange, bringing the total to 190 companies for the study (for detailed information on the selected companies, refer to Appendix A). Moreover, the selected companies from both the SSE and SZSE for this research are only listed on one of the exchanges (i.e., the SSE or the SZSE) and are not dual-listed on foreign stock exchanges (see Chapter 2 for clarification on dual-listed companies).

There are several reasons for selecting of large companies. First, a review of prior studies shows that in the majority of countries, company size has a significant impact on corporate social and environmental disclosure (Adams et al., 1998; Haniffa & Cooke, 2005; Neu et al., 1998). More importantly, studies using China as the context have also found that the size of companies is positively correlated to environmental information disclosure (L. Y. Cheng et al., 2011). Secondly, large companies are more politically visible and exposed to greater attention from the public and stakeholders, so large companies usually face pressure to disclose more information than smaller companies (Deegan & Gordon, 1996). In this regard, voluntary disclosures (i.e., environmental information disclosures) can be explained as an effort to legitimise corporate behaviour (Adams & Zutshi, 2004; Bushman et al., 2004). Thirdly, collecting, preparing and disclosing environmental information incurs costs. Compared to smaller companies, larger companies are better equipped to allocate financial resources and hire experts for environmental information disclosure (Da Silva Monteiro & Aibar-Guzmán, 2010; Murray et al., 2006; Tagesson et al., 2009). Given that corporate water reporting is an integral part of a company's voluntary disclosures, selecting large companies is more likely to provide fruitful insights into the accounting and accountability of water.

Table 5.1 provides a summary of the descriptive statistics of the companies in the sample by sectors. Panel A presents an overview of the minimum, maximum, mean, median and standard deviation for sectors from both the SSE and the SZSE. Panel B offers a detailed breakdown of the statistics specifically for sectors from the SSE, while Panel C focuses on the breakdown for sectors from the SZSE. It is clear that companies listed on the SZSE are generally smaller than companies listed on the SSE, and significantly smaller for the financial, energy and industrial sectors. However, companies in the IT sector listed on the SZSE show significantly higher average total assets and revenue compared to those on the SSE. This difference may be

[18] 'Market value' refers to the value of a company according to the stock market. A company's market value is calculated by multiplying the share price at year end by the number of shares issued at year end.

attributed to the SZSE's appeal to high-tech and innovation-driven companies, making it the preferred exchange for companies in these dynamic industries.

Table 5.1 Descriptive statistics for the sample companies by sector

Panel A – Combined for both stock exchanges

	N	Minimum		Maximum		Mean		Std. Deviation	
Sectors		Total assets	Revenue	Total assets	Revenue	Total assets	Revenue	Total assets	Revenue
Energy	20	49,809	32,371	2,798,023	2,999,148	653,789	637,315	916,907	1,134,223
Materials	20	25,217	20,370	581,148	408,122	231,138	167,019	174,555	125,762
Industrials	20	44,684	12,103	2,305,202	1,617,328	641,023	413,441	764,134	569,163
Consumer Discretionary	20	23,396	7,570	1,305,921	1,078,826	322,598	207,214	417,795	333,335
Consumer Staples	20	13,154	4,355	305,669	199,834	102,595	76,361	97,636	72,181
Healthcare	20	12,298	2,517	107,017	62,268	35,696	19,774	29,316	19,687
IT	20	12,811	3,460	458,009	159,079	101,616	37,347	133,743	53,046
Telecommunication Services	20	5,879	2,248	714,866	510,149	120,993	96,793	219,187	174,496
Utilities	20	56,757	2,026	527,659	201,814	302,294	76,242	147,403	58,823
Financials	10	383,7063	273,955	34,577,950	1,260,103	1,639,4467	757,149	13,440,754	360,547
Overall (by sector)		5,879	2,026	34,577, 950	2,999,148	1,890,621	248,865	1,634,143	290,126
Overall (by company)						99,506	13,098	86,008	15,270

Panel B – SSE

	N	Minimum		Maximum		Mean		Std. Deviation	
SSE		Total assets	Revenue	Total assets	Revenue	Total assets	Revenue	Total assets	Revenue
Energy	10	45,636	31,076	2,732,910	2,966,193	629,292	623,013	897,732	1,123,161
Materials	10	13,568	9,791	339,633	291,594	128,071	99,135	93,255	80,679
Industrials	10	37,171	10,945	2,034,452	1,419,837	553,188	357,234	686,983	499,187
Consumer Discretionary	10	8,977	5,359	849,333	826,530	153,096	141,971	252,988	249,041
Consumer Staples	10	3,514	3,582	183,042	90,009	44,034	37,066	52,826	35,979

Healthcare	10	2,660	1,894	76,120	28,585	17,927	10,940	22,099	9,766
IT	10	6,174	3,203	33,752	23,526	18,862	9,981	10,169	6,049
Telecommunication Services	10	2,932	2,141	564,231	408,698	98,824	85,276	173,871	142,849
Utilities	10	37,455	838	413,597	173,485	247,517	69,358	117,842	50,848
Financials	5	3,726,734	269,703	30,109,436	1,218,315	15,131,914	743,123	11,622,366	344,932
Overall (by sector)		2,660	838	30,109,436	2,966,193	1,702,272	217,710	1,393,013	254,249
Overall (by company)						179,187	22,917	146,633	26,763

Panel C – SZSE

	N	Minimum		Maximum		Mean		Std. Deviation	
SZSE		Total Assets	Revenue	Total Assets	Revenue	Total Assets	Revenue	Total Assets	Revenue
Energy	10	4,173	1,295	65,113	32,955	24,497	14,302	19,175	11,061
Materials	10	11,649	10,579	241,515	116,528	103,067	67,885	81,300	45,083
Industrials	10	7,513	1,158	270,750	197,491	87,835	56,207	77,151	69,976
Consumer Discretionary	10	14,419	2,211	456,588	252,296	169,502	65,243	164,807	84,294
Consumer Staples	10	9,640	773	122,627	109,825	58,561	39,295	44,810	36,202
Healthcare	10	9,638	623	30,897	33,683	17,770	8,835	7,217	9,920
IT	10	6,637	257	424,257	135,553	82,753	27,366	123,574	46,997
Telecommunication Services	10	2,947	107	150,635	101,451	22,169	11,517	45,316	31,648
Utilities	10	19,302	1,188	114,062	28,329	54,777	6,884	29,562	7,975
Financials	5	110,329	4,252	4,468,514	41,788	1,262,553	14,026	1,818,387	15,614
Overall (by sector)		2,947	107	4,468,514	252,296	188,349	31,156	241,130	35,877
Overall (by company)						19,826	3,280	25,382	3,777

Note: All figures are presented in millions of Chinese yuan (¥). The exchange rate of ¥ 1RMB = $0.14 USD (i.e., 1 USD equals 7.10 RMB) is that of 5 November 2024. Overall, the average company size in total assets is $14,015 million USD ranging from $828 million USD to $4,879,134 million USD. (The smallest company in the sample had total assets of $415 million USD and the largest company had total assets of $4,240,766 million USD.)

5.3 Content analysis

Content analysis was developed to systematically describe the content of communication. As a research method, content analysis has found widespread use in studying social and environmental disclosures (Gray et al., 1995b; Hackston & Milne, 1996; Milne & Adler, 1999; Unerman, 2000). It is particularly valuable for quantifying and analysing the extent of social and environmental information in corporate reporting (Dagiliene, 2010; Deegan & Rankin, 1996).

In the literature, content analysis has been described as a technique for gathering data that consists of codifying narrative information into categories in order to derive quantitative scales of varying levels of complexity (Abbott & Monsen, 1979). Krippendorff (1989) defines content analysis as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to contexts for their use" (p. 18). Under this notion, content analysis is helpful in gathering narrative data from an entity (including symbols, meaning and volume) and in classifying various elements and text units into different categories (Beattie et al., 2004). In addition, it is also valuable to capture the narratives of social and environmental matters from the text of a company's reports (Stanton & Stanton, 2002). Content analysis was therefore employed as an appropriate method to address research question 1. It was utilised to investigate the current state of corporate water disclosures within the Chinese business context, focusing on the content of corporate water information and any key information disclosed in companies' reports and on their websites.

This research also aims to develop a specific corporate water disclosure index. Such an index is expected to provide an extensive and comprehensive understanding of current water information disclosure practices in the Chinese business context. Additionally, a scoring approach will be designed alongside the index to measure the comprehensiveness of companies' disclosures. This scoring approach will serve as a measurement tool to analyse the comprehensiveness of the disclosed water-related information. Consequently, each company will be assigned a score indicating the comprehensiveness of its water disclosures. The following sections discuss the development of a corporate water disclosure index and a score system.

The data used in the content analysis were collected from three sources and will be analysed in Chapter 6. First, corporate water disclosure is considered a vital component of companies' social and environmental reporting practices. The disclosure of social and environmental information in annual reports is a well-established practice, extensively studied across various contexts. Previous research has shown that large companies and international corporations tend to include such disclosures in their annual reports (Barbu et al., 2014; Deegan & Gordon, 1996;

Gray et al., 1995a; Guthrie & Parker, 1990). In the current Chinese business reporting landscape, corporate water disclosure remains predominantly voluntary. However, annual reports offer a valuable avenue for collecting water-related information. Therefore, collecting and analysing information from annual reports could provide significant insights into the extent of corporate water disclosure among Chinese listed companies.

Secondly, past studies indicate that companies' financial reports primarily focus on showcasing economic and financial performance to inform shareholders, investors, and other relevant stakeholders about their financial situation (Moneva & Llena, 2000; C. De Villiers & Van Staden, 2011). While financial information is significant, social and environmental information has importance for shareholders and a broader range of stakeholders, including employees, customers, and various social stakeholders. As reporting on social and environmental dimensions becomes more value-relevant, companies often strategically present environment-related information (Bewley & Li, 2000; Cahan et al., 2016). Corporate social responsibility (CSR) report and sustainability report (SR) provide avenues for companies to enhance communication on social and environmental activities and performance with stakeholders. It can be argued that companies have a responsibility to report not only financial but also social and environmental information to their stakeholders. CSR reporting can be used by companies to discharge their accountability to their social and environmental stakeholders by providing relevant information to those who need it. Additionally, past studies show a trend whereby stakeholders, especially those of large, publicly listed companies, are increasingly seeking additional information on water-related activities (Signori & Bodino, 2013). Furthermore, Y. Lu and Abeysekera (2014) found that Chinese listed companies are progressively adopting public disclosure of social and environmental information in their CSR reporting and SR. Therefore, it is reasonable to assume that if companies do not disclose water information in their annual reports, this information might appear in their CSR reporting and SR. Consequently, companies' CSR/sustainability reports are also examined.

Thirdly, the internet is widely recognised as a crucial communication channel in contemporary times. Companies frequently use it to disseminate various types of information, often replacing traditional forms of corporate communication with stakeholders (Alarussi et al., 2013; H. Chen et al., 2023; L. Fan et al., 2020). Prior studies indicate that corporate environmental information is not solely disseminated through reports but also through company websites, a trend that has become increasingly prevalent in recent years (C. De Villiers & Van Staden, 2011; Juhmani, 2014; Oyelere et al., 2003; Tagesson et al., 2009). Therefore, this research also considered water-related information disclosed on companies' websites.

5.4 The development of corporate water disclosure index

The development a specific and comprehensive index for measuring the comprehensiveness of corporate water information disclosure is a significant contribution of this research. The process of developing such an index is complex and involves several steps to ensure its robustness and comprehensiveness. The specific water disclosure index is based on various sources, including past literature on water accounting, existing reporting guidelines and standards that encompass water-related aspects, and consultation with academics specialising in water accounting and corporate water information disclosure (see Appendix B for the academics who have been consulted). The consultation with academics followed after the development of a prototype index based on past literature and existing guidelines. The researcher engaged with experts worldwide through online calls and email communication, seeking opinions and suggestions to refine the index. This collaborative process ensured that the index is well-founded and aligns with current academic knowledge of corporate water information disclosure. Moreover, the development of this index is necessary, as it addresses the first research question: *To what extent are companies in China currently disclosing water-related information in their reports and on their websites?* This objective cannot be achieved without an adequate and systematic evaluation tool. Therefore, constructing a disclosure index is a necessary step in assessing the water-related information disclosed by Chinese companies. The following sections discuss the entire process of index development, as well as the materials utilised to support its development.

5.4.1 Past literature

The development of this index was initially motivated by prior literature and studies in corporate water management and water-related information disclosure. Reviewing past literature provided fundamental knowledge for observing various water issues within the business context, which was crucial for developing the index. Subsequently, assimilating studies from specific areas helped narrow down the scope and translate general knowledge into specific themes, which are presented and discussed in the following sections.

5.4.2 Reporting frameworks covering water-related aspects

In China, corporate water information disclosure is voluntary, with no generally accepted format or legislative requirements for reporting corporate water performance (C. Liu et al., 2021; S. X. Zeng et al., 2011). In this context, measuring the comprehensiveness of Chinese companies' water-related information disclosure can be challenging. To address this issue, obtaining insights from reporting guidelines and standards in use internationally is vital. These guidelines provide knowledge on how companies in a Western context report water-related information and the diverse water-related activities inherent in their business operations (Andreassen, 2017;

Darnall et al., 2022; Sethi et al., 2017). Furthermore, given the geographical variability of water contexts, lessons drawn from various international disclosure guidelines have enhanced the comprehensiveness of the index and ensure its applicability in a Chinese business context. Table 5.2 provides an overview of the disclosure guidelines and standards used to support the development of this index.

Table 5.2 Current disclosure guidelines and reporting standards covering water-related aspects

	Name of the guidelines/standards	**Year of publication**
1	Global Reporting Initiative (GRI) 303: Water and effluents	2018
2	CEO Water Mandate	2014
3	CDP Water Reporting Guideline	2019
4	Alliance for Water Stewardship (AWS) Standard	2019
5	The Water Footprint Assessment Manual	2011
6	United Nations Environmental Program (UNEP)	2010
7	United Nations World Water Development Report (UN WWDR)	2019
8	United Nations Sustainable Development Goal (SDG) No. 6: Clean water and sanitation	2018
9	World Health Organization (WHO)	2018

5.4.3 Disclosure categories and codes

As noted above, the corporate water information disclosure index was developed based on several sources. First, reviewing studies in the field of water-related information disclosure helped the researcher identify the key aspects of water that concern companies and relevant stakeholders who are interested in such information. Secondly, reviewing and summarising the currently widely used international disclosure guidelines and reporting frameworks that include water-related information helped the researcher to systematically plan each disclosure category and the items within each of them. Thirdly, after developing the initial version of the disclosure index, the researcher consulted with other academics worldwide to seek their opinions on potential improvements. After these steps, eight disclosure categories were identified as important to constitute a comprehensive corporate water disclosure index. For analytical purposes, each category is coded with a letter, as follows:

A. Water policy

B. Water consumption
C. Wastewater discharge
D. Wastewater treatment
E. Water recycling and reuse
F. Information assurance
G. Water risks
H. Other water-related disclosures

The following sections specifically explain and discuss each category and the items within them.

A. Water policy

Water is an indispensable resource for almost every company, but such resources are not unlimited, and companies must pay to utilise them. In this context, it is essential for companies to set water-related targets or goals to effectively manage their water use and discharge during business operations (Kunz & Moran, 2014; Newborne & Mason, 2012). These targets or goals typically encompass areas such as water consumption, water discharge, wastewater treatment, and water recycling and reuse. Achieving these targets or goals necessitates a strategic plan (Church, 2021; Essex et al., 2020). Therefore, a water policy that includes water-related targets or goals, along with a strategic plan, is a crucial element in building a comprehensive system that allows a company to optimise its water management.

Consequently, the first category in this comprehensive corporate water disclosure index involves disclosing information related to the company's water policy (A1). This disclosure enables information users and the public to gain a deeper understanding of the company's water-related targets or goals and the strategies they will employ to achieve them.

B. Water consumption

Water consumption is a broad concept that can be defined in various ways depending on the context. In the business context, it refers to the total amount of water used by a company during a specific reporting period (GRI, 2018). Specifically, the CDP Water Security Reporting Guidelines (2019) define water consumption as "the total volume of water drawn from all sources and embedded within the boundaries of the company".

The CEO Water Mandate (2014) notes that corporate water consumption is a crucial aspect of water sustainability. The amount of water a company consumes has a significant impact on

freshwater availability because once water is used in corporate operations, it is unlikely to return to its original source with the same quality and is no longer available for other uses and/or users (UN WWDR, 2019).

Water is a critical resource for many companies. Lambooy (2001) suggests that water consumption serves as a vital indicator, reflecting a company's water usage during corporate operations and industrial production. Understanding total water use can help companies recognise their impact on freshwater availability levels and avoid excessive water consumption. Chapagain and Hoekstra (2008) found that overuse of water resources can threaten freshwater availability, creating challenges for local citizens in accessing clean water sources. Burritt et al. (2016), meanwhile, discovered that approximately 35% of Japanese companies consumed water without systematic assessment or measurement, potentially damaging the water environment and harming other local water users.

In line with the above discussion, the first item within the water consumption category aims to capture the general information that a company uses to describe its water consumption situation (B1). The second item involves reporting the total volume of water consumed by the company, expected to be presented in megalitres or cubic metres (B2).

Water intensity is an important indicator that shows the water use per unit of product or dollar revenue (AWS, 2019; CDP, 2019). Joa et al. (2014) used water intensity as a key benchmark to test and compare the internal water performance between different suppliers in the cotton industry. Their findings show that when a company's water intensity decreases, the company is better utilising water in its production. As a result, water productivity becomes more efficient with the same level of water usage.

Measuring water intensity is becoming a popular practice in many industries. The CEO Water Mandate (2014) suggests two different approaches to measure water intensity. The first approach is to measure the water consumption per unit of product, and this approach is more suitable for companies with discrete output such as food, beverage and automobile industries. However, this approach may not be relevant for companies with diversified product portfolio or service-oriented sectors. In this situation, measuring water consumption per dollar of revenue is another approach to show water intensity. Based on these two approaches, the third item will be designed to capture information pertaining to water consumption per unit of product or water consumption per dollar of revenue (B3).

The availability of information regarding water consumption is crucial not only for the company but also for relevant stakeholders, as it demonstrates the company's overall water usage (Christ, 2014; Christ & Burritt, 2017b; Danoucaras et al., 2014; Morrison et al., 2010). If a company announces a reduction in overall water usage, it potentially indicates the company's awareness of issues related to inappropriate or excessive consumption of water resources. From this perspective, the fourth item under the water consumption category is designed to capture changes in water consumption by the company (B4). This information is expected to be disclosed in volumetric units or as a percentage change.

In China, most companies source their water from local municipal water plants, with pricing typically based on the volume of water used. The fifth item under the water consumption category is the total cost of water consumption (B5). This item is measured in monetary units (RMB/yuan) and indicates the total expenditure incurred by the company for water use.

Water utilised in corporate operations or industrial processes can be withdrawn from a variety of sources, such as surface water, groundwater, municipal water supplies, recycled water, rainwater, runoff, and seawater (AWS, 2019). Consequently, the sixth item within the water consumption category aims to record water withdrawal based on source type and location (B6). This item seeks to identify the specific locations from which the company obtains water and the types of water sources utilised in its operations.

Overall, water consumption constitutes an important part of corporate water disclosure, and the following items under the category of water consumption are expected to be disclosed in the corporate reports or websites:

B1. Description of water consumption
B2. Total volume of water consumption (in megalitres or cubic metres)
B3. Intensity of water use, i.e., water consumption per unit of product; or water consumption per dollar revenue
B4. Change in water consumption (in monetary terms or physical quantities)
B5. Total cost of water consumption (in monetary terms)
B6. Water withdrawal by source type (surface water/groundwater/seawater/third-party supply) and location

C. Wastewater discharge

In everyday life, wastewater originates from domestic activities such as kitchen and bathroom use. In a business context, wastewater refers to water used in industrial processes or other business-related activities, such as cooling and cleaning. Understanding a company's wastewater situation is important. Therefore, the first item in this category will focus on describing the wastewater generated from business activities (C1), while the second item will address the total volume of wastewater produced from these activities (C2). Specifically, C2 is expected to be disclosed in megalitres or cubic metres.

A company's water discharge typically includes effluents, used water, and unused water discharged to surface, ground, sea, or to a third party, for which the company has no further use (GRI, 2018). This definition illustrates the close connection between corporate water discharge and consumption, where the amount of water withdrawn by the company represents the water input, and the water discharge represents the water output.

Industrial water discharge is a significant concern for companies and water users due to its potential for large-scale water quality degradation and direct damage to ecosystems (AWS, 2019; CDP, 2019; CEO Water Mandate, 2014). Industrial wastewater often contains a variety of substances, including chemicals and pollutants, requiring treatment before discharge or reuse.

Hildering (2004) highlights that unregulated industrial wastewater discharge is a major contributor to water pollution. Poor water quality caused by industrial pollution violates human rights to access safe water sources (Delai & Takahashi, 2013; Hazelton, 2013). China has suffered dramatic environmental degradation due to water pollution (Q. Wang & Yang, 2016). The poor water quality caused by water pollution has had a negative impact on the public health of Chinese citizens (M. Shao et al., 2006; M. Wang et al., 2008). Q. Wang and Yang (2016) explored the adverse health effects of water pollution and found that it is a significant source of morbidity and mortality in China. Tao and Xin (2014) reported that about 190 million people experience illness and injuries associated with water pollution each year, and 60,000 people die from a range of water-related diseases. Q. Wang and Yang (2016), meanwhile, identified industrial wastewater discharge as a pressing concern for the current water situation in China. J. Qu and Fan (2010) noted the large volume of industrial contaminants discharged into the nation's waterways annually. Miao et al. (2015) subsequently found that industrial toxic discharges are a main cause of water pollution in China. Furthermore, research by Okadera et al. (2006) highlights the industrial sector as a major contributor to wastewater discharge in China, leading to substantial pollution of local water sources.

Given the importance of wastewater discharge in corporate water disclosure, the third item under the category of wastewater discharge will focus on describing the nature of wastewater discharge (C3), while the fourth item will quantify the total volume of wastewater discharged (C4). Specifically, C4 is expected to be reported in quantitative terms.

Furthermore, disclosing the destination and location of a company's wastewater is also important, considering the potential water-related risks and negative impacts on local water bodies. Therefore, the fifth item under the category of wastewater discharge is designed to capture information related to the wastewater discharge destination and location (C5). Specifically, the destination refers to the place where a company discharges its wastewater, such as a river, land, sea, or independent sewage treatment plant, while the location specifies the name of that place.

In each reporting period, the wastewater discharge situation of a company is not fixed. The quantity and method of wastewater discharge fluctuate with the company's operations and production. Consequently, it is essential to disclose these changes in each reporting period. Such disclosure provides comparable information that not only aids managers in comprehending the variations in their company's wastewater discharge but also signals information users regarding the company's wastewater management changes. This facilitates comparisons with data from previous reporting periods, serving as a crucial indicator for stakeholders in their decision-making processes. Therefore, the sixth item under this category will be designed for companies to disclose their change in water discharge (C6).

The following items are expected to be disclosed in the corporate reports or websites:

C1. Description of wastewater generated from business activities (i.e. how wastewater is produced during business activities)
C2. Total volume of wastewater produced during business activities (in megalitres or cubic metres)
C3. Description of wastewater discharge
C4. Total volume of wastewater discharged (in megalitres or cubic metres)
C5. Water discharged by destination (river/land/sea/independent sewage treatment) and location
C6. Change in water discharge (in monetary terms or physical quantities)

D. Wastewater treatment

Wastewater treatment is an important strategy to deal with used wastewater. It is also a vital step before wastewater being discharged back to the environment or being reused again in corporate operations.

Before starting the discussion of items in wastewater treatment, it is important to understand how water degrades into wastewater. In general, wastewater refers to used water of reduced quality. More specifically, it represents the water that has no further value for the purpose for which it was obtained, or for the activity that generated it, due to factors such as diminished quality, reduced quantity or time of occurrence[19] (AWS, 2019). Nevertheless, wastewater could be treatable, but the treatment should be compliant with appropriate quality standards to minimise the risk of environmental harm (AWS, 2019).

Prior literature indicates that treated wastewater can significantly reduce environmental damage and prevent potential hazards to clean water sources (Akpor et al., 2014; Jhansi & Mishra, 2013). Additionally, safely treated water can be reused by other users, thereby reducing their initial water demand. Thus, selecting an appropriate treatment method is a critical consideration for many companies.

It is worth noting that wastewater treatment may not apply to all companies, as not every company generates wastewater. Also, different industries may opt for different treatment methods. Generally, there are two primary methods for treating wastewater: centralised and decentralised treatment. For decentralised treatment, a company must build its own wastewater infrastructure, such as a wastewater treatment plant. This approach is usually very expensive due to the substantial initial investment required to construct the facilities and the need to recruit experts to operate them. In contrast, centralised wastewater treatment is a popular solution for managing wastewater. It does not require companies to have their own facilities. Instead, companies discharge wastewater into a sewage network, which connected to a central wastewater treatment plant, making treatment operations easier to manage. However, the wastewater must meet the treatment standards set by the centralised treatment plant. If it does not, companies are required to perform pretreatment before discharging it into the network. Also, companies are responsible for covering the treatment costs charged by the central treatment plant, and this cost is usually associated with the quantity of wastewater discharged.

[19] 'Time of occurrence' refers to the specific time when wastewater is produced or becomes available. This factor can affect its value or usability, especially if the wastewater needs to be managed or treated at specific time to prevent environmental damage or to align with treatment facility capacities.

China is a typical example of this approach, as its economic growth heavily depends on industrial development, many companies choose to discharge their wastewater into the municipal sewage pipeline and treat their wastewater at the local municipal wastewater treatment plant. Consequently, most industries in China use centralised wastewater treatment to manage their wastewater (Wilderer & Schreff, 2000).

Based on the above discussion, the first and second items under this category will be the description of wastewater treatment (D1) and the total volume of wastewater treated (D2). Specifically, D1 is expected to provide a detailed description of the wastewater treatment process, including the treatment method used by the company. D2 should be disclosed in quantitative terms, indicating the total volume of wastewater that has been treated.

Wastewater is treatable, and after proper treatment it can be reused in various applications for different purposes or discharged after treatment (Salgot & Foloh, 2018). In this situation, the portion of wastewater that has been treated is important and indicates a company's wastewater treatment rate. This information helps the users to understand how effectively a company manages its wastewater (Z. Li et al., 2023). More specifically, a high wastewater treatment rate indicates that a substantial portion of wastewater is processed to comply with environmental and health standards, thereby reducing pollution and safeguarding water resources. In contrast, a low treatment rate implies that a large amount of wastewater is discharged untreated, which can pose significant risks to the environment and public health. Consequently, the third item will require companies to disclose the proportion of wastewater that has been treated (D3). Additionally, this item is expected to be presented as a percentage to the total volume of wastewater.

Similar to water consumption and wastewater discharge, wastewater treatment practices and outcomes will change over time. These changes can be driven by several factors, including changes in production levels, advancements in treatment technology, shifts in regulatory requirements, and changes in company policies or environmental goals (Monteith & Sterne, 2001; Salgot & Foloh, 2018). Therefore, it is crucial for companies to provide stakeholders with updated information on their wastewater treatment practices regularly. To address this need, the fourth item will be designed for companies to disclose changes in their wastewater treatment (D4). This item should capture both qualitative and quantitative changes. For example, companies can disclose any upgrades or modifications to their treatment facilities, adoption of new technology for wastewater treatment, and any changes in treatment efficiency and capacity.

The cost associated with wastewater treatment is significant. Although centralised wastewater treatment is a more popular practice for most companies due to its operational and managerial

advantages, this incurs considerable expenses. These costs are typically measured based on the quantity of wastewater sent for treatment. For companies that have their own wastewater treatment plants, the initial investment is usually substantial, encompassing the construction of facilities and the acquisition of necessary technology. Additionally, ongoing maintenance costs must be considered, including expenses for operations, repairs, and the employment of specialised personnel to manage the treatment processes. Given these financial implications, the fifth item is designed for companies to disclose the total cost invested in wastewater treatment (D5). This item is expected to be disclosed in monetary terms, providing a clear and comprehensive view of the financial commitment companies make towards managing their wastewater. This disclosure will not only enhance transparency but also enable stakeholders to assess the financial burden and investment efficiency in environmental management practices.

The following items under the category of wastewater treatment are expected to be disclosed in the corporate reports and websites:

D1. Description of wastewater treatment (i.e. describe the process of wastewater treatment)
D2. Total volume of wastewater treated (in megalitres or cubic metres)
D3. The proportion of wastewater that has been treated (percentage of total wastewater)
D4. Change in wastewater treatment (in monetary terms or physical quantities)
D5. Total cost invested in wastewater treatment (in monetary terms)

E. Water recycling and reuse

Water recycling and reuse has rapidly become the key strategy to mitigating the pressure of freshwater availability. Also, many countries have included wastewater reuse as an important component of their water resource planning to reduce water wastage (Angelakis & Durham, 2008; Hamdy et al., 2003; SDG 6, 2018).

Water recycling and reuse are defined in the CDP Water Security Reporting Guidance (2019) as "water and wastewater (treated or untreated) that has been used more than once before being discharged from the organisation's boundary" (p. 26). In other words, water recycling could be used as an alternative source that contributes to the reduction of freshwater demand and ensures that water supply can be adequate to meet future water need (Larson et al., 2012).

In business practice, water recycling has been extensively adopted in the food and drink industry (Alkaya & Demirer, 2015; Casani et al., 2005). Miller (2006) suggests that water recycling can potentially address the issue of water resource availability and create an

opportunity for water users to supplement their demands by using recycled water. However, used water must go through a proper recycling process, including removing harmful substances from the used water and other necessary treatment. After proper treatment, water can be reused in the same process or a different process, which is a sufficient approach to improve the water reuse efficiency and reduce the demand for freshwater. Hancock (1999) suggests that water recycling is a valuable option for many industries to cut down their overhead expenses on water consumption.

China is one of the countries with the lowest (fresh)water availability in the world and is facing increasing demand for freshwater (R. K. Mishra, 2023; Musie & Gonfa, 2023). More importantly, water scarcity has become a significant obstacle to the country's economic development (Yi et al., 2011). In this respect, water recycling and wastewater reuse have been adopted as long-term strategies for Chinese companies and the government to manage available water resources. The UN WWDR (2019) emphasised that water recycling and reuse offer valuable opportunities for enhancing conventional water supply and reduce environmental impacts and operational costs, which is an important step in sustainable development. Therefore, the first item will be designed to capture a detailed description of water recycling and reuse practices (E1). This includes information on the methods and processes employed, the types of water recycled or reused, and any technological advancements or improvements in recycling efficiency.

The second item will require the disclosure of the total volume of water recycled or reused (E2). This should be presented in quantitative terms, providing stakeholders with a clear understanding of the scale and impact of the company's recycling efforts. By including these items in corporate water reporting, companies can enhance transparency, demonstrate their commitment to sustainable water management, and provide valuable data for benchmarking and continuous improvement in environmental performance.

Moreover, if a company is using water from recycling, it is important to disclose the volume and/or percentage of water recycled or reused from the total water consumption (E3). The GRI (2013) states that the percentage of water reuse and recycling could be applied as an indicator to demonstrate the success of a company in reducing total water consumption and discharge. An increased rate of reuse and recycling of water resources could result in a reduction of water consumption, treatment, and disposal costs. In addition, such a rate may effectively benefit the public and those potential users who may not have specialised in this field. Consequently, this metric serves as a valuable indicator to show the amount of water saved from consumption, highlighting the company's efforts in reducing its reliance on fresh water sources.

Additionally, changes in water recycling and reuse practices (E4) represent an important indicator of a company's commitment to conserving water resources. This disclosure provides stakeholders with information on the company's progress and any adjustments made to its water recycling strategies. It allows for the assessment of improvements or declines in water reuse over time. By reporting on these changes, companies offer comparable information to potential users and relevant stakeholders, facilitating better understanding of the company's performance of water utility. This helps stakeholders make informed decisions and fosters trust in the company's water sustainability practices.

Although water recycling and wastewater reuse is a practical approach in terms of mitigating the current pressure on water need, the price for introducing and operating a water reuse programme is high (Yi et al., 2011). Duong and Saphores (2015) found that the major obstacle for companies adopting water recycling is the associated costs. These include purchasing and installing equipment, recruiting expertise, and performing regular maintenance. Other studies have also demonstrated that cost is one significant element in respect of the application and the development of water reuse and recycling in multiple industries (Giurco et al., 2011; X. Lu et al., 2010).

Cost has always been a perplexing and pertinent issue for many disciplines. However, the importance of water recycling and reuse has been emphasised in many prior studies and business practices. In this case, if a company is involved in recycling water or any water reuse activities, it would be important to disclose the cost associated with it (E5).

The following items under the category of water recycling and reuse are expected to be disclosed in the companies' reports or websites:

E1. Description of water recycling or reuse
E2. Total volume of water recycled or reused (in megalitres or cubic metres)
E3. Total volume of water recycled or reused as a percentage of the total water consumption
E4. Change in water recycling and reuse (in monetary terms or physical quantities)
E5. Total cost invested in water recycling or reuse activities (in monetary terms)

F. Information assurance

As noted previously, water information disclosure in China is a voluntary reporting practice. This means that companies have the discretion to decide what water-related information to prepare and disclose to the public. In this context, the authenticity and reliability of the disclosed information can be a potential issue for those interested in such information, including information users and relevant stakeholders.

Information assurance plays an important role in ensuring that the water-related information contained in companies' reports meets a certain level of reliability and credibility. Assurance helps minimise the risk for potential users who rely on such information for decision-making. To address this need, the first item in this category will be designed to determine whether the information has been assured or not (F1).

For companies that undergo assurance, it is important to disclose information regarding their assurance providers. This transparency helps users evaluate the credibility of the assurance. The second item will therefore be the assurance scope (F2), which aims to identify whether water disclosure is included in the assurance scope. This distinction is critical as it informs stakeholders about the specific areas covered by the assurance process, allowing them to understand the extent of the reliability and accuracy of the disclosed information.

The third and fourth items in the assurance category are the assurance opinion (F3) and the assurance standards (F4). These items are essential for providing stakeholders with a clear understanding of the assurance process and its outcomes. The assurance opinion (F3) is usually issued by the assurance provider to express an opinion (i.e., limited or reasonable) designed to enhance the degree of confidence of the users about the result of an evaluation or measurement of a specific item. Assurance standards refer to the frameworks and guidelines followed by the assurance provider to conduct the assurance engagement. This understanding helps stakeholders to assess the rigor and thoroughness of the assurance process. Also, knowing the assurance standards used allows stakeholders to compare assurance processes across different companies. In addition, disclosure of the assurance standards enhances stakeholders' confidence in the processes used to verify the disclosed information, ensuring that the assurance engagement meets the expectations from the stakeholders.

The following items under the category of information assurance are expected to be disclosed in the companies' reports or websites:

F1. Assurance provider

F2. Assurance scope

F3. Assurance opinion

F4. Assurance standards

G. Water risks

In this research, water risks are water-related risks relevant to companies, not the planet or society. Different companies may encounter different water-related risks, and it is important to disclose these risks to the relevant stakeholders and the public. There are five identified risks associated with water, and companies that face any of these risks should disclose them.

The first risk to consider is physical water risk, particularly in terms of quantity (G1). Physical water risks are associated with the availability of water resources necessary for a company's operations, supply chains and logistics. This risk can manifest in several ways, including water scarcity, droughts, and competition for water resources (Reig et al., 2013). More specifically, this type of risk is often associated with the geographical location of a company's operations. Companies operating in regions affected by water scarcity or experiencing freshwater shortages are particularly exposed to such risks. This disclosure item is intended to capture information related to these conditions. In addition, if a company faces challenges related to limited or unreliable water supply from external providers, such as municipal water systems or private water utilities, this item also allows companies to disclose such information.

The second risk to consider is physical water risk, particularly in terms of quality (G2). Water quality issues can pose significant challenges for companies. Contaminated or poor-quality water can disrupt manufacturing processes, affect product quality, and necessitate additional treatment and purification measures, all of which can incur substantial costs. In this case, if a company is facing such issue, they can use this item to disclose the details to the public. Moreover, if a company receives poor-quality water from its water provider, such as a municipal supply or a private water utility, it may also use this disclosure item to report such issues.

The third risk to consider is reputational risk (G3). Reputational risk refers to potential conflicts with the public regarding water issues that can damage a company's public image or result in the loss of the company's licence to operate in a community. This type of risk is particularly common in developing countries, for several important reasons. First, developing countries often lack adequate infrastructure to ensure all users have access to safe and reliable drinking water supplies. Companies operating in these regions may face greater scrutiny regarding their water use and wastewater management practices. Secondly, weak regulatory frameworks in

developing countries can lead to inconsistent enforcement of water-related regulations. In this situation, companies might exploit these gaps, resulting in practices that can harm the environment and public health, thereby increasing their reputational risks. Thirdly, developing countries often rely on industrial activities to drive economic growth (Haraguchi et al., 2019). China, as a developing country, faces significant challenges with wastewater, which has led to serious public health issues and substantial pollution of the natural water environment (B. Chen et al., 2019; Y. Hu & Cheng, 2013). In this situation, Chinese companies must navigate the delicate balance between economic contributions and environmental stewardship to minimise reputational risks.

The fourth risk pertains to regulatory risk (G4), defined as the exposure to the impacts of water-related regulations on a company. As pressures related to physical water scarcity and quality, as well as reputational concerns, increase, many local and national governments are enacting more stringent water policies or revising existing regulations. For example, new and more rigorous water regulations often necessitate that companies invest in advanced technologies and processes to comply with standards for water usage, wastewater discharge, and pollution control. The costs of compliance can be substantial, particularly for companies operating in water-intensive industries. Furthermore, regulatory changes can impose restrictions on water usage and wastewater discharge, potentially limiting a company's operational capacity. Examples include water allocation limits during drought periods or stricter effluent standards, both of which can directly impact production processes and productivity levels.

Additionally, changes in water regulations may involve the need to obtain new permits and licences under updated regulatory frameworks. For example, in China, companies involved in discharging wastewater need to apply for a Pollutant Discharge Permit (see Chapter 2 for more details). Companies may encounter extended review periods for this permit, leading to delays in project timelines, or they may face additional requirements to continue normal business operations. In this context, if companies fail to anticipate these regulatory changes, the consequences can be costly. Unanticipated regulatory changes can not only impose significant financial burdens but also, in some cases, restrict industrial activities in specific geographic areas. Therefore, companies facing such issues can disclose the relevant effects under this item.

The fifth risk is regional risk (G5). This type of risk is particularly pertinent for companies operating in areas where water scarcity is a pressing concern. These risks can have far-reaching implications for business operations and sustainability. In regions with limited water resources, companies may struggle to secure the necessary water supplies for their operations. This scarcity can lead to increased competition for water between industrial, agricultural, and

domestic users. China faces the challenge of an unbalanced spatial distribution of water resources (Piao et al., 2010; Q. Wang et al., 2023). For example, northern China accounts for over 60% of the nation's farmland and supports more than half of the population but has only approximately 20% of the country's overall water resources. In contrast, southern China has relatively abundant water resources, but much of the runoff is wasted due to floods and water pollution (B. Cai et al., 2019; Guan et al., 2014; Kang et al., 2017). This geographical imbalance of water resources has significant implications for many business sectors, such as agriculture (D. Li et al., 2022; H. Yan et al., 2019), energy (X. Yan et al., 2022), and so on. As a result, companies which operating in water scarce regions may face higher costs to access water or may need to invest in alternative water sources and technologies to maintain their normal business activities and operations.

The following items under the category of water risks are expected to be disclosed in the companies' reports or websites:

G1. Physical water risks – in quantity
G2. Physical water risks – in quality
G3. Reputational risks
G4. Regulatory risks
G5. Regional risks

H. Other water disclosures

The purpose of including this category is to accommodate alternative disclosures that may be observed during the analysis of corporate reports and information on company websites. Recognising that water-related issues vary significantly across different contexts, the researcher has intentionally created an open category to capture unique water-related content disclosed by Chinese companies. Additionally, the predefined disclosure categories (A–G) are grounded in the existing literature and reporting frameworks. They represent the key aspects of water management in the business context and are designed to provide a comprehensive overview of corporate water disclosures. However, category H is designed for capturing disclosures that do not fit neatly into the predefined categories. Consequently, it will be insightful to explore disclosures unique to the Chinese setting.

5.4.4 Development of the scoring system

The primary objective of the scoring system is to measure the comprehensiveness of water-related disclosures. Comprehensive disclosure is crucial for stakeholders who rely on detailed

and accurate information to make informed decisions. By systematically evaluating the comprehensiveness of disclosures, the scoring system will provide insights into how thoroughly companies report their water management practices. Prior literature suggests that significant achievements can be obtained with scale analysis, which has been extensively employed in numerous research areas (Ramlawati, 2018; Staniewski & Awruk, 2019). More importantly, previous studies have highlighted the importance of measuring the corporate environmental information disclosure by assessing the comprehensiveness of such disclosures using a scoring system (Bewley & Li, 2000; Cho & Patten, 2007; Cormier et al., 2011; Hooks & Van Staden, 2011; Y. Lu & Abeysekera, 2014; Patten, 2002). Therefore, to assess the comprehensiveness of water-related information disclosed by Chinese companies, this research develops a unique and water-specific scoring approach. More specifically, a 5-point comprehensiveness scale (Table 5.3) will be used to measure the comprehensiveness of corporate water information disclosures. The development of a comprehensive scoring system will address a gap in the literature by providing a methodical approach to measuring the comprehensiveness of corporate water disclosures. Also, this scoring system will offer a valuable tool for academics and practitioners to analyse and compare water-related disclosures across different companies, industries, and countries.

The scoring system has been meticulously designed as a 5-point scale, with a score of (0) representing the lowest possible score. A score of (0) indicates that no water-related information has been disclosed in the corporate reports or on the company's website. A score of (1) indicates that an information item has been disclosed with minimal coverage and discussion. This score is assigned when the information is presented only in general terms, typically in a narrative format without detailed elaboration. A score of (2) refers to an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but there is no explanation putting the issue in perspective. A score of (3) signifies that the impact of the item has been clearly defined in quantitative terms, accompanied by explanations and additional information that provide context. This includes comparative data, as well as tracking progress against aims and budgets. A score of (4) indicates a truly extraordinary disclosure, benchmarked against best practices. This includes adherence to standards such as the GRI, industry averages, regulatory requirements, and other reporting standards or guidelines.

The aforementioned scoring system was used for all categories except category F – Information Assurance. This category includes four disclosure items, as discussed previously. For the item F1 (information provider), a 3-point scale will be utilised: 0 = no information on assurance; 1 = internal assurance, which means information assured by the company itself through its internal process; 2 = external assurance, which means information assured by a domestic/international

accounting firm, domestic/international consulting firm, or NGOs. A 2-point scale will be used for the item F2 (assurance scope): 0 = no indication of the assurance scope or assurance does not include water information; 1 = assurance include water information. A 3-point scale will be used to measure the item F3 (assurance opinion): 0 = no opinion specified; 1 = limited assurance opinion (moderate); 2 = reasonable assurance opinion (high). A 2-point scale will be used to measure item F4 (assurance standards): 0 = no indication of the assurance process and standard; 1 = assurance standards were disclosed in the assurance report.

Overall, the development of a comprehensive scoring system for corporate water information disclosure represents a significant advancement in the field of water accounting. By providing a robust framework for evaluating the comprehensiveness of water information disclosure, the scoring system will contribute to a deeper understanding of corporate water management practices. Also, it will fill an important gap in the literature and provide valuable tools for enhancing water-related information disclosure in the corporate sector.

Furthermore, to ensure intercoder reliability in the content analysis, an independent reviewer was invited to follow the same scoring process for all companies and assign scores to each disclosure item. This was done to verify the consistency and accuracy of the results. In cases where discrepancies arose between the scores, the researcher carefully re-evaluated the item to ensure the accuracy and reliability of the final scores.

Table 5.3 The scoring system

Categories	**Scoring system**
A. Water policy	A 5-point scale (0–4) was used for measuring the comprehensiveness of the disclosures: 0 = no information disclosed. 1 = an information item disclosed with minimum coverage and discussion about the issue. Information disclosed only in general terms (i.e., narrative only). 2 = an information item disclosed in quantitative terms (i.e. in monetary terms or physical quantities), but there is no explanation putting the issue in perspective. 3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets).
B. Water consumption	
C. Wastewater discharge	
D. Wastewater treatment	
E. Water recycling and reuse	
G. Water risks	
H. Other water disclosures	

	4 = truly extraordinary, benchmarking against best practice (i.e., GRI or other standards/guidelines, industry averages, regulatory requirements/guidelines).
F. Information assurance	A 3-point scale (0–2) was designed for measuring the index item F1. 0 = no information on assurance. 1 = internal assurance: information assured by the company itself through its internal process. 2 = external assurance: information assured by the Big 4 accounting firms, a domestic/international accounting firm, a domestic/international consultant group or a domestic/international NGOs. A 2-point scale (0–1) was designed for measuring the index item F2. 0 = no indication of the assurance scope or assurance does not include water information. 1 = assurance include water information. A 3-point scale (0–2) was designed for measuring the index item F3. 0 = no opinion specified. 1 = limited assurance opinion (moderate). 2 = reasonable assurance opinion (high). A 2-point scale (0–1) was designed for measuring the index item F4. 0 = no indication of the assurance process and standard. 1 = assurance standards were disclosed in the assurance report.

5.5 Semi-structured interviews

Semi-structured interviews are often employed to explore interviewees' perspectives on a given set of issues and questions. The literature suggests that conducting semi-structured interviews is highly beneficial in exploratory studies (Denzin, 2008; S. Q. Qu & Dumay, 2011). This research method creates more opportunities for researchers to capture and uncover issues under specific themes (Grindsted, 2005; Longhurst, 2003). Moreover, conducting interviews with participants

or different participant groups provides additional insights based on their reflections, generating a substantial amount of in-depth knowledge about the research topic.

In this study, interviews were conducted via online calls, using platforms preferred by participants such as Microsoft Teams, Skype, VooV, and WeChat Meeting. Each interview lasted between 30 and 60 minutes. All interviews were recorded and stored in compliance with the ethical protocols approved by the Auckland University of Technology Ethics Committee (AUTEC). Data collected from semi-structured interviews were transcribed, coded, and analysed to address research questions 2–4 (see Chapter 7 for more detail regarding the interviews). The interviews were conducted and recorded in Chinese. The researcher first translated the recordings from Chinese to English (without using software) to facilitate analysis. Subsequently, the researcher manually coded the responses by identifying themes based on the participants' answers to the interview questions. This process ensured that the qualitative data were systematically categorised and aligned with the research objectives, preserving the integrity of the participants' perspectives while enabling a thorough analysis.

Common responses and highly repetitive topics were highlighted in the research notes to support the data analysis process. This approach ensures that recurring themes and key ideas are identified and documented, providing a robust foundation for further analysis. Highlighting such patterns also enhances the credibility of the findings by emphasising the consistency and relevance of participant responses across the dataset. Information collected from the semi-structured interviews assisted the researcher in exploring the motivations and challenges faced by Chinese companies in reporting corporate water information. The interviews also revealed stakeholder expectations regarding water disclosure and the gap between current corporate water disclosures and the expectations of various stakeholder groups. In addition, they provide firsthand insights from participants who hold influential positions regarding corporate water information disclosure in China. The following section explains the selection of interview participants and the development of the interview questions.

5.5.1 The selection of interview participants

In this study, participants were recruited from eight distinct influential stakeholder groups, including corporate managers, government officials, managers from the stock exchanges, shareholders, academics, managers from the employee unions, media, and environmental NGOs. The reasons for selecting these stakeholders are explained in the following paragraphs.

Given the broad range of stakeholder groups involved, participants were selected to effectively represent the perspectives of each group. Specifically, corporate managers chosen for this study were those directly responsible for their company's environmental management or information disclosure. Government officials included representatives from environmental protection and law enforcement departments. The participants from the stock exchanges were professionals working in disclosure policy development. Academic participants were those whose research emphasises environmental information disclosure, with particular attention to water-related disclosures. Additionally, senior managers from employee unions, shareholder associations, media organisations, and environmental NGOs were selected to represent the viewpoints of these groups, ensuring a well-rounded perspective on the issues under investigation. The interviewees were subsequently categorised into four groups for analytical purposes (see Table 5.4).

Originally, the interviews were intended to be conducted face-to-face in China. However, due to the COVID-19 outbreak and subsequent border closures, an alternative approach was necessary, resulting in the interviews being conducted via online video calls. This shift introduced additional challenges, particularly given that Chinese culture often considers in-person meetings to be more appropriate, respectful, and conducive to engagement. Despite these obstacles, these challenges were effectively overcome, and a total of 54 meaningful interviews were successfully completed. The primary recruitment method used to connect with interviewees was snowball sampling. According to Noy (2008),

> A sampling procedure may be defined as snowball sampling when the researcher accesses informants through contact information that is provided by other informants. This process is, by necessity, repetitive: informants refer the researcher to other informants, who are contacted by the researcher and then refer her or him to yet other informants, and so on. (p. 330)

The literature also highlights snowball sampling's effectiveness when the target population is difficult to access (Browne, 2005; Kirchherr & Charles, 2018; Naderifar et al., 2017). In this study, stakeholders from eight distinct groups were considered a hard-to-reach population. Establishing contact with shareholders, for example, was challenging, particularly given the limitations on online interaction. In this context, snowball sampling proved beneficial, as corporate managers who had completed their interviews often acted as referees by providing contact information of shareholders who might be available for an interview. In addition to the snowball sampling approach, interviewees from each stakeholder group were selected through a structured process. This process involved multiple steps to maximise response rates and ensure representation across all eight stakeholder groups. Initially, an invitation letter (reproduced in Appendix C) was sent to potential participants via their publicly available email addresses. This letter was accompanied by a participant information sheet (reproduced in Appendix D) detailing

the research objectives, the scope of the study, and specific information about the interview processes, as well as a consent form (reproduced in Appendix E). Upon receiving a participant's acceptance of the invitation, a follow-up email was sent to arrange a mutually convenient date, time, and preferred online platform for the interview. Given that the study relied on virtual interviews due to COVID-19 restrictions, flexibility in scheduling and platform choice was prioritised to accommodate participants' preferences. Recognising that not all invitees would respond, a second round of follow-up invitations was sent to those who did not initially reply, with careful attention to ensure persistence without pressure. This step aimed to gently remind potential participants of their importance to the study and increase overall participation. As a result of this carefully managed recruitment process, a total of 54 interviews were successfully completed (see Appendix F for detailed information on each interview). The following paragraphs provide a detailed explanation of the target participants selected from each stakeholder group.

Corporate managers play a crucial role in preparing water-related information disclosures (Cormier et al., 2004; Matta et al., 2019). Since water information disclosure is voluntary in the Chinese business context, managers responsible for preparing and reporting this information hold significant influence over what is disclosed to stakeholders and the public (Z. Cheng et al., 2017). These managers are typically senior executives/managers (Y. Ma et al., 2019) and interviewing them can provide valuable insights into their perspectives on corporate water information disclosure. Additionally, as information providers, interviewing them can shed light on the motivations driving Chinese companies to disclose water-related information, which is essential for addressing research question 2.

Companies need acceptance from society and stakeholders in terms of their survival and long-term sustainable development. Hence, the disclosure of social and environmental information is a common approach for companies to obtain legitimacy. Prior studies in the area of corporate environmental information disclosure have identified that compliance with local regulations and laws is one of the key factors driving companies to disclose relevant information (Diamastuti et al., 2021; Khosroshahi et al., 2021; Matta et al., 2019). The government's role in setting laws and regulations influences companies' business processes and operations, which directs companies to seek acceptance from society (Jahid et al., 2020; Siddiqui, 2010). In China, studies have shown that government efforts have a significant impact on the level of corporate environmental performance, including environmental information disclosure (X. Liu et al., 2010). L. Zhang et al. (2016) also demonstrate that supervision pressure from the government can elevate the quality of corporate environmental information disclosure. For this reason, interviewing government officials provides insights into the design of relevant laws and

regulations (H. Ji & Miao, 2020). More importantly, it offers knowledge about how the government can influence companies in disclosing water-related information.

Companies listed on the stock market are usually strictly regulated. In 2008, the SSE issued its Guidelines on Environmental Information Disclosure for companies listed on the exchange. This was preceded by the SZSE's Guidelines for Information Disclosure in 2007, aiming to encourage listed companies to actively disclose corporate information relevant to environmental protection. More importantly, both guidelines have been recently revised and will become mandatory disclosures in 2026. From this perspective, it is important to include managers from the stock exchanges themselves in the interview scope to explore their perspectives on corporate water information disclosure. At the same time, they will have insights into the ideas behind these guidelines and how they differ from government regulations.

Companies undertake various initiatives to increase their corporate value and attract more investors, and environmental information disclosure is one of these strategies (J. Meng & Zhang, 2022). Shareholders, as a type of investor, play a crucial role since they represent the principal providers of capital for listed companies. While there are many other types of investors, it is not feasible to interview all of them. Therefore, in this research shareholders represent the broad expectations of investors towards the company. Interviewing shareholders will enable an exploration of their perceptions and expectations regarding corporate water information disclosure and how they can influence a company's disclosure of water-related information.

Academic research on corporate environmental information disclosure has a relatively long history in Western countries compared to China. However, the past decade has seen significant progress in this area within China (Lei et al., 2017; Qing, 2022). An increasing number of academic researchers are dedicating their efforts to research corporate environmental information disclosure and transparency. Therefore, interviewing Chinese academics – particularly those whose research focuses on corporate water information disclosure – will reveal their perspectives on the issue and how they can influence corporate water information disclosure.

Employees have always been important stakeholders of companies as they create value (Massingham & Tam, 2015; Suto & Takahara, 2022). Employee matters are also an important topic in many studies related to non-financial reporting and CSR-related disclosures (Costa & Agostini, 2016; Kent & Zunker, 2013). In the context of Chinese business, recent research indicates that high-quality corporate environmental disclosure often leads companies to allocate

more resources towards environmental activities. However, this investment can crowd out resources that might otherwise be used to improve employee treatment, suggesting that employees exert a negative moderating effect on the relationship between environmental disclosure and corporate capital allocation efficiency (Su et al., 2023). This finding aligns with previous research by X. Wang et al. (2020), which demonstrates a significant positive connection between corporate environmental information disclosure and investment efficiency in China, where employee compensation acts as a mediator, indirectly influencing the impact of environmental disclosure on investment efficiency. Following this notion, including employees in the interview scope was considered necessary as employees can be influenced by corporate environmental performance and activities. However, reaching individual employees was challenging given the scope of this research. Therefore, managers from various employee unions were invited to participate in the interviews, as they represent the broader perspectives of employees.

The media plays an important role in environmental information disclosure, serving as a crucial external social supervision mechanism and information intermediary. It is capable of disseminating, diffusing, and exchanging important environmental information, which in turn reduces information asymmetry in the capital market, draws regulatory attention, improves investor trust in companies, and develops societal confidence (L. Fan et al., 2020; P. Wang et al., 2018). Moreover, past studies have revealed that media coverage of corporate environmental matters (i.e., good and/or bad news) not only influences companies' financial outcomes and corporate values (W. Luo et al., 2019), but, more importantly, explicitly contributes to improving the quality of environmental information disclosure (Deng & Shao, 2022; Xue et al., 2021). Following this notion, journalists from different media outlets that focus on business-related matters—particularly those reporting corporate information—were invited to participate in this research.

Over the past decade, the number of environmental NGOs in China has been growing due to the increasing severity of environmental pollution issues. These organisations have been an influential force in promoting environmental protection through various ways, including agenda advocacy, environmental education and initiatives, and protests against polluting facilities, and these efforts have had significant positive influence on environmental governance (G. Li et al., 2018; Pien, 2020). Studies conducted in the Chinese context show that environmental NGOs are very helpful in bridging the gap between society and business. They also play a supervisory role in addressing environmental issues in China (Qing, 2022). Due to the many efforts made by environmental NGOs, environmental information disclosure and transparency have seen significant improvements (Seligsohn et al., 2018). Environmental NGOs have successfully

pressured the private sector to disclose more environmental information and have produced their own reports to disclose business-related environmental issues to the public (Bi et al., 2024; A. L. Wang, 2018; L. Zhang et al., 2016). Therefore, managers from environmental NGOs were invited to participate in interviews to explore their perspectives on current water information disclosure and how they can influence such disclosure.

As noted above, participants selected from the above stakeholder groups were further categorised into four distinct groups for analytical purposes. Company managers were allocated to the first group, named Information Providers/Preparers, as they are responsible for preparing and providing corporate water information. Next, government officials selected from departments responsible for corporate information disclosure, environmental law and regulation, the water conservancy bureau, and the enforcement office were allocated to the second group, representing the Regulators. Thirdly, shareholders and managers from the stock exchanges were placed into the third stakeholder group, representing the broad perspective investors. Lastly, the fourth group included Chinese academics, managers from employee unions, journalists from the media, and environmental NGOs identified as other stakeholders who can have an influential impact on corporate water information disclosure. Among them, participants from the media group represented the Chinese public/consumers, while the rest are important social stakeholders.

Given that the interviews were conducted in Chinese, the process included translating the content from the video recordings into English transcripts for analysis. To ensure both linguistic and contextual accuracy, forward and backward translation was carried out and verified by independent individuals proficient in both Chinese and English.

Table 5.4 Participants for interviews

Eight different stakeholder groups	**Four analytical groups**
Corporate managers	Information providers
Government officials	Regulators
Managers from the stock exchanges	Stock exchanges and shareholders
Shareholders	
Academics	Other stakeholders
Managers from the employee unions	
Media	
NGOs	

5.5.2 The design of interview questions

This research invited a wide range of participants from eight different stakeholder groups. Therefore, the interview questions were designed in two phases, which enabled the researcher to explore in-depth knowledge from different stakeholders and gather valuable insights regarding corporate water information disclosure in China. Such a design is evident in past studies relating to environmental information disclosure and has achieved significant outcomes (Campbell & Slack, 2011; M. J. Jones & Solomon, 2010; Passetti et al., 2018). It was expected that participants' answers to the interview questions would contribute to addressing the research questions of this research project.

In the first phase, each participant was asked the same core questions. This phase started by asking participants how they generally perceived corporate environmental responsibility (Q1) and then gradually directing them to the topic of China's water environment (Q2) and corporate disclosure on water-related issues (Q3). Given that water-related information disclosure is voluntary in China, the following question prompted participants to express their perceptions on what constitutes good corporate water information disclosure (Q4), and what elements they expect to see in companies' water information disclosures (Q5).

Once participants had discussed their expectations regarding corporate water information disclosure, the next question (Q6) guided them to explore the gap between current water information disclosures and their expectations. If the current water information disclosures did not meet their expectations, the subsequent question asked them to provide their opinions on how to improve water information disclosure (Q7). These interview questions were designed to address research question 3: *What are the expectations of stakeholders regarding water disclosure in China?* and research question 4: *To what extent are Chinese companies currently meeting stakeholder expectations concerning water-related aspects?*

The last question in the first phase directed the conversation to existing reporting frameworks that cover water-related aspects (Q8). After being shown the findings from the content analysis, participants were asked if they thought the current international reporting frameworks, such as GRI, ISO, or ESG, are best suited for Chinese companies to disclose water-related information. The reason for asking this question was that the existing international reporting frameworks contributed to the development of the novel water disclosure index. Therefore, it is important to explore the practical difficulties that Chinese companies face in adopting these frameworks. Additionally, the answers obtained from this question highlighted the challenges that Chinese companies face when implementing a Western-based approach to water accountability.

This step-by-step inquiry approach has been widely used in many previous studies. It allows participants to express their views on the research topic and let them feel comfortable to take the conversation to another level. This, in turn, enables the researcher to gather additional and more in-depth information during the interviews (Hossain et al., 2015; Rimmel & Jonäll, 2013).

The second phase of the interview consisted of individual questions tailored to each specific stakeholder group (see Table 5.5). Specifically, these questions were asked to facilitate further discussion on water information disclosure. For example, corporate managers (representing the information providers/preparers) were asked detailed questions related to their company's water disclosure situation. For example, they were asked whether their company has a policy for water information disclosure, who they think the stakeholders interested in water-related information are. More importantly, the questions aimed to reveal what motivated them to disclose water-related information and the challenges they faced during the process. The answers to these questions are significant as they directly contribute to addressing research question 2: *What are the motivations for Chinese companies to disclose water information?*

Government officials are important because they play a regulatory role in setting water-related laws and regulations that directly influence corporate water performance. Therefore, understanding the water-related issues they are concerned with and the objectives of establishing water-related policies and regulations can greatly contribute to understanding Chinese corporate water accountability.

The shareholders and managers from stock exchanges represent the perspective of a wide range of investors. Therefore, their questions were designed to uncover their impact on water-related information disclosure. In addition, since listed companies are strictly regulated by stock exchanges, it was important to identify the differences between government regulations and stock exchange policies in disclosing water information.

Among the other stakeholders, managers of employee unions represented employees' perspectives on corporate water information disclosure, and these questions were designed to explore how employees can influence water information disclosure. The media represented customers and the public, and NGOs represented a social perspective on corporate water information disclosure. Participants from these two groups were asked how they influence water information disclosure in their respective roles. Additionally, academics whose research focuses on water information disclosure were included to provide their insights.

Overall, this research makes a relatively modest contribution to the interview-based research methodology, particularly within the Chinese business context. Challenges were encountered during both the recruitment and transcription phases, which is consistent with existing literature highlighting the difficulties of conducting interviews in China. As noted previously, the snowball sampling method was employed, resulting in a total of 54 interviews with participants from diverse stakeholder groups. This outcome demonstrates the effectiveness of snowball sampling in accessing a broad range of participants in the Chinese context. However, a significant amount of time was required to secure confirmations from potential interviewees, underscoring the importance of patience and persistence in the recruitment process. Additionally, it was found that providing comprehensive information about the purpose and process of the interview prior to the meeting increased participants' willingness to engage. Ensuring anonymity, offering a summary of the research findings, and clearly communicating ethical safeguards helped to build trust and enhance the reliability of the relationship between the researcher and participants. These pre-interview preparation elements were essential in successfully securing a substantial number of interviews.

Furthermore, the interviews were conducted during a period when China was implementing lockdown measures due to the COVID-19 pandemic. As a result, many individuals had adapted to remote work and exhibited greater flexibility in managing their time while working from home. This context presented a valuable opportunity for the researcher to conduct online interviews, as participants were generally more accessible and willing to engage in virtual discussions.

Table 5.5 Interview questions

	Core interview questions
Q1	How do you define a company's responsibility to the environment?
Q2	How do you see the corporate impact on China's water environment?
Q3	How do you do perceive companies' voluntary water disclosure in China? Also, do you think voluntary disclosure and information transparency can be used as a way of discharging corporate water accountability?
Q4	How do you define good water disclosure by a company?
Q5	What water-related information do you expect from the company? What will you use it for?
Q6	Does the current corporate water disclosure meet your expectations? If not, what is the gap between current disclosure and your expectations?
Q7	From your perspective, how can companies improve their current water-related information disclosure?
Q8	Do you think the existing international frameworks, for example the GRI, ESG and ISO, are good or the best for Chinese companies to disclose water-related information? If not, what do you think are the challenges for companies to implement these reporting frameworks?
Specific interview questions for each stakeholder group	
Managers	Q1. What do you think about your company's water disclosure? Could you please tell me about your company's water disclosure policy?
	Q2. What motivates (or does not motivate) your company to disclose water-related information?
	Q3. What reporting medium/media do you use for disclosing water-related information? What are the reasons?
	Q4. Who are the stakeholders you think might be interested in water-related information? Why do they want this information?
	Q5. What are the challenges in the process of disclosing water-related information?
Government officials	Q1. What water-related concerns do you want companies to disclose? Why are those concerns important to you?
	Q2. What are the objectives of Chinese-specific water-related disclosure policies and regulations?
Stock exchange managers	Q1. What is the difference between government regulations and stock exchange reporting rules?

Shareholders	Q1. How do you, as a shareholder, influence corporate water disclosure?
Employees	Q1. How do you use corporate information disclosure?
	Q2. Does employers provide any water-related training on water saving and water protection, or knowledge in other water-related areas?
	Q3. How do you, as an employee, influence corporate water disclosure?
Media	Q1. How do you, as a media, influence corporate water disclosure?
Academia	Q1. How do you, as an academic, influence corporate water disclosure?
NGOs	Q1. What is the mission and vision of your organisation?
	Q2. How do you incorporate your mission and vision into your organisational activities?
	Q3. How do you, as an NGO, influence corporate water information disclosure?

5.6 Conclusion

In this research, content analysis and semi-structured interviews were employed as the primary research methods to address the research questions. Content analysis was used to examine water disclosures among Chinese listed companies. To facilitate this, a unique and specific water information disclosure index has been developed, contributing to the measurement of the extent of water-related information disclosed in corporate reports and websites. Additionally, a scoring system has been designed to assess the comprehensiveness of the disclosed water information.

In addition to the content an analysis, semi-structured interviews were conducted to gather firsthand insights from key stakeholders regarding their perceptions of corporate water disclosure and water accountability, as well as their expectations for current water information disclosure within the Chinese business context. This combination of content analysis and interviews was expected to yield valuable insights into the research topic, ultimately contributing to answering the research questions. The next chapter discusses the findings derived from the content analysis.

Chapter 6. Content Analysis Findings

6.1 Introduction

This chapter presents the findings resulting from the content analysis carried out for this research. This analysis focuses on eight distinct water disclosure categories: water policy, water consumption, wastewater discharge, wastewater treatment, water recycling and reuse, water-related risks, water information assurance, and other water-related issues. These categories were identified through a thorough examination of publicly available company disclosures, as detailed in Chapter 5. The reporting frameworks used by Chinese companies are also identified and discussed.

More specifically, this chapter delves into each of the eight water disclosure categories, offering a comprehensive analysis and presentation of the data obtained. To aid in the understanding of the results, tables have been utilised to provide visual representations and facilitate the interpretation of the findings.

This chapter uses the corporate water disclosure index developed in Chapter 5 to empirically analyse the content of the water reporting done by Chines companies. It offers readers valuable insights into how Chinese listed companies disclose information related to water, a critical resource in today's corporate landscape.

6.2 Reporting frameworks

Water is an essential topic in corporate sustainability reporting (Gallego-Álvarez et al., 2018). Given the importance of water information, companies may disclose different water-related information in different ways. Therefore, companies can adopt an external reporting framework as a standardised system to facilitate consistent reporting. Also, using a sustainability reporting framework can help companies communicate to a wide range of stakeholders regarding water-related information in a more structured format. Following this notion, the researcher examined the reporting frameworks that have been adopted by 190 Chinese listed companies, which they used to prepare their sustainability reports.

Table 6.1 provides an overview of the current status of the reporting frameworks adopted by the Chinese listed companies. It shows that 75 out of the 190 companies did not provide evidence of using any reporting framework to produce sustainability reports. Of these 75 companies, 58 did not prepare sustainability reports (but may have included water information in other reports or on their website). As a result, 115 (60%) companies indicated that they had followed at least one or more reporting frameworks during the preparation stage of their sustainability reporting.

Table 6.1 Number of companies using/not using reporting framework(s)

Stock exchanges	**Use reporting framework(s) (%)**	**Do not use reporting framework(s) (%)**	**No report available (%)**	**Total**
Shanghai Stock Exchange (SSE)	66 (70%)	3 (3%)	26 (27%)	95
Shenzhen Stock Exchange (SZSE)	49 (52%)	14 (15%)	32 (34%)	95
Total	115 (60%)	17 (9%)	58 (31%)	190

Table 6.2 identifies a significant gap in average disclosure scores between companies that use and do not use reporting frameworks to report water-related information. The average disclosure score for companies that used external reporting frameworks is 24.9. In contrast, the average disclosure score for companies that did not use or did not mention using any external reporting framework is only 11.6.

Furthermore, when comparing the disclosure scores between companies that utilised a reporting framework and those that did not, a t-test of means yielded a significant result, with a p-value less than 0.00 ($p < 0.00$) (Table 6.2). This difference indicates that adopting external reporting frameworks is positively associated with higher overall mean water disclosure scores. This finding suggests that the adoption of a reporting framework can significantly impact corporate water disclosure.

Table 6.2 Comparing disclosure scores of companies that use/do not use reporting framework(s)

General statistics			**t-test**
	Use framework	Do not use framework	t-value
Mean	24.940	11.608	7.698***
Std. dev.	15.454	8.282	
N	116	74	
Max.	65	29	
Min.	0	0	
25%	13	4	
Median	23	11	
75%	34	19	

Note: *** represent significance at the 1% level.

Panels A and B of Table 6.3 show the different reporting frameworks used by companies listed on the SSE and SZSE to prepare their sustainability reports. The reporting frameworks were categorised into international and domestic to provide a more specific indication of companies' focus. Also, it is worth noting that some companies use more than one framework to prepare their sustainability reports. In these cases, the researcher counted all the reporting frameworks to see which were more popular in the Chinese business context.

From Table 6.3 it is evident that 31% of the companies had adopted reporting guidelines established by the Global Reporting Initiatives (GRI), making it the most commonly used reporting framework among companies listed on both stock exchanges. This result is not surprising, given that the GRI is also the most common corporate reporting framework globally. Prior literature highlights that GRI reporting standards articulate crucial principles governing the content of reports, aiming to enhance the quality and transparency of the reporting (Fernandez-Feijoo et al., 2014). Moreover, the GRI is a globally recognised reporting framework celebrated for establishing one of the foremost standards in sustainability reporting. Its value lies in offering a structured system for reporting, enabling the creation of reports that incorporate quantified and comparable data (Godha & Jain, 2015; Michalczuk & Konarzewska, 2020).

Several factors have led to the GRI becoming the most popular reporting framework in China. First, the GRI has published many versions over the past decade, and water-related disclosures have always been a key topic of the GRI guidelines. Secondly, the GRI published its first

Chinese version for sustainability reporting in 2016, which uses a common language to guide companies to report on different environmental topics (Caputo et al., 2021). At the same time, the Chinese government introduced a series of policies to promote environmental information disclosure, such as the regulations regarding Pollutant Discharge Permits (PDPs; see Chapter 2 for more details). The GRI covers various environmental areas, including water, materials, energy, biodiversity, and emission. Hence, it enables managers to report on different environmental topics to meet different stakeholder needs. Due to this broad scope, the GRI rapidly attracted managers' attention as a solution to help companies disclose environmental information and systematically meet the government requirements. Thirdly, as one of the largest manufacturing and exporting countries in the world, China's listed companies are not only models of the local industry but also represent China's overall business image because their business partners are worldwide. GRI is collaborating closely with policymakers and industry associations in China, becoming one of the key actors in capital markets to further regional sustainable development goals.

Table 6.3 Reporting framework(s) used by companies to disclose water-related information

Panel A – Companies listed on the SSE

International reporting guidelines	**No. of companies**	**% of reporting companies/95**
GRI	44	46%
ISO26000 Guidance on social responsibility	17	18%
Ten Principles of the UN Global Compact	8	8%
UN Sustainable Development Goals (SDGs)	3	3%
Domestic reporting guidelines	**No. of companies**	**% of reporting companies/95**
Environmental, social, and governance (ESG)	35	37%
Chinese Academy of Social Sciences (CASS)-CSR	30	32%
GB/T 36001 Guidance on CSR reporting	15	16%
Guidelines on Environmental Information Disclosure issued by the SSE	34	36%
Guidelines for Preparing CSR Report issued by the SSE	22	23%

Notice on Strengthening Listed Companies' Undertaking of Social Responsibility and Issuance of Guidelines on Environmental Information Disclosure by Companies Listed on the SSE	12	13%

Panel B – Companies listed on the SZSE

International reporting guidelines	**No. of companies**	**% of reporting companies/95**
GRI	29	31%
ISO 26000 Guidance on social responsibility	15	16%
Ten Principles of the UN Global Compact	6	6%
UN SDGs	3	3%

Domestic reporting guidelines	**No. of companies**	**% of reporting companies/95**
CSR Disclosure Requirements/Instructions issued by the SZSE	22	23%
ESG	10	11%
GB/T 36001 Guidance on CSR reporting	18	19%
CASS-CSR	21	22%
Guidelines for Standardised Operation of Listed Companies on the Main Board of the SZSE	23	24%

Moreover, the standards set out by the International Organization for Standardization (ISO)[20] and UN also profoundly impacted the sustainable development of Chinese business and corporate sustainability reporting.

It is important to note that the Ten Principles of the UN Global Compact differ from the UN SDGs. The Ten Principles pertain to a company's core values and its fundamental responsibilities in the realms of human rights, labour, the environment, and anti-corruption.

[20] The ISO is an independent NGO responsible for the development of international standards. Its membership comprises of various national standardisation bodies, including China's. The representative member body for China is the Standardization Administration of the People's Republic of China (SAC). Authorised by the State Council, the SAC holds responsibility for exercising administrative functions, including unified management, supervision and overall coordination of standardisation activities within China.

Principles Seven, Eight, and Nine are particularly relevant to the corporate environmental dimension. These three principles advocate for companies to endorse a precautionary approach to environmental challenges (related to disclosure category G, which concerns water-related risks), take initiatives to promote greater environmental responsibility, and foster the development and dissemination of environmentally friendly technologies. Consequently, these three principles provide valuable insights for Chinese listed companies in terms of their management and practices concerning water resources.

The SDGs, also known as the global goals, were adopted by the UN in 2015 as a universal call to action for safeguarding the planet. There is a total of 17 SDGs, with Goal 6 focusing on clean water and sanitation, aiming to ensure the availability and sustainable management of water and sanitation for all. The enhancement of water quality, wastewater treatment, and safe reuse are significant sub-objectives within this specific goal. The analysis shows that Chinese companies are following international reporting guidelines and standards to some extent.

Table 6.3 also shows several domestic reporting frameworks from the central government and stock exchanges. The GB/T standards are the national standards proposed by the China National Institute of Standardization, which identifies the basic principles, procedures, and methods for all organisations to prepare social responsibility reports. The SSE and SZSE have also issued guidelines to encourage listed companies to disclose corporate environmental information. Although these guidelines are named differently, their primary purpose and core concepts are similar. It is worth highlighting that ESG reporting involves the disclosure of information related to environmental, social, and governance aspects. The objective of ESG reporting is to illuminate a company's activities in these areas and facilitate the communication of its initiatives, performance, and risks. This, in turn, enhances transparency for stakeholders. ESG has been identified as one of the domestic reporting frameworks in this research because Chinese listed companies primarily use the ESG reporting guidelines issued by the Hong Kong Stock Exchange (HKEX). Therefore, for the purposes of this study it has been considered a domestic reporting framework.

CASS-CSR is also among the domestic reporting frameworks commonly utilised by Chinese listed companies in their information disclosure practices. In February 2008, the Corporate Social Responsibility Research Centre within the Chinese Academy of Social Sciences (CASS) was established. Operating as a research body, facilitator, and observer, the Centre has played a pivotal role in shaping the reporting framework for CSR practices in China. A significant milestone in the advancement of sustainability reporting in China was achieved with the release of the first set of Guidelines on Corporate Social Responsibility Reporting for Chinese

Enterprises (CASS-CSR) in December 2009. These guidelines have since evolved and are now in their fourth edition, which was officially launched in 2017. CASS-CSR 4.0 offers insights into issues of national significance and provide guidance for addressing regional concerns. The GRI published a linkage document between CASS-CSR 4.0 and the GRI Standards to assist Chinese companies in meeting the reporting requirements of both frameworks through a single report.

Overall, it is interesting that Chinese listed companies have adopted both international and domestic reporting frameworks together in their sustainability reporting. Appendix G illustrates the details of the reporting frameworks used by each company. There are a number of aspects that warrant attention. First, many companies use various reporting frameworks to diversify their sustainability reporting to meet government requirements and the information needs of different stakeholders. However, there is no clear pattern, nor any explanation for companies selecting or using a particular reporting framework. Adopting multiple reporting standards is not a new practice in the modern business environment (Albu et al., 2013; Hahn & Kühnen, 2013). The factors contributing to this variation are influenced by a complex set of elements, encompassing the diversity of existing reporting guidelines; variations in acceptance and enforcement approaches; the nature of country-specific legal frameworks; organisational characteristics such as size, industry, and geographical location; as well as the influence of local culture and institutions (Bebbington et al., 2012; Hahn & Kühnen, 2013). In this context, Opferkuch et al. (2021) suggest the decision on which reporting framework to use is often influenced by the company's goals and sustainability commitments, and more importantly, the target audience of the report. Gary (2006) emphasises that the selection of a framework must take into account the information requirements of various stakeholders. This consideration enables stakeholders to make informed assessment of the company's non-financial performance.

However, Chinese companies rarely discuss the reasoning and principles behind choosing a particular reporting framework in their sustainability reports. As a result, the voluntary nature of choosing and using these frameworks can lead to an issue where the content of actual reporting is inconsistent and lacks comparability. Secondly, the researcher found many companies tended to partially report on specific indicators that they thought were best for the company (i.e., selecting only the indicators that yield favourable results for reporting purpose), which resulted in inconsistent and incomplete reporting of water information. This situation is not limited to companies in China. Past studies also discovered similar findings on the risks of unethical reporting behaviour (García-Sánchez et al., 2019; Siew, 2015). For example, Farneti et al. (2019) examined the non-financial information disclosure of Italian local governments. Their findings revealed that many of the social and environmental indicators set out in the GRI

guidelines were not disclosed. Similar results have also been reported by Guthrie and Farneti (2008), showing that the application of GRI indicators is fragmentary because organisations attempt to cherry-pick the indicators and integrate them into the annual report. To this end, there is a high degree of agreement between the current findings and previous studies (Farneti et al., 2019; Manes-Rossi, 2019), which identified significant room for companies to improve their adoption of reporting frameworks.

Table 6.4 lists the sustainability reporting frameworks listed Chinese companies used in preparing their sustainability reports, including their corporate water information disclosure and other popular water-specific disclosure frameworks/guidelines that companies adopted in the Western business context. It indicates that the GRI and UN standards are the only crossovers. In contrast, Chinese companies do not commonly use the other popular water reporting frameworks/guidelines, including the CEO Water Mandate, the CDP Water Reporting Guidelines, the AWS International Water Stewardship Standard, and the Water Footprint Assessment Manual in their water disclosure practices. It is worth noting that the water reporting framework is not a necessary tool for companies to disclose water-related information but serves as a guideline that helps the company to be consistent and more systematic in their corporate water reporting. Table 6.4 also indicates a gap in the utilisation of reporting frameworks, which has the potential to reduce the consistency and quality of reporting on water-related information.

Table 6.4 Difference between Chinese and Western companies in adopting sustainability reporting frameworks/guidelines

Reporting frameworks/guidelines used by Chinese listed companies
GRI
ISO26000: Guidance on social responsibility
Ten Principles of the UN Global Contract
UN SDGs
ESG
CASS-CSR
GB/T 36001 Guidance on CSR reporting
Guidelines on Environmental Information Disclosure issued by the SSE
Guidelines for Preparing CSR Report issued by the SSE
Notice on Strengthening Listed Companies; Undertaking of Social Responsibility and Issuance of Guidelines on Environmental Information Disclosure by Companies Listed on the SSE

Guidelines for Standardised Operation of Listed Companies on the Main Board of the SZSE

CSR Disclosure Requirements/Instructions issued by the SZSE

Water-specific disclosure frameworks/guidelines used by Western companies
GRI 303: Water and effluents
CEO Water Mandate
CDP Water Reporting Guidelines
AWS International Water Stewardship Standard
Water Footprint Assessment Manual
UN Environment Programme
UN World Water Development Report
UN SDG 6
WHO

6.3 Corporate water disclosure in each category

The eight corporate water disclosure categories will be analysed separately in the following sections, complemented with discussions on the disclosure items from each water-related category. It is essential to note that these eight corporate water disclosure categories have been derived from the disclosure index, which was constructed based on prior literature and relevant guidelines for water-related information disclosure (see Chapter 5 for its development).

As explained in Chapter 5, to facilitate understanding of the following discussion the eight disclosure categories have been coded as follows: water policy (A); water consumption (B); wastewater discharge (C); wastewater treatment (D); water recycling and reuse (E); water information assurance (F); water-related risks (G); and other water disclosures (H).

6.3.1 Water policy (category A)

The CEO Water Mandate describes corporate water policy as a mechanism that supports companies in integrating water management into their core management processes and business planning. Ultimately, it provides a unifying storyline that assembles the company's water-related activities and processes as part of its overarching priorities and actions. In the Chinese business context, a comprehensive water policy includes water-related targets (i.e., relating to water use and wastewater management and discharge) and goals and strategic plans to achieve them. Therefore, companies are encouraged to establish water policies to help managers make water-related decisions and enhance corporate water accountability by reporting on the achievement of the policies.

The extent of corporate water policy disclosure will be measured based on the company's information disclosure on their corporate water policy relating to water consumption, discharge, wastewater treatment, pollution and wastewater recycling and reuse. Also, an excellent corporate water policy should include information on water-related targets, goals, and water-related strategies. At the same time, the comprehensiveness of water policy disclosure will be measured using a 4-point scale (0–3). The scale was applied as follows: 0 = no information disclosed; 1 = brief mention of water policy (i.e., the company has an existing water policy in place, but no detail about the policy); 2 = detail water policy (i.e., water policy was clearly described in the corporate reports, with water-related targets, goals, and strategies [including both qualitative and quantitative information]); 3 = excellent (i.e., the company has an extended water statement/policy, with the detail of water-related targets, goals and water-related strategies [including both qualitative and quantitative information], and the design of water policies complies with local or international regulatory requirements).

Panel A of Table 6.5 provides an overview of Chinese listed companies' corporate disclosures on water policy. The overall average score for companies listed on both stock exchanges is 1.1, with 1.4 the average for companies listed on the SSE and 0.8 for companies listed on the SZSE. This indicates an unsatisfactory result, with the average score being only 37% of the maximum possible.

Panel B of Table 6.5 compares corporate water policy disclosure at the sector level between the SSE and the SZSE. In general, companies listed on the SSE disclosed more comprehensive information on their water policy, with a 46% average score. In contrast, companies listed on the SZSE only scored 27% on average. More specifically, seven out of 10 SSE sectors scored above the overall average; and two out of 10 SZSE sectors did. Moreover, it is evident that some companies achieved a score of 3, indicating the attainability of the highest score on this measure.

Table 6.5 Water policy

(No. of disclosure items: 1; score 0–3)

Panel A – Overall disclosure on corporate water policy

	Average score/3	**Average percentage**
SSE	1.4	46%
SZSE	0.8	27%

Total	1.1	37%		

Panel B – Disclosures on water policy for companies listed on the SSE and SZSE

SSE sectors	Sector average/3	Average percentage	Min.	Max.
Energy	2.7	90%	2	3
Consumer Staples	2.2	73%	0	3
Materials	1.9	63%	0	3
Industrials	1.6	53%	0	3
Consumer Discretionary	1.6	53%	0	3
Healthcare	1.5	50%	0	3
Utilities	1.2	40%	0	2
IT	0.6	20%	0	3
Telecommunication Services	0.6	20%	0	3
Financials	0	0%	0	0
Total	1.4	46%		

SZSE sectors	Sector average/3	Average percentage	Min.	Max.
Materials	1.5	50%	0	2
Industrials	1.2	40%	0	3
Consumer Staples	0.9	30%	0	3
Healthcare	0.9	30%	0	1
Utilities	0.9	30%	0	2
IT	0.8	27%	0	3
Telecommunication Services	0.7	23%	0	2
Energy	0.6	20%	0	2
Consumer Discretionary	0.2	7%	0	3
Financials	0.4	13%	0	1
Total	0.8	27%		

Furthermore, the results presented in Table 6.4 indicate that the materials and consumer staples sectors occupy the top three positions in terms of scores for both stock exchanges. Prior literature indicates that industrial sectors are associated with varying economic and environmental water risks (Morrison et al., 2010; Sarni, 2013). Burritt et al. (2016) investigated 100 large Japanese companies to uncover the drivers of water-related disclosure. Their findings

suggest that large and highly water-sensitive companies have the highest level of water-related information disclosure and are less able to ignore different stakeholders' water concerns. Likewise, H. C. Yu (2022) notes that the potential water-related risks are highly associated with the level of water engagement. They also identified a number of industries with significant water consumption and severe water pollution, including mining, manufacturing, electricity and gas. From this point of view, companies operating in highly water-intensive sectors should establish a more transparent process to assess water-related impacts with a systematic approach to determine the subsequent water-related problems. The researcher found that companies from highly water-intensive sectors were more willing to disclose their water policies, including their water-related goals and strategies. In contrast, companies that operate in the IT, telecommunication services and financial sectors are less reliant on water. Hence, these companies and their relevant stakeholders are less concerned about establishing a corporate water policy.

6.3.2 Water consumption (category B)

Freshwater is essential to many business operations (Ercin et al., 2011; Gerbens-Leenes et al., 2003). Past studies identify the private sector as one of the main contributors to water consumption (Hildering, 2004; Lambooy, 2010). Although 71% of the Earth's surface is covered by water, most (over 96%) is saline water in the oceans, which makes freshwater a scarce resource when and where people need it (M. De Villiers, 2001; Gleick, 2000b).

Access to an unlimited amount of clean and useable water (i.e., freshwater) is not always assured, and many companies are dependent on continuous clean water availability to sustain their business operations. However, water overuse could threaten the accessibility to freshwater and ultimately damage the local water environment. With this concern in mind, the researcher designed six disclosure items to measure the extent of corporate disclosure covering water consumption: B1 – Description of water consumption; B2 – The total volume of water consumption (in megalitres or cubic metres); B3 – Water consumption per production unit, or water consumption per dollar revenue; B4 – Change in water consumption (in monetary terms or physical quantities); B5 – The total cost of water consumption; and B6 – Water withdrawal by source type (i.e., surface water, groundwater, seawater or third-party water supply) and location.

Moreover, a 5-point scale (0–4) was applied to measure the comprehensiveness of the disclosure. Hence, the researcher was able to distinguish between poor and excellent disclosures. The scale was applied as follows: 0 = no information disclosed; 1 = an information

item disclosed with minimum coverage and discussion about the issue, information disclosed only in general terms (i.e., narrative only); 2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but there is no explanation putting the issue in perspective; 3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets); 4 = truly extraordinary, benchmarking against the best practice (i.e., GRI or other standards/guidelines, industry averages, regulatory requirements/guidelines).

Panel A of Table 6.6 provides an overview of corporate water disclosures on water consumption. The result indicates that the overall average score on water consumption is 4.5, which is only 19% of the maximum possible score of 24. This result is surprisingly low given that water consumption is essential to the overall corporate water accounting and accountability. A comparison shows that companies listed on the SSE scored 5.6 on average, which is higher than the overall average and higher than companies listed on the SZSE (3.3). However, this is still a meagre result compared to the maximum possible score of 24. Consequently, the results indicate that Chinese companies did not provide comprehensive information on water consumption.

Panel B of Table 6.6 shows corporate water disclosure relating to water consumption at the sector level. From a general perspective, it indicates that the SSE's energy sector scored the highest in disclosing information regarding corporate water consumption among all sectors across both stock exchanges. King et al. (2008) studied the relationship between water and energy from the perspective of resource use. Their findings suggest that water and energy are inextricably linked because producing energy requires large quantities of water. Prior literature also indicates that water is a fundamental resource that has high consumption during the development, exploitation, and production of energy (Gu et al., 2016; Scott et al., 2011). A similar situation also applies to companies operating in the materials and industries sectors. For example, the materials sector scored the highest among all sectors from the SZSE and ranked second among all SSE sectors, and the industries sector scored second in the SZSE, following the materials sector. Carrillo and Frei (2009) show that the process of extracting and refining raw materials requires large quantities of water. Likewise, Ahmadun et al. (2009) report that large volumes of water are used in the production process of oil and gas. Given that the energy, materials, and industries are high water-intensity sectors, companies that operate in these sectors require more freshwater to sustain their business operations. Therefore, the analysis results here are consistent with previous findings that the energy, materials, and industries score higher in disclosing information relating to water consumption.

Table 6.6 Corporate water consumption

(No. of disclosure items: 6; score 0–4)

Panel A – Overall disclosure on corporate consumption

	Average/24	**Average percentage**
SSE	5.6	23%
SZSE	3.3	14%
Overall	4.5	19%

Panel B – Corporate information disclosure on water consumption for each sector in the SSE and SZSE

SSE sectors	**Sector average/24**	**Average percentage**	**Min.**	**Max.**
Energy	11.1	46%	5	14
Materials	8.7	36%	3	19
Financials	7	29%	5	10
Utilities	6.2	26%	0	16
Telecommunication Services	5.2	22%	0	12
Industries	4.8	20%	1	13
Consumer Staples	3.9	16%	0	14
Healthcare	3.8	16%	0	15
Consumer Discretionary	3.7	15%	0	11
IT	1.8	8%	0	4
Overall	5.6	23%		
SZSE sectors	**Sector average/24**	**Average percentage**	**Min.**	**Max.**
Materials	6.7	28%	2	10
Industries	5.2	22%	0	12
IT	4.3	18%	0	14
Consumer Staples	3.5	15%	0	10
Financials	3	13%	0	7
Utilities	2.4	10%	0	7
Consumer Discretionary	2.1	9%	0	8

Healthcare	2.1	9%	0	5
Energy	2	8%	0	4
Telecommunication Services	1.6	7%	0	5
Overall	3.3	14%		

On the other hand, the consumer staples, healthcare, consumer discretionary, and IT sectors from both stock exchanges, as well as the utilities and financial sectors from the SZSE, scored lower than the overall average of 4.5. Arguably, companies listed in these sectors differ from those listed in the energy, materials, and industries sectors because their business orientation primarily focuses on providing services and is less involved in manufacturing and production. Hence, they may not consume that much water in their business operations. Nevertheless, there is one exception from the above discussion, and that is the SSE's financial sector. It is worth noting that in this sample, only five financial companies were selected from each stock exchange due to the low level of water sensitivity. Panel B shows that the SSE's financial sector scored an average of 7, which is higher than the overall average. The financial sector sample consists of three of China's major banks and two of its largest insurance companies. All five companies extensively disclosed their water consumption, including comprehensive information on the description of water use, the total volume of water consumption, and changes in water consumption. Therefore, the average score in the SSE financial sector is surprisingly high.

Overall, Table 6.6 shows that the score of Chinese listed companies' information disclosure on water consumption is generally low. Despite the SSE sectors scoring higher than the SZSE ones, this does not change the fact that the current status of corporate information disclosure on water consumption is poor in China, compared with the maximum possible score. Additionally, there is no indication of consistency in the water consumption information disclosed by Chinese listed companies. Despite both the SSE and SZSE having identical sectors, it is challenging to identify any consistency between sectors regarding the disclosure of water consumption information. The exception is the materials sector, which accounts for the highest of disclosure on the SSE and the second-highest on the SZSE. In addition, it is noteworthy that no company achieved the maximum score for disclosing information about water consumption. This aspect is further illustrated in Table 6.7, where the average score for each water disclosure item pertaining to water consumption is presented and analysed.

Table 6.7 presents all the disclosure items relating to water consumption. In general, items B1, B5 and B4 achieved an overall average score of 1, with 25% over the maximum possible score, which represents the highest among all disclosure items related to water consumption. It is worth noting that water is a valued commodity that has a cost of consumption. In this sense,

item B5 is designed to capture the corporate disclosure on water consumption from a monetary aspect. More specifically, it reflects the actual water usage cost by measuring the company's information disclosure on the total cost of water consumption. Prior literature agrees that monetary aspects of water management should be required to complement the physical data as it could potentially impact the long-term economic success of the company (Farneti et al., 2019; Guthrie & Farneti, 2008; Larson et al., 2012; Morrison et al., 2010; Signori & Bodino, 2013). Therefore, useful monetary information such as that captured by B5 assists different stakeholders in evaluating the financial investment in water use better.

Table 6.7 Water disclosure items relating to water consumption

Overall	**Disclosure items**					
	B1	**B2**	**B3**	**B4**	**B5**	**B6**
SSE	1.2	1.1	0.7	1.3	0.9	0.4
SZSE	0.7	0.5	0.2	0.7	1.1	0.1
Overall	1	0.8	0.5	1.0	1.0	0.3
Average percentage/4	25%	20%	11%	25%	25%	6%
	Disclosure items					
SSE sectors	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**
Energy	2.1	2.6	2	2.6	0.7	1.1
Materials	1.7	2	1	1.6	1.2	1.2
Industrials	1.3	1.1	0.2	1	0.8	0.4
Consumer Discretionary	0.8	0.6	0.6	1.3	0.4	0
Consumer Staples	1	0.4	0.5	0.9	0.8	0.3
Healthcare	0.8	0.7	0.5	1	0.4	0.4
IT	0	0.2	0	0.3	1.2	0.1
Telecommunication Services	1.1	0.9	0.8	1	1.3	0.1
Utilities	1.8	0.7	0.6	1.1	1.5	0.5
Financials	1.2	2.6	0.4	2.4	0.4	0
Overall	1.2	1.2	0.7	1.3	0.9	0.4
Average percentage/4	30%	30%	17%	33%	22%	10%
Min.	0.0	0.2	0.0	0.3	0.4	0.0
Max.	2.1	2.6	2.0	2.6	1.5	1.2
	Disclosure items					
SZSE sectors	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**
Energy	0.1	0	0	0.5	1.4	0

Materials	1.8	1.2	0.7	1.5	1.2	0.3
Industrials	1.2	0.9	0.6	1.1	1.3	0.1
Consumer Discretionary	0.2	0.4	0	0.6	0.7	0.2
Consumer Staples	1.1	0.4	0	0.7	0.8	0.5
Healthcare	0.1	0	0.2	0.4	1.4	0
IT	0.6	0.8	0.4	0.8	1.4	0.3
Telecommunication Services	0.5	0.2	0	0.1	0.8	0
Utilities	0.2	0.2	0	0.6	1.4	0
Financials	1	0.4	0	1.2	0.4	0
Overall	0.7	0.5	0.2	0.8	1.1	0.1
Average percentage/4	17%	11%	5%	19%	27%	4%
Min.	0.1	0.0	0.0	0.1	0.4	0.0
Max.	1.8	1.2	0.7	1.5	1.4	0.5

Note: B1: descriptions of water consumption; B2: total volume of water consumption (in megalitres or cubic metres); B3: water consumption per unit of product; or water consumption per dollar revenue; B4: change in water consumption (in monetary terms or physical quantities); B5: total cost of water consumption (in monetary terms); B6: water withdrawal by source type (surface water/groundwater/seawater/third-party) and location.

The researcher discovered that most of the information about water costs is revealed in companies' annual reports, combined with other utility expenses, such as electricity and heating. Water expenses are a cost associated with different water uses, which can be allocated to various departments or business tasks, depending on how utilities are used. We expect companies to provide more detailed information on different water costs. However, their reports show no indication of discussion on how water cost was allocated.

Item B4 measures the information disclosure about a company's water consumption changes, which can be disclosed in different ways, including monetary terms and physical quantities. The researcher found that Chinese companies tend to use different reporting mediums to disclose information regarding water consumption changes. More specifically, most of the monetary information relating to changes in water consumption is disclosed in companies' annual reports. In contrast, quantitative changes are more often seen in CSR, sustainability and ESG reports. Water consumption changes in the business context are a complex phenomenon that can be affected by many elements, including climate and land-use change, socio-economic changes, and legislative changes (Giertz et al., 2006; Phipps & Brace-Govan, 2011). In this sense, we expect to see more detailed discussions in companies' reports about the impact on society and/or

environment regarding the corporate changes in water consumption which put the issue in perspective. However, the available information relating to water consumption changes is very limited, with only a few companies from highly water-sensitive industries having discussions on this topic. Fewer companies disclosed their changes in water consumption in accordance with best practices. The researcher found that the tables/graphs were largely used in presenting information regarding water consumption changes, which show differences between the current year's water usage and the previous years in cubic metres, megalitres or percentages. However, there is no indication of supplementary notes near the tables/graphs or further discussions to explain those figures in most cases. Tables/graphs with quantitative statistics are essential but cannot reflect the social and environmental impact caused by changes in corporate water consumption. More importantly, such information is insufficient for the potential information users and stakeholders to evaluate the water performance. For example, Christensen et al. (2021) suggest shareholders are caring more about a company's impact on society or the environment, even if this impact does not have immediate financial consequences. Given that most companies disclosed only quantitative information regarding the changes in water consumption, they can only score two out of four points because no explanation puts the issue in perspective.

Furthermore, the researcher found it suspicious that none of the companies reported an increase in water consumption compared to the previous year. Although reducing water consumption might indicate water-saving awareness, this may be an instance of managers being selective and wanting to convey only positive information to its stakeholders. As discussed in the water policy section, saving water is one of the core organisational water principles to minimise unnecessary water waste. In this situation, an excellent disclosure would explain the water reduction method, with a discussion on the social and environmental impact of changes in water consumption. From this point of view, it is reasonable to speculate that ignoring negative information and magnifying positive achievements in reports could be a strategy to avoid criticism from the public and other relevant stakeholders.

The average score for item B2 was only 20% of the maximum possible score. This result is relatively low considering the importance of this item. Freshwater is not an unlimited resource and is even more severe in certain areas, depending on the geographic location and the natural water distribution. Prior literature indicates that the business sector is one of the largest contributors to global water consumption. Therefore, corporate water consumption can significantly impact the local water resource, especially in those water shortage areas. Information regarding the description of water consumption (B1) conveys valuable information to different stakeholders regarding the company's water usage situation, which allows them to

effectively evaluate a company's overall water performance on water consumption. At the same time, disclosing information regarding water consumption provides accountability to the local community regarding the company's water consumption situation. The total volume of water consumption (B2) is also an essential indicator adopted in many popular water reporting guidelines (i.e., GRI 303 and 305, CDP, the CEO Water Mandate, and the Water footprint assessment). It measures water consumed by a company such that it is no longer available for use by the ecosystem and local communities. Thus, disclosing such information can assist the company in understanding the overall scale of its impact on downstream water availability. Table 6.7 shows that only 43% of the companies described their water consumption (B1) in their reports, and 33% of the companies reported the total volume of water consumption (B2). Although more than half (53%) of the SSE companies disclosed information on B1 and 44% of the SSE companies disclosed on B2, the overall result still shows that more than half of the Chinese companies did not provide any relevant information regarding B1 and B2.

The researcher found that information relating to B1 and B2 is primarily disclosed in companies' sustainability reports, including CSR, sustainability, and ESG reports. In contrast, the annual reports tended not to contain information about water consumption, except for monetary information (e.g., item B5, the total cost spent on water consumption). Most of the companies only disclosed quantitative figures regarding the amount of water use without explaining the relevant social and environmental impacts that put the issue in perspective. Therefore, a low score was assigned to those companies that lacked a detailed explanation regarding their water consumption.

Those companies that disclosed information in quantitative terms and complemented with discussions that explained the company's targets and goals relating to water consumption scored higher than others. Not surprisingly, there are only a few companies had an excellent disclosure on B1 and B2. Their disclosures cover not only all materials mentioned above but also more in-depth discussions about benchmarking against some of the best practices (i.e., GRI, industrial averages, and discussions on the local regulatory requirements on corporate water consumption). Moreover, companies that made excellent disclosures on B1 and B2 also discussed social and environmental aspects, such as maintaining sustainable water use and improving the ecological and hydrological processes to enhance the long-term water use efficiency of the company.

Table 6.7 indicates that corporate water disclosure on water consumption per product unit or per dollar revenue (B3) is poor, with an average score of 0.5, only 11% of the maximum possible score. Only 21% of the companies across both stock exchanges disclosed this item (see Table

6.8), and most of these companies were operating in the energy and material sectors, with few companies from other sectors disclosing such information. More specifically, the available information on B3 is very general, without sufficient details to put the issue in perspective. It is argued that water intensity is an important indicator that reflects the pressure on the current corporate water consumption. It is more relevant for companies that operate in an extreme water shortage area, and they can use this information to better account for limited water supply, which eventually leads to an improvement in their long-term water use efficiency. However, from current disclosures, there is no indication that companies pay enough attention to this information. Given that Chinese companies scored very low on this item, one possible explanation would be that Chinese companies primarily rely on municipal water supply. Therefore, managers and stakeholders might be less concerned about the issues relating to water shortage than the cost of the water they use.

Table 6.8 shows that B6 is the least reported item in this category, with only 16% of the companies disclosed information regarding this aspect. In 2002, the central government promulgated The Water Law, which sought to establish a strict licensing system, stating that state-owned all water resources and that water users were required to obtain permits from local government departments. Within this background, municipal water supply seems to be the most common way, if not the only way, for companies in China to draw water. Given that water is an essential component of business operations, supply interruptions may negatively impact profitability (Hazelton, 2015). Many companies would rather pay the local city water supply costs to avoid potential risks of unreliable water supply and competition with other water users.

Overall, Chinese companies' disclosure on water consumption is poor, with significant room for improvement. These findings suggest that Chinese companies are heavily focused on reporting monetary information on water consumption. At the same time, Chinese companies are more likely to disclose information in quantitative terms and often omit clear explanations in their reports. Undoubtedly, using quantitative figures is a more straightforward method of presenting key information to audiences. However, ignoring the impactful discussions may not put the issues in perspective. Also, Chinese companies are more willing to report positive information (i.e., reduction in water usage and water-saving) than adverse information that may potentially disadvantage the company's public reputation. The Chinese government controls the water supply and set the water prices for every local city, which leaves minimal options for Chinese companies to select where to draw their water from. In this context, companies that made disclosures on item B6 are highly consistent.

Table 6.8 Number of companies disclosing each item relating to water consumption

	Disclosure items					
Sectors overall	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**
Energy	10	9	8	14	10	5
Materials	19	13	8	15	11	8
Industrials	10	9	4	10	12	3
Consumer Discretionary	6	5	3	7	8	1
Consumer Staples	9	4	3	9	8	4
Healthcare	4	3	3	6	9	2
IT	3	5	2	5	13	3
Telecommunication Services	6	5	4	6	10	1
Utilities	8	4	3	10	15	3
Financials	6	6	1	8	2	0
Overall/190	43%	33%	21%	47%	52%	16%
Max. (no. of companies)	19	13	8	15	15	8
Min. (no. of companies)	3	3	1	5	2	0
	Disclosure items					
SSE sectors	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**
Energy	9	9	8	10	3	5
Materials	10	7	4	7	5	5
Industrials	6	5	1	4	4	2
Consumer Discretionary	4	3	3	4	4	0
Consumer Staples	4	2	3	5	4	2
Healthcare	3	3	2	4	2	2
IT	0	1	0	2	6	1
Telecommunication Services	4	4	4	5	6	1
Utilities	7	3	3	4	8	3
Financials	3	5	1	5	1	0
Overall/95	53%	44%	31%	53%	45%	22%
Max. (no. of companies)	10	9	8	10	8	5
Min. (no. of companies)	0	1	0	2	1	0
	Disclosure items					
SZSE sectors	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**
Energy	1	0	0	4	7	0
Materials	9	6	4	8	6	3
Industrials	4	4	3	6	8	1

Consumer Discretionary	2	2	0	3	4	1
Consumer Staples	5	2	0	4	4	2
Healthcare	1	0	1	2	7	0
IT	3	4	2	3	7	2
Telecommunication Services	2	1	0	1	4	0
Utilities	1	1	0	6	7	0
Financials	3	1	0	3	1	0
Overall/95	33%	22%	11%	42%	58%	9%
Max. (no. of companies)	9	6	4	8	8	3
Min. (no. of companies)	1	0	0	1	1	0

6.3.3 Wastewater discharge (category C)

Wastewater discharge is the third category in the disclosure index. Disclosure of this aspect is crucial to address environmental concerns and ensure sustainable practices in various industries.

Panel A of Table 6.9 illustrates the average disclosure score for wastewater discharge for companies listed on the SSE and SZSE. The findings reveal that SSE listed companies achieved a higher average score (6.8) in wastewater discharge disclosure compared to SZSE listed companies (5). However, the findings also identify that overall companies only achieved 25% of the maximum possible score (24) for this category, with an average score of 5.9.

Panel B of Table 6.9 presents the individual sector averages from both the SSE and SZSE companies regarding wastewater discharge disclosure. The findings reveal that the energy sector in SSE and the material sectors of the SZSE attained the highest average score, indicating their superior information disclosure practices regarding wastewater discharge. The IT, telecommunication services, utilities and financial sectors meanwhile obtained lower scores, below the average for both stock exchanges.

In prior literature, it has been demonstrated that water and energy are interconnected, with the production of energy requiring a substantial amount of water. Consequently, a significant quantity of wastewater is generated during energy production (Rad & Lewis, 2014). Similar conclusions have also been drawn in studies concerning various industries, such as mining (Gunson et al., 2012), iron and steel (S. Zhang et al., 2022), petroleum refining (Nacheva, 2011), dyeing (Shindhal et al., 2021), and the textile industry (Khan & Malik, 2014). The findings drawn from the content analysis are in alignment with these past studies, indicating that

companies operating in the energy and materials sectors tend to disclose more information regarding wastewater discharge compared to companies in other sectors.

Furthermore, previous findings indicated that companies in the IT, telecommunication services, utilities, and financial sectors showed relatively lower sensitivity to wastewater disclosure. This implies that their water usage levels do not have a significant impact on their business operations, leading to limited wastewater discharge information obtained from their reports and disclosures.

Table 6.9 Corporate wastewater discharge

(No. of disclosure items: 6; score 0–4)

Panel A – Overall disclosure on corporate wastewater discharge

	Average/24	**% of max. possible**
SSE	6.8	28%
SZSE	5.0	21%
Overall	5.9	25%

Panel B – Corporate information disclosure on wastewater discharge for each sector in the SSE and SZSE

SSE sectors	**Sector average/24**	**Average percentage**	**Min.**	**Max.**
Energy	10.8	45%	5	17
Materials	10.4	43%	1	21
Industries	7.2	30%	0	19
Consumer Discretionary	7.9	33%	0	15
Consumer Staples	7.8	33%	1	12
Healthcare	8.9	37%	0	19
IT	3.2	13%	0	10
Telecommunication Services	4.9	20%	0	13
Utilities	5.3	22%	1	17
Financials	1.4	6%	0	5
Overall	6.8	28%		

SZSE sectors	Sector average/24	Average percentage	Min.	Max.
Energy	5	21%	0	13
Materials	10.9	45%	6	17
Industries	6.5	27%	1	12
Consumer Discretionary	3.7	15%	0	13
Consumer Staples	8.5	35%	1	14
Healthcare	5.8	24%	0	10
IT	4.3	18%	0	11
Telecommunication Services	2.3	10%	0	10
Utilities	3.3	14%	0	11
Financials	0	0%	0	0
Overall	5.0	21%		

Table 6.10 presents the average for each water disclosure item relating to wastewater discharge, categorised by stock exchanges and sectors. Taking a comprehensive view, item C3 garnered the highest average score of 1.9, which represents 47% of the maximum possible score (the maximum possible score for each disclosure item is 4). Such a score indicates that companies provided at least quantitative information, such as the total volume of wastewater discharged, but lacks a detailed discussion of the issue.

The second-highest average score of 1.5 was attributed to C1, which represents a 37% of the maximum possible score. Item C1 pertains to the explanation of wastewater generation from business operations, and it is closely intertwined with wastewater discharge. The relationship between wastewater generated and wastewater discharged results from the fact that companies initially generate wastewater before discharging it. Therefore, observed outcome from Table 6.10 aligns with reasonable expectations. A high disclosure score on C3 had the potential to positively influence the score on C1.

Item C2, addressing the total volume of wastewater produced from business activities, emerged with the least favourable outcome in this category, attaining a meagre average score of 0.2 (just 5% of the maximum possible). This finding underscores a prevailing trend among companies to place comparatively less emphasis on disclosing information pertinent to the volume of wastewater generated throughout their operations.

Table 6.11 presents the number of companies that reported information on each disclosure item pertaining to wastewater discharge. The findings indicate that the description of wastewater discharged stands as the most frequently disclosed item among Chinese listed companies (75% disclosed information regarding item C3). This observation aligns with the findings from Table 6.10, wherein category C3 received the highest score due to the majority of companies disclosing information within this specific disclosure category. China presently operates under the framework of the Pollutant Discharge Permit (PDP) system. Consequently, enterprises involved in wastewater discharge are connected with the government's digital platform to facilitate real-time monitoring. In essence, this regulatory framework indirectly mandates companies to proactively monitor their own real-time wastewater discharge data and conditions. As a result, when companies possess pertinent data, the process of disclosing such information becomes significantly streamlined. This obviates the necessity for allocating supplementary human resources and financial investment towards the collection and organisation of data. In addition, the discharge of wastewater bears significant implications for ecosystems. The transparent dissemination of information concerning a company's wastewater discharge has the potential to indirectly bolster corporate accountability towards stakeholders and the broader societal context.

Table 6.10 Water disclosure items relating to wastewater discharge

Overall	**Disclosure items**					
	C1	**C2**	**C3**	**C4**	**C5**	**C6**
SSE	1.7	0.3	2.1	1.0	1.1	0.6
SZSE	1.2	0.1	1.7	0.9	0.9	0.3
Overall	1.5	0.2	1.9	0.9	1.0	0.4
Average percentage/4	37%	5%	47%	23%	25%	11%
	Disclosure items					
SSE sectors	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
Energy	2.8	0.2	2.6	2	1.5	1.7
Materials	2.8	0.8	2.2	2.1	1.8	0.7
Industries	1.9	0.7	2.6	0.8	0.9	0.3
Consumer Discretionary	2.1	0.2	2.5	0.8	1.7	0.6
Consumer Staples	1.7	0.2	2.9	1	1.4	0.6
Healthcare	2.7	0.2	2.4	1.4	1.5	0.7
IT	0.9	0	1.2	0.5	0.5	0.1
Telecommunication Services	0.9	0.2	1.7	0.6	0.9	0.6
Utilities	0.9	0.4	2.3	0.7	0.4	0.6

Financials	0.2	0.4	0.6	0	0.2	0
Overall	1.7	0.3	2.1	1.0	1.1	0.6
Average percentage/4	42%	8%	53%	25%	27%	15%
Min.	0.2	0.0	0.6	0.0	0.2	0.0
Max.	2.8	0.8	2.9	2.1	1.8	1.7

	Disclosure items					
SZSE sectors	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
Energy	1.3	0	1.6	1	0.9	0.2
Materials	2.4	0	3.6	1.9	1.9	1.1
Industrials	1.7	0	2.4	1	1.2	0.2
Consumer Discretionary	1	0	1.1	0.8	0.6	0.2
Consumer Staples	2.3	0.3	2.4	1.4	1.6	0.5
Healthcare	1.7	0	2	1	1	0.1
IT	1	0.4	1	0.8	0.8	0.3
Telecommunication Services	0.4	0	0.9	0.5	0.4	0.1
Utilities	0.6	0.1	1.7	0.4	0.4	0.1
Financials	0	0	0	0	0	0
Overall	1.2	0.1	1.7	0.9	0.9	0.3
Average percentage/4	31%	2%	42%	22%	22%	7%
Min.	0.0	0.0	0.0	0.0	0.0	0.0
Max.	2.4	0.4	3.6	1.9	1.9	1.1

Note: C1: description of wastewater generated from business activities; C2: total volume of wastewater produced during business activities; C3: description of wastewater discharge; C4: total volume of wastewater discharged (in megalitres or cubic metres); C5: wastewater discharged by destination (river/land/sea/independent sewerage treatment) and location; C6: change in wastewater discharged (in monetary terms or physical quantities).

Table 6.11 Number of companies disclosing each item relating to wastewater discharge

	Disclosure items					
Sectors overall	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
Energy	16	2	15	14	9	8
Materials	19	3	18	17	16	10
Industrials	15	3	18	8	11	4
Consumer Discretionary	12	1	12	8	11	5
Consumer Staples	16	2	19	12	15	5

Healthcare	18	1	17	10	12	4
IT	9	2	10	7	6	3
Telecommunication Services	9	0	14	5	7	4
Utilities	7	3	18	5	5	4
Financials	1	1	1	0	1	0
Total	122	18	142	86	93	47
% of total companies	64%	9%	75%	45%	49%	25%

	Disclosure items					
SSE sectors	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
Energy	10	2	9	9	5	7
Materials	9	3	8	8	7	3
Industrials	8	3	9	3	4	2
Consumer Discretionary	8	1	8	4	7	3
Consumer Staples	8	1	10	5	8	3
Healthcare	9	1	8	5	6	3
IT	4	0	4	3	2	1
Telecommunication Services	5	0	9	3	5	3
Utilities	4	2	10	3	3	3
Financials	1	1	1	0	1	0
Total	66	14	76	43	48	28
% of total companies	69%	15%	80%	45%	51%	29%

	Disclosure items					
SZSE sectors	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
Energy	6	0	6	5	4	1
Materials	10	0	10	9	9	7
Industrials	7	0	9	5	7	2
Consumer Discretionary	4	0	4	4	4	2
Consumer Staples	8	1	9	7	7	2
Healthcare	9	0	9	5	6	1
IT	5	2	6	4	4	2
Telecommunication Services	4	0	5	2	2	1
Utilities	3	1	8	2	2	1
Financials	0	0	0	0	0	0
Total	56	4	66	43	45	19
% of total companies	59%	4%	69%	45%	47%	20%

Items C4, C5, and C6 exhibit a close relationship with item C3, which pertains to the details of wastewater discharge. The findings reveal that 45% of the companies disclosed the total volume of discharged wastewater (C4). Additionally, 49% of companies disclosed information pertaining to discharge locations, predominantly directing industrial wastewater towards municipal sewage networks, which is subsequently centralised at municipal wastewater treatment facilities (C5). Moreover, 25% of companies showed changes in their wastewater discharge practices, often quantitatively depicting these changes through tables that facilitate a comparison between the current and preceding years' volumes of discharged wastewater (C6).

Item C1 ranks as the second most frequently disclosed item across the majority of companies. This finding aligns with the results presented in Table 6.10. Notably, the creation of wastewater precedes its discharge, and 64% of the companies provide information pertaining to the description of wastewater generated as a result of business activities. Nevertheless, it is noteworthy that only 9% of the companies took their disclosure to a more detailed level by engaging in detailed discussions on the overall quantity of wastewater generated during their business operations.

6.3.4 Wastewater treatment (category D)

Table 6.12 provides a comprehensive overview of the average disclosure scores concerning wastewater treatment across the diverse sectors and stock exchanges. The table is divided into two panels: Panel A presents an overview of the disclosure landscape regarding corporate wastewater treatment, while Panel B offers insights into specific sectors, detailing information related to wastewater treatment.

Panel A of Table 6.12 reveals an overall average score of 2.7 for companies disclosing wastewater treatment information. This suggests that companies offering disclosure on wastewater treatment have predominantly used quantitative data, yet there remains a dearth of complementary qualitative information, including explanations and contextual details to put the issue in perspective. As a result, this outcome underscores that while companies are providing some quantitative data, they are yet to incorporate comprehensive explanations and discussions on the issues relating to wastewater treatment. More specifically, the results indicate that companies listed on the SSE exhibit a slightly higher average score compared to those listed on the SZSE, with a marginal difference of 0.6. Nevertheless, both stock exchanges demonstrate relatively modest results, with their averages being just 15% and 12% of the maximum possible score, respectively. Consequently, this outcome indicates that there is room for improvement in

terms of the extent and comprehensiveness of wastewater treatment disclosures across both stock exchanges.

Panel B of Table 6.12 provides an in-depth breakdown of the disclosure scores for wastewater treatment within each sector across both stock exchanges. At the sector level, the results highlight that the energy sector within the SSE and the consumer staples sector within the SZSE attained the highest average scores in comparison to the other sectors.

Existing literature underscores the significance of the coal industry as a major water consumer in China. Within this sector, activities such as coal mining, coal washing, coal power generation, and coal chemical play pivotal roles in water consumption. Notably, the cumulative water resource demand from these sectors equates to the annual drinking water requirement of a city with a population of approximately 13.03 million (X. Gao et al., 2019).

Moreover, it's essential to recognise that the wastewater produced by these coal-related industries contains a substantial concentration of toxic, refractory compounds, as well as phenolic and oil substances (L. Pan et al., 2012; J. Shi et al., 2019). Direct introduction of such wastewater into municipal or standard microbiological treatment systems can prove detrimental, given the high concentration of these substances, potentially compromising subsequent treatment processes, and posing significant challenges for the receiving environment (H. Zhou et al., 2016).

As a result, the implementation of pretreatment measures before wastewater discharge holds profound implications for maintaining the stability of subsequent treatment systems and achieving desired treatment outcomes. In this context, the findings of the content analysis align with prior research within the same context, indicating that energy companies exhibit a higher inclination to disclose information pertaining to wastewater treatment.

Within the SZSE, the consumer staples sector emerged with the highest average disclosure score of 4.4 pertaining to wastewater treatment information. This result can be attributed to the composition of companies within the consumer staples sector, predominantly comprising food and beverage enterprises. Prior literature widely recognises the profound association between the food and beverage industry and various environmental issues, prominently featuring elevated water consumption levels and substantial wastewater generation (Valta et al., 2015).

It is evident that a substantial volume of water is utilised in production, washing, and cleaning processes, where nearly half of the water used is eventually categorised as wastewater and

discharged. A significant aspect is that the food and beverage sector is known for discharging wastewater characterised by high concentrations of both organic and inorganic substances (Muhamad et al., 2021). In light of these circumstances, the outcome derived from the content analysis aligns coherently with the industry context, elucidating that companies operating within the consumer staples sector are motivated to engage in more comprehensive disclosure practices.

Furthermore, the findings suggest that companies currently operating within the materials and healthcare sectors also disclose a certain degree of information regarding wastewater treatment practices. The wastewater generated from the healthcare sector is typically characterised by the presence of various emerging contaminants, such as pharmaceutically active compounds, biological oxygen demand (BOD), chemical oxygen demand (COD), ammonia, and nitrogen.[21] The concentration levels of these contaminants often surpass those found in domestic or municipal wastewater. Should this wastewater be directly discharged into the domestic wastewater network, it could potentially exert significant strain on local wastewater treatment facilities, leading to considerable challenges (Bergé et al., 2018; A. Majumder et al., 2021).

Wastewater resulting from mining, petroleum, and metallurgical processes is a global phenomenon with far-reaching implications. This wastewater is prone to contamination by a diverse array of pollutants. These pollutants encompass a spectrum of elements, including powders, chemicals, metal ions, oils, organic compounds, and other contaminants. Such contaminants possess the potential to render the discharged water unsuitable for subsequent discharge and/or recycling (Rubio et al., 2002). In the absence of appropriate pre-treatment prior to releasing these wastewaters into aquatic bodies or the municipal wastewater network, the repercussions could range from environmental hazards to unwarranted strain on central municipality wastewater treatment infrastructure. Consequently, the revelation of wastewater treatment details by companies in the healthcare and materials sectors potentially reflects their dedication to transparency and responsibility. This form of disclosure illustrates their readiness to offer a deeper understanding of their operations in handling the wastewater arising from their activities. Consequently, this action serves to alleviate their accountability to the public and other relevant stakeholders.

[21] BOD measures the oxygen microbes need to decompose biodegradable matter in water. COD measures the oxygen needed to oxidise all organic and some inorganic pollutants. Both tests are vital for evaluating water quality and pollution levels.

Table 6.13 provides a comprehensive overview of corporate wastewater disclosure by focusing on the various items in this category. The table also presents a detailed breakdown for each sector within both stock exchanges, further enhancing our understanding of the disclosed information in relation to wastewater treatment practices.

Table 6.12 Corporate wastewater treatment

(No. of disclosure items: 5; score 0–4)

Panel A – Overall disclosure on corporate wastewater treatment

	Average/ 20	**Average percentage**
SSE	3.0	15%
SZSE	2.4	12%
Overall	2.7	13%

Panel B – Corporate information disclosure on wastewater treatment for each sector in the SSE and SZSE

SSE sectors	**Sector average/20**	**Average percentage**	**Min.**	**Max.**
Energy	6.1	31%	2	13
Materials	3.6	18%	1	21
Industries	3.7	19%	0	6
Consumer Discretionary	1.8	9%	0	4
Consumer Staples	4.3	22%	0	9
Healthcare	4.5	23%	0	8
IT	1.5	8%	0	7
Telecommunication Services	1.6	8%	0	6
Utilities	2.9	15%	1	11
Financials	0	0%	0	0
Overall	3	15%		

SZSE sectors	**Sector average/20**	**Average percentage**	**Min.**	**Max.**
Energy	2.8	14%	0	6

Materials	4.1	21%	1	8
Industries	2.1	11%	0	5
Consumer Discretionary	0.9	5%	0	3
Consumer Staples	4.4	22%	1	7
Healthcare	3.6	18%	1	6
IT	2.1	11%	0	6
Telecommunication Services	0.5	3%	0	2
Utilities	3.1	16%	0	10
Financials	0	0%	0	0
Overall	2.4	12%		

From a holistic point of view, it is evident that disclosure item D1 garnered the highest average score of 1.5 when compared to the other four items pertaining to wastewater treatment. The average company score stands at 1.5, denoting that information provided on this specific item exceeds mere general discussion but falls short of offering comprehensive insights into the subject matter. Upon closer examination of companies' disclosures, it becomes apparent that the information pertaining to item D1 encompasses a broad outline of methods associated with wastewater treatment yet lacks in-depth explanations of the intricate processes and their potential impact on the environment. It is crucial to acknowledge that the composition of contaminants within industrial wastewater significantly varies based on the nature of the business. As a result, delving into the intricate details of the wastewater treatment process becomes paramount, along with understanding the potential implications it holds for the natural environment. Consequently, this outcome underscores untapped potential for enhancement in the realm of wastewater treatment information disclosure.

The average scores for items D2 and D5 were similar, at 0.6 and 0.5, respectively. This indicates that the disclosure of information pertaining to the total volume of wastewater treatment and the financial investments made in wastewater treatment fall below the minimal coverage threshold. Such low scores reflect a lack of comprehensive discussion on these aspects. In addition, items D4 and D3 garnered average scores of just 0.1 and 0.01, respectively, signifying a near absence of disclosed information in relation to these issues. Moreover, the data concerning changes in wastewater treatment (D4) and the proportion of treated wastewater (D3) are closely intertwined with the availability of information regarding the total volume of wastewater treatment (D2). In essence, if there is limited information provided for D2, leading to a low disclosure score, it will have a direct impact on the results observed for D3 and D4.

Table 6.13 Water disclosure items relating to wastewater treatment

	Disclosure items				
	D1	**D2**	**D3**	**D4**	**D5**
SSE	1.9	0.6	0.0	0.1	0.4
SZSE	1.2	0.5	0.0	0.0	0.6
Overall	1.5	0.6	0.0	0.1	0.5
Average percentage/4	39%	14%	0%	2%	13%
	Disclosure items				
SSE sectors	**D1**	**D2**	**D3**	**D4**	**D5**
Energy	3.2	0.9	0	0.3	1.7
Materials	2.5	0.6	0	0	0.5
Industries	2.3	1.2	0	0.2	0
Consumer Discretionary	1.4	0.2	0	0	0.2
Consumer Staples	2.6	1.1	0.2	0	0.4
Healthcare	2.4	1.3	0	0.2	0.6
IT	0.9	0.2	0	0	0.4
Telecommunication Services	1.2	0.4	0	0	0
Utilities	2	0.3	0	0.2	0.4
Financials	0	0	0	0	0
Overall	1.9	0.6	0.0	0.1	0.4
Average percentage/4	46%	16%	1%	2%	11%
Min.	0	0	0	0	0
Max.	3.2	1.3	0.2	0.3	1.7
	Disclosure items				
SZSE sectors	**D1**	**D2**	**D3**	**D4**	**D5**
Energy	1	0.6	0	0	1.2
Materials	2.1	0.6	0	0	1.4
Industrials	1.3	0.6	0	0	0.2
Consumer Discretionary	0.7	0.2	0	0	0
Consumer Staples	2.2	1	0	0	1.2
Healthcare	2	1	0	0	0.6
IT	1.1	0.4	0	0	0.6
Telecommunication Services	0.5	0	0	0	0
Utilities	1.5	0.4	0	0.3	0.9
Financials	0	0	0	0	0
Overall	1.2	0.5	0.0	0.0	0.6

Average percentage/4	31%	12%	0%	1%	15%
Min.	0	0	0	0	0
Max.	2.2	1	0	0.3	1.4

Note: D1: description of wastewater treatment (i.e., describe the process of wastewater treatment); D2: total volume of wastewater treatment (in megalitres or cubic metres); D3: the proportion of wastewater that has been treated (percentage of total wastewater); D4: change in wastewater treatment (in monetary terms or physical quantities); D5: total cost invested in wastewater treatment (in monetary terms).

Table 6.14 presents the number of companies that reported on each disclosure item related to wastewater treatment. Overall, the table demonstrates that 71% of the companies disclosed information describing their wastewater treatment processes (D1), highlighting its popularity as a disclosure subject within various wastewater treatment aspects. Delving deeper, all companies operating in the energy, materials, and utilities sectors listed on the SSE, as well as those in the consumer staples and healthcare sectors, made some disclosure on this specific item. Notably, the financial sector companies do not generate wastewater (see Table 6.11), resulting in no information within this specific disclosure category.

Items D2 and D5 yielded comparable outcomes, with 27% and 26% of companies disclosing information pertaining to these two elements, respectively. This alignment with the findings from Table 6.13 suggests that companies do not prioritise comprehensive disclosure of the volume of wastewater treatment, or the associated expenses related to treatment infrastructure. This could be indicative of a prevailing trend whereby these aspects are given relatively less emphasis in corporate water disclosures, potentially warranting further investigation into the reasons behind such limited attention.

Moreover, the outcomes reveal a notable deficiency in disclosure for items D3 and D4, with only 1% and 3% of a total 190 companies providing information on these aspects, respectively. This conspicuous lack of attention to disclosing the proportion of treated wastewater (D3) and any changes over time (D4) underscores a gap in information availability. This finding indicates that Chinese listed companies do not prioritise these specific aspects when preparing their disclosures on wastewater treatment. The absence of data on these two elements raises questions about the companies' commitment to presenting a comprehensive picture of their wastewater treatment practices and their consideration of the evolving nature of these practices over time.

Table 6.14 Number of companies disclosing each item relating to wastewater treatment

	Disclosure items				
Sectors overall	**D1**	**D2**	**D3**	**D4**	**D5**
Energy	16	6	0	1	13
Materials	19	6	0	0	10
Industrials	16	8	0	1	1
Consumer Discretionary	12	2	0	0	1
Consumer Staples	19	10	1	0	8
Healthcare	19	12	0	1	6
IT	7	3	0	0	5
Telecommunication Services	8	2	0	0	0
Utilities	19	3	0	3	6
Financials	0	0	0	0	0
Overall/190	71%	27%	1%	3%	26%
Max. (no. of companies)	19	12	1	3	13
Min. (no. of companies)	0	0	0	0	0
	Disclosure items				
SSE sectors	**D1**	**D2**	**D3**	**D4**	**D5**
Energy	10	3	0	1	7
Materials	10	3	0	0	3
Industrials	9	5	0	1	0
Consumer Discretionary	7	1	0	0	1
Consumer Staples	9	5	1	0	2
Healthcare	9	7	0	1	3
IT	3	1	0	0	2
Telecommunication Services	5	2	0	0	0
Utilities	10	1	0	1	2
Financials	0	0	0	0	0
Overall/95	76%	29%	1%	4%	21%
Max. (no. of companies)	10	7	1	1	7
Min. (no. of companies)	0	0	0	0	0
	Disclosure items				
SZSE sectors	**D1**	**D2**	**D3**	**D4**	**D5**
Energy	6	3	0	0	6
Materials	9	3	0	0	7
Industrials	7	3	0	0	1

Consumer Discretionary	5	1	0	0	0
Consumer Staples	10	5	0	0	6
Healthcare	10	5	0	0	3
IT	4	2	0	0	3
Telecommunication Services	3	0	0	0	0
Utilities	9	2	0	2	4
Financials	0	0	0	0	0
Overall/95	66%	25%	0%	2%	32%
Max. (no. of companies)	10	5	0	2	7
Min. (no. of companies)	0	0	0	0	0

6.3.5 Water recycling and reuse (category E)

Table 6.15 offers a comprehensive analysis of the disclosures related to corporate water recycling and reuse. It is organised into two distinct panels. Panel A provides an overarching perspective on the disclosure practices observed across both the SSE and the SZSE. It highlights key metrics such as the average score and the percentage of the maximum possible score for both stock exchanges. Panel B delves into the subject of corporate information disclosure on water recycling and reuse in relation to various sectors within the SSE and SZSE. This section reveals important details such as the average score within each sector, the percentage of disclosure achievement of the maximum possible score, and the range (i.e., min. and max.) for every sector. This breakdown by sectors provides valuable insights into how different industries within these exchanges perform in terms of disclosing information regarding their water recycling and reuse practices.

Panel A of Table 6.15 provides a comprehensive insight into the overall landscape of corporate water recycling and reuse disclosure scores. The average score of 1.6 indicates that companies generally engage in disclosing information related to water recycling and reuse. However, these disclosures predominantly remain within a general scope. What is noticeably missing is a more detailed discussion that includes monetary values or physical quantities, which would contribute to a deeper contextualisation of the disclosed information. This suggests that while some disclosure is taking place, there is a need for greater granularity and precision.

Furthermore, the overall score achieved for water recycling and reuse, standing at just 8% of the maximum possible score, highlights an area of concern. This outcome indicates that Chinese listed companies might not be prioritising or adequately addressing the aspect of information disclosure concerning water recycling and reuse. The very low percentage of the maximum

possible score implies that companies are falling short of their potential to provide comprehensive and insightful disclosures in this domain. This observation underscores the importance of enhancing disclosure practices and encouraging companies to furnish more comprehensive and detailed information regarding their water recycling and reuse efforts.

Panel B of Table 6.15 offers a detailed breakdown of the information disclosure concerning water recycling and reuse, categorised by sector for both the SSE and SZSE. The overall findings reveal that the SSE achieved a higher total score compared to the SZSE, indicating a sector average of 2.1 as opposed to the SZSE's 1.2. More specifically, the energy sector emerges as the frontrunner in terms of disclosing information pertaining to water recycling and reuse. This observation is substantiated by the robust disclosure scores that energy companies have garnered in other water-related categories, including water consumption, wastewater discharge, and wastewater treatment.

Table 6.15 Corporate water recycling and reuse

(No. of disclosure items: 5; score 0–4)

Panel A – Overall disclosure on corporate water recycling and reuse

	Average/20	**Average percentage**
SSE	2.1	10%
SZSE	1.2	6%
Overall	1.6	8%

Panel B – Corporate information disclosure on water recycling and reuse for each sector in the SSE and SZSE

SSE sectors	**Sector average/20**	**Average percentage**	**Min.**	**Max.**
Energy	5.3	27%	1	11
Materials	3.9	20%	1	9
Industries	2.3	12%	0	12
Consumer Discretionary	1.3	7%	0	6
Consumer Staples	2.4	12%	0	6
Healthcare	1.3	7%	0	6
IT	0.2	1%	0	1
Telecommunication Services	1.5	8%	0	8
Utilities	2.3	12%	0	7

Financials	0	0%	0	0
Overall	2.1	10%		

SZSE sectors	Sector average/20	Average percentage	Min.	Max.
Energy	1.3	7%	0	3
Materials	3.5	18%	1	7
Industries	0.9	5%	0	2
Consumer Discretionary	0.4	2%	0	4
Consumer Staples	2	10%	0	5
Healthcare	0.4	2%	0	1
IT	1.5	8%	0	10
Telecommunication Services	0.2	1%	0	1
Utilities	1.8	9%	0	7
Financials	0.4	2%	0	2
Overall	1.2	6%		

As established previously, the energy sector stands as a significant water consumer, with companies operating within this sector generating substantial volumes of wastewater. This underscores the sector's inclination to furnish comprehensive disclosures concerning water recycling and reuse practices. Such disclosure conveys an elevated awareness among these companies about their water management strategies and the resulting environmental ramifications. The act of divulging information on water recycling and reuse can be interpreted as a strategic endeavour to showcase corporate water accountability, accentuating endeavours towards water conservation, and mitigating any adverse consequences on the ecosystem.

The materials sector achieved the highest average score with a sector average of 3.5, surpassing the scores of other sectors listed on the SZSE. Intriguingly, in the context of water recycling and reuse information disclosure a single financial company listed on the SZSE stood out by revealing insights regarding water recycling within its annual and CSR reports. This disclosure encompasses specific metrics, notably the aggregate volume of recycled water. Nevertheless, its limitation lies in the absence of more detailed elaboration on the water recycling process. Despite this limitation, the cumulative evidence suggests that financial entities can effectively pursue water conservation goals through the adoption of water recycling practices. Moreover, this investigation highlights the feasibility of quantifying and disseminating such water-related data. Likewise, this approach holds potential applicability to other listed financial sectors.

Overall, it is evident that Chinese listed companies' information disclosure pertaining to water recycling and reuse remains limited. The aggregate disclosure underscores an inadequacy in this aspect. This outcome highlights the scope for enhancement in terms of providing comprehensive and insightful information on the topic of water recycling and reuse.

Table 6.16 Water disclosure items relating to water recycling and reuse

	Disclosure items				
	E1	**E2**	**E3**	**E4**	**E5**
SSE	1.1	0.5	0.2	0.1	0.2
SZSE	0.6	0.3	0.2	0.1	0.1
Overall	0.9	0.4	0.2	0.1	0.1
Average percentage/4	21%	10%	5%	2%	3%
	Disclosure items				
SSE sectors	**E1**	**E2**	**E3**	**E4**	**E5**
Energy	2.4	1.3	0.8	0.4	0.4
Materials	1.8	1.1	0.6	0	0.4
Industrials	1.2	0.5	0.3	0.3	0
Consumer Discretionary	0.9	0.4	0	0	0
Consumer Staples	1.6	0.4	0.2	0	0.2
Healthcare	0.8	0.3	0	0	0.2
IT	0.2	0	0	0	0
Telecommunication Services	0.8	0.5	0	0.2	0
Utilities	1.3	0.5	0.2	0	0.3
Financials	0	0	0	0	0
Overall	1.1	0.5	0.2	0.1	0.2
Average percentage/4	28%	13%	5%	2%	4%
Min.	0.0	0.0	0.0	0.0	0.0
Max.	2.4	1.3	0.8	0.4	0.4
	Disclosure items				
SZSE sectors	**E1**	**E2**	**E3**	**E4**	**E5**
Energy	0.6	0.2	0	0	0.5
Materials	1.5	0.9	0.8	0.3	0
Industrials	0.7	0.2	0	0	0
Consumer Discretionary	0.2	0.2	0	0	0
Consumer Staples	0.9	0.4	0.4	0.2	0.1
Healthcare	0.4	0	0	0	0

IT	0.6	0.4	0.3	0.2	0
Telecommunication Services	0.2	0	0	0	0
Utilities	1	0.2	0	0	0.6
Financials	0	0.4	0	0	0
Overall	0.6	0.3	0.2	0.1	0.1
Average percentage/4	15%	7%	4%	2%	3%
Min.	0.0	0.0	0.0	0.0	0.0
Max.	1.5	0.9	0.8	0.3	0.6

Note: E1: description of water recycling or reuse; E2: total volume of water recycled or reused (in megalitres or cubic metres); E3: total volume of water recycled or reused as a percentage of the total water consumption; E4: change in water recycling and reuse (in monetary terms or physical quantities); E5: total cost invested in water recycling or reuse activities (in monetary terms).

Table 6.16 provides a comprehensive view of corporate water disclosure concerning individual items related to water recycling and reuse. The findings reveal that item E1 achieved the highest overall score of 0.9, averaged from 1.1 for the SSE and 0.6 for the SZSE. Notably, the companies' average percentage of the maximum score for this particular item stands at 21%, indicating that Chinese listed companies are not extensively divulging information regarding the detail of water recycling and reuse. Instead, this disclosure was generally of a rudimentary nature, demonstrating minimum coverage of this critical subject matter.

The information disclosed on item E2 secured the second-highest average score (0.4). However, this is just 10% of the maximum possible score, indicating suboptimal performance. This outcome suggests that Chinese companies are not adequately disclosing the total volume of water recycled or reused in their operations.

Item E3 attained an average score of 0.2, followed by items E4 and E5 with average scores of 0.1, respectively. Item E3 refers to the proportion of total water consumption represented by the total volume of recycled or reused water, revealing an inadequate performance in this area among Chinese listed companies. On the other hand, Table 6.16 shows notably limited disclosure scores regarding alterations in water recycling and reuse, as well as the total investment in associated initiatives. The former is intrinsically tied to the availability of information in item E2; without historical measurements of the total volume of recycled or reused water, effectively comparing changes in water recycling or reuse becomes challenging. The latter dimension signifies the economic commitment to water recycling or reuse endeavours. Given the disclosure score, there is scant indication that companies are giving

considerable attention to this specific facet in their water-related information disclosure practices.

Overall, the findings from the content analysis underscore the general and descriptive nature of Chinese companies' information disclosure on water recycling and reuse. However, the analysis reveals a lack of detailed and comprehensive information concerning quantities and costs associated with water recycling or reuse.

Table 6.17 Number of companies disclosing each item relating to water recycling and reuse

	Disclosure items				
Sectors overall	**E1**	**E2**	**E3**	**E4**	**E5**
Energy	16	6	3	2	5
Materials	18	10	6	2	2
Industrials	10	3	1	1	0
Consumer Discretionary	6	3	0	0	0
Consumer Staples	15	4	3	1	2
Healthcare	8	1	0	0	1
IT	5	2	1	1	0
Telecommunication Services	6	2	0	0	0
Utilities	12	3	1	0	4
Financials	0	1	0	0	0
Overall/190	51%	18%	8%	4%	7%
Max. (no. of companies)	18	10	6	2	5
Min. (no. of companies)	0	1	0	0	0
	Disclosure items				
SSE sectors	**E1**	**E2**	**E3**	**E4**	**E5**
Energy	10	5	3	2	2
Materials	8	5	2	0	2
Industrials	5	2	1	1	0
Consumer Discretionary	5	2	0	0	0
Consumer Staples	8	2	1	0	1
Healthcare	4	1	0	0	1
IT	2	0	0	0	0
Telecommunication Services	4	2	0	0	0
Utilities	6	2	1	0	1
Financials	0	0	0	0	0

Overall/95	55%	22%	8%	3%	7%
Max. (no. of companies)	10	5	3	2	2
Min. (no. of companies)	0	0	0	0	0
	Disclosure items				
SZSE sectors	**E1**	**E2**	**E3**	**E4**	**E5**
Energy	6	1	0	0	3
Materials	10	5	4	2	0
Industrials	5	1	0	0	0
Consumer Discretionary	1	1	0	0	0
Consumer Staples	7	2	2	1	1
Healthcare	4	0	0	0	0
IT	3	2	1	1	0
Telecommunication Services	2	0	0	0	0
Utilities	6	1	0	0	3
Financials	0	1	0	0	0
Overall/95	46%	15%	7%	4%	7%
Max. (no. of companies)	10	5	4	2	3
Min. (no. of companies)	0	0	0	0	0

Table 6.17 shows the companies' disclosures on the individual items associated with water recycling or reuse. The description of water recycling or reuse (E1) emerges as the most prevalent subject of disclosure. Specifically, 51% of the companies across both stock exchanges communicated information pertaining to the description of their strategies concerning water recycling or reuse. At the same time, the analysis reveals that this inclination is nuanced across the stock exchanges, with 55% of companies listed on the SSE disclosing and 46% of those on the SZSE. This observation underscores the different disclosure patterns between the SSE and SZSE companies, indicating that water recycling or reuse disclosure practice are more commonly adopted within the SSE companies.

The findings reveal that information pertaining to the aggregate quantity of water subjected to recycling or reuse (E2) constitutes the second most prevalent aspect of disclosure. Specifically, 18% of companies listed on both stock exchanges provided insights to varying degrees concerning this item. Notably, a comparable trend is observed in terms of the breakdown, where a higher proportion of companies (22%) listed on the SSE opted to disclose information regarding the volume of water recycled or reused. In contrast, a slightly lower proportion of SZSE-listed companies (15%) disclosed this specific item.

Moreover, the results underscore a tendency among companies to allocate comparatively less attention to the disclosure of information pertaining to items E3, E4, and E5, with only 8%, 4%, and 7% of companies opting to share insights on these particular dimensions, respectively. Only one IT company listed on the SZSE disclosed details regarding changes in their water recycling and reuse practices (E4). Notably, this outcome diverges from the scenario observed among IT companies listed on the SSE, where no disclosures were made concerning E4. Consequently, the findings do not provide substantial evidence to suggest that Chinese listed companies prioritise these dimensions in the context of disclosing water-related information.

6.3.6 Information assurance (category F)

Accounting information plays a pivotal role in the process of decision-making. Consequently, environmental information, encompassing elements such as water-related data, wields substantial influence over the assessments made by stakeholders. Within this context, the notion of information assurance emerges as a critical consideration, serving to uphold the authenticity and accuracy of disclosed water-related information. In light of this, the outcomes pertaining to the assurance provider (F1), the extent of assurance coverage (F2), the assurance opinion (F3), and the assurance standard used (F4) resulting from the content analysis are expounded upon in the subsequent subsections.

Assurance provider (F1)

The disclosure item regarding the assurance provider pertains to the entity responsible for delivering information assurance in relation to the disclosed water-related information. To quantify the degree of assurance, a rating scale ranging from 0 to 2 was employed. More specifically, a rating of 0 indicates the absence of information on the assurance provider within the companies' reports or disclosures. A rating of 1 signifies internal assurance, denoting instances where the company asserts that the information has been assured through its internal procedures. A rating of 2 corresponds to external assurance, meaning the information has been validated by a domestic accounting firm, consultant group, or NGO; or one of the Big 4 accounting firms, an internationally recognised consulting entity, or an international NGO.

Table 6.18 illustrates that 58% of companies across both stock exchanges did not provide any information regarding their assurance provider. Among the companies that did, a majority (35%) chose the route of self-assurance, and only 7% had embarked on the path of external assurance.

Upon a detailed comparison of the two stock exchanges, it becomes evident that a majority of companies listed on the SSE disclosed the origins of their assurance providers within their reports or disclosures. Notably, 41% of these companies opted for self-assurance as their chosen approach. In contrast, such a trend is less prevalent among the companies listed on the SZSE. Table 6.18 reveals that a substantial 68% of SZSE-listed companies refrained from disclosing information concerning their assurance providers to the public or the information users. In essence, this signifies a scenario where external stakeholders are left uninformed about whether the disclosed water-related information has undergone any form of assurance process.

Table 6.18 Assurance provider

	0	**1**	**2**
SSE	45	39	11
SZSE	65	28	2
Overall (no. of companies)	110	67	13
Average percentage/190	58%	35%	7%

SSE sectors	**0**	**1**	**2**
Energy	0	9	1
Materials	4	5	1
Industrials	2	6	2
Consumer Discretionary	6	4	0
Consumer Staples	6	3	1
Healthcare	7	2	1
IT	10	0	0
Telecommunication Services	6	3	1
Utilities	3	7	0
Financials	1	0	4
Overall (no. of companies)	45	39	11
Average percentage/95	47%	41%	12%

SZSE sectors	**0**	**1**	**2**
Energy	10	0	0
Materials	5	5	0
Industrials	6	4	0
Consumer Discretionary	6	4	0

Consumer Staples	8	2	0
Healthcare	6	4	0
IT	8	2	0
Telecommunication Services	6	4	0
Utilities	7	3	0
Financials	3	0	2
Overall (no. of companies)	65	28	2
Average percentage/95	68%	29%	2%

Note: 0 = no information on assurance; 1 = internal assurance: information assured by the company itself through its internal process; 2 = external assurance: information assured by one of the Big 4 accounting firms, a domestic/international accounting firm, a domestic/international consultant group, or a domestic/international NGO.

The findings suggest that companies listed on the SSE are more inclined to include an assurance report in their sustainability reports compared to their counterparts listed on the SZSE. Nonetheless, it is apparent that the practice of disclosing particulars regarding the assurance provider remains uncommon within the context of water-related information disclosure in China. Despite the fact that over half (53%) of the SSE-listed companies provided information concerning their assurance provider, the average for both exchanges stands at just 42%, underscoring that more than half of the sampled companies abstained from disclosing information regarding their assurance provider.

Assurance scope (F2)

The objective for this item is to determine whether the disclosures pertaining to water-related information are comprehensively encompassed within the boundaries of the assurance content. A 2-point scale was used for measuring this item, in which 0 = no indication of the assurance scope or assurance scope does not include water information, and 1 = assurance scope includes water information.

Table 6.18 clearly indicates that out of the 190 companies, 80 incorporated information assurance in their reports, of which 67 provided internal assurance by the board of directors and 13 provided external assurance on their sustainability reports. Table 6.19 presents the incorporation of water-related information within the overall scope of the assurance. All 13 companies that provided external assurance offered substantiating evidence in their disclosures to signify that the water-related information had undergone assurance and fell within the scope of information assurance. Notably, 11 of these companies were listed on the SSE. In addition, among these 13 companies, 11 were assured by the Big 4 accounting firms and international

consultant groups (SGS and TUV NORD), while the other two companies were assured by a domestic accounting firms and the Shanghai Audit Center of Quality System (SAC).[22] Conversely, the 67 companies that provided internal assurance did not provide any indication as to whether their water-related disclosures had been included within the assurance scope or not.

Table 6.19 Number of companies identifying if water disclosure is included in the assurance scope

	Disclosure item F2
SSE	11
SZSE	2
Overall (no. of companies)	13
Average percentage/80	16%
SSE sectors	**Disclosure item F2**
Energy	2
Materials	2
Industrials	1
Consumer Discretionary	0
Consumer Staples	1
Healthcare	1
IT	0
Telecommunication Services	1
Utilities	0
Financials	3
Overall (no. of companies)	11
Average percentage/50	22%
	Disclosure item

[22] The SAC is China's inaugural institution for management system certification, established in 1992, with independent legal status approved by the State Certification and Accreditation Administration. It has obtained recognition from the China National Accreditation Service for Conformity Assessment (CNAS) and has also been accredited by the American National Standards Institute (ANSI) National Accreditation Board and the Dutch Accreditation Council (RvA). Adhering strictly to the regulations, including the Regulations on Certification and Accreditation of the People's Republic of China and international accreditation criteria, SAC engages in voluntary product certification, organic product certification, and management system certification activities covering quality, environment, occupational health and safety, food safety, information security, and more.

SZSE sectors	F2
Energy	0
Materials	0
Industrials	0
Consumer Discretionary	0
Consumer Staples	0
Healthcare	0
IT	0
Telecommunication Services	0
Utilities	0
Financials	2
Overall (no. of companies)	2
Average percentage/30	7%

Overall, the fact that only 16% of the companies disclosed whether water disclosure was encompassed within their assurance scope suggests that this aspect is not regarded as a significant consideration among Chinese listed companies during the process of preparing water-related information disclosures.

Assurance opinion (F3)

An assurance opinion from an independent professional empowers users of information to make confident decisions, as it signifies a diminished risk of inaccuracies within the information provided. In line with this rationale, an assurance opinion pertaining to water-related information is an important signal to stakeholders and information users regarding the dependability of the disclosed water-related information.

Table 6.20 Number of companies that included an assurance opinion

	Disclosure item
Sectors overall	F3
Energy	2
Materials	2
Industrials	1
Consumer Discretionary	0
Consumer Staples	1
Healthcare	1
IT	0

Telecommunication Services	1
Utilities	0
Financials	5
Overall (no. of companies)	13
Average percentage/80	16%

SSE sectors	Disclosure item F3
Energy	2
Materials	2
Industrials	1
Consumer Discretionary	0
Consumer Staples	1
Healthcare	1
IT	0
Telecommunication Services	1
Utilities	0
Financials	3
Overall (no. of companies)	11
Average percentage/50	22%

SZSE sectors	Disclosure item F3
Energy	0
Materials	0
Industrials	0
Consumer Discretionary	0
Consumer Staples	0
Healthcare	0
IT	0
Telecommunication Services	0
Utilities	0
Financials	2
Overall (no. of companies)	2
Average percentage/30	7%

Table 6.20 elucidates the availability of information concerning assurance opinions. To measure the assurance opinion, a 3-point scale was employed, with the following assignments: 0 =

absence of specified opinion; 1 = limited assurance opinion (moderate level); and 2 = reasonable assurance opinion (high level).

Only 13 companies of the 80 that incorporated information assurance in their reports included an assurance opinion in relation to their water-related information disclosure. Furthermore, companies that opted for external assurance were the only ones incorporating an assurance opinion within their reports.

Table 6.21 Assurance opinion

	1	**2**
SSE	2	9
SZSE	1	1
Overall (no. of companies)	3	10
Average percentage/13	23%	77%
SSE sectors	**1**	**2**
Energy	1	1
Materials	0	2
Industrials	0	1
Consumer Discretionary	0	0
Consumer Staples	1	0
Healthcare	0	1
IT	0	0
Telecommunication Services	0	1
Utilities	0	0
Financials	0	3
Overall (no. of companies)	2	9
Average percentage/11	18%	82%
SZSE sectors	**1**	**2**
Energy	0	0
Materials	0	0
Industrials	0	0
Consumer Discretionary	0	0
Consumer Staples	0	0
Healthcare	0	0
IT	0	0
Telecommunication Services	0	0

Utilities	0	0
Financials	1	1
Overall (no. of companies)	1	1
Average percentage/2	50%	50%

Note: 1 = limited assurance opinion (moderate); 2 = reasonable assurance opinion (high).

Table 6.21 shows the distribution of scores for the 13 assurance reports that disclosed assurance opinions. Of these, three were assessed a limited assurance opinion, indicated by a score of 1, whereas the remaining 10 provided a reasonable assurance opinion, reflected by a score of 2 for their water-related information disclosure.

Assurance standard (F4)

An assurance standard guides the methodology employed by the external and internal assurance providers in their information assurance process. For this item, a scale consisting of two points was utilised: 0 signifies the absence of any information regarding the assurance process and associated standards, while 1 indicates the disclosure of assurance standards within the report.

Table 6.22 shows that 17 of the 80 companies that incorporated information assurance in their reports disclosed the assurance standard used. The majority of these were SSE-listed companies, with only two emanating from the SZSE (the two that had provided external assurance). All 13 reports provided by independent external assurance providers included explicit information about their assurance standards. In contrast, among the 67 internal assurances, only four disclosed information regarding the assurance standards (Table 6.17 outlined a total of 80 assurances, with 13 being external and the remaining 67 being internal assurances.) The overall figure of just 21% of assurance reports featuring assurance standards suggests suboptimal adherence to transparency standards. This underscores the need for enhanced transparency and consistency in communicating assurance standards, particularly among companies opting for internal assurance, to bolster the credibility and reliability of information assurance practices in the realm of corporate water information disclosures.

Overall, the results show that companies that provided external assurance incorporated an assurance report with both assurance scope and assurance standards, while those that provided internal assurance did not disclose information about the assurance scope, although a few (4) did disclose the assurance standard used. This highlights the limited prevalence of external assurance practices for water information disclosures among Chinese listed companies. The findings suggest that while some companies engage in external assurance, the broader landscape

exhibits a low adoption rate, indicating potential opportunities for increased emphasis on external assurance mechanisms to enhance transparency and credibility in water-related information reporting among Chinese listed companies, particularly when the outcomes are reported or disclosed only when external assurance is provided.

Table 6.22 Assurance standards used

	Disclosure item F4
SSE	15
SZSE	2
Overall (no. of companies)	17
Average percentage/80	21%
SSE sectors	**Disclosure item F4**
Energy	4
Materials	3
Industrials	1
Consumer Discretionary	0
Consumer Staples	1
Healthcare	1
IT	0
Telecommunication Services	1
Utilities	0
Financials	4
Overall (no. of companies)	15
Average percentage/50	30%
SZSE sectors	**Disclosure item F4**
Energy	0
Materials	0
Industrials	0
Consumer Discretionary	0
Consumer Staples	0
Healthcare	0
IT	0
Telecommunication Services	0

Utilities	0
Financials	2
Overall (no. of companies)	2
Average percentage/30	7%

Note: 0 = no indication of the assurance process and standard; 1 = assurance standards were disclosed.

6.3.7 Water risks (category G)

Water is a fundamental resource that underpins business operations and development. However, companies often face a variety of water-related risks. Therefore, category (G) aimed to assess corporate water disclosure concerning various water risks. Five distinct water risks were identified in Chapter 5, each with the potential to pose threats to companies.

First, physical water risks related to quantity (G1) pertain to a company's exposure to changes in water quantity, such as droughts or floods, which can impact its direct operations, supply chains, and logistics. These risks also encompass the disruption of essential electric power due to water-related issues, as many electricity sources require water for cooling (e.g., coal plants) or power generation (e.g., hydropower). Secondly, physical water risks related to quality (G2) involve exposure to variations in water quality that can affect a company's direct operations, supply chains, and logistics. Thirdly, reputational risk (G3) encompasses potential conflicts with the public related to water issues, which could harm a company's image or lead to the revocation of its operating licence within a community. Fourthly, regulatory risk (G4) is associated with a company's vulnerability to the impacts of water-related regulations. As physical and reputational pressures mount, many local and national governments are responding with stricter water policies. If not planned for, these regulatory changes can prove costly to companies and, in some cases, restrict industrial activities in specific geographic areas. Lastly, regional risk (G5) pertains to water supply issues, encompassing both quantity and quality, in regions experiencing significant water shortages.

A 5-point scale (0–4) was employed to measure the comprehensiveness of information disclosed by companies concerning the water-related risks they might be encountering. The scale was applied as follows: 0 = no information disclosed; 1 = an information item disclosed with minimum coverage and discussion about the issue, information disclosed only in general terms (i.e., narrative only); 2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but there is no explanation putting the issue in perspective; 3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations

and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets); 4 = truly extraordinary, benchmarking against the best practice (i.e., GRI or other standards/guidelines, industry averages, regulatory requirements/guidelines).

Panel A of Table 6.23 presents the overall results of corporate water risk disclosure and for each exchange. The panel indicates that the average score for the SSE surpasses that for the SZSE, highlighting a disparity in the level of disclosure between these two major stock exchanges in China. The overall average score stands at 0.6, just 3% of the maximum possible score. This outcome implies that disclosing information related to water risks is not a common practice within the context of Chinese listed companies.

Panel B of Table 6.23 indicates that the energy sectors of both stock exchanges achieved the highest average disclosure score on water-related risks (2.4 for SSE and 1.4 for SZSE). This suggests a greater commitment to transparency and awareness of water-related challenges within this sector. In contrast, the IT sector within the SSE, the healthcare and financial sector within the SZSE, and the consumer discretionary and financial sectors in both stock exchanges disclosed no information regarding the potential water-related risks they might confront during their business operations. This discrepancy in disclosure practices emphasises the varying levels of engagement with water-related risks among different sectors, signalling a need for enhanced attention to water risk disclosures, particularly in sectors where such disclosures are currently lacking. However, considering China's prevailing strict regulations regarding water resource extraction and centralised management of public water resources, most businesses rely on municipal water supply systems as their primary water source. Consequently, these companies generally only incur water-related expenses based on established pricing models. As a result, water-related risks may not be the foremost concern for listed companies operating within this framework.

Table 6.23 Corporate water risks

(No. of disclosure items: 5; score 0–4)

Panel A – Overall disclosure on corporate water risks

	Average/ 20	**Average percentage**
SSE	0.7	4%

SZSE	0.4	2%
Overall	0.6	3%

Panel B – Corporate information disclosure on water risks for each sector in the SSE and SZSE

SSE sectors	Average/ 20	Average percentage	Min.	Max.
Energy	2.4	12%	0	7
Materials	1.3	7%	0	5
Industries	0.8	4%	0	3
Consumer Discretionary	0	0%	0	0
Consumer Staples	0.5	3%	0	2
Healthcare	0.4	2%	0	2
IT	0	0%	0	0
Telecommunication Services	0.5	3%	0	2
Utilities	1.2	6%	0	5
Financials	0	0%	0	1
Overall	0.7	4%		

SZSE sectors	Average/ 20	Average percentage	Min.	Max.
Energy	1.4	7%	0	4
Materials	0.4	2%	0	2
Industries	0.8	4%	0	3
Consumer Discretionary	0	0%	0	0
Consumer Staples	0.6	3%	0	2
Healthcare	0	0%	0	0
IT	0.1	1%	0	1
Telecommunication Services	0.1	1%	0	1
Utilities	0.6	3%	0	2
Financials	0	0%	0	0
Overall	0.4	2%		

Table 6.24 furnishes a comprehensive perspective on the individual disclosure items concerning water risks. It becomes evident that among the various water-related risks, Chinese listed companies exhibited the greatest concern for physical water risks in quantity (G1), as this item

garnered the highest average score. Conversely, there is a noticeable absence of information concerning reputational risks (G3) in the disclosed information. This finding implies that, while reputational risk is a potential concern for companies, it may not be considered a priority within Chinese listed companies.

Furthermore, the outcomes clearly indicate that items G2, G4, and G5 obtained low scores. This implies that Chinese listed companies do not accord prioritise disclosing potential water-related risks. It is of course possible that these potential risks do not pose a substantial threat to the operations of Chinese listed companies, and consequently these water-related risks might not occupy a prominent position in companies' considerations.

Table 6.24 Water disclosure items relating to water risk

	Disclosure items				
	G1	**G2**	**G3**	**G4**	**G5**
SSE	0.4	0.2	0.0	0.1	0.1
SZSE	0.7	0.6	0	0	0.1
Overall	0.6	0.4	0.0	0.0	0.1
Average percentage/4	14%	9%	0%	1%	3%
	Disclosure items				
SSE sectors	**G1**	**G2**	**G3**	**G4**	**G5**
Energy	1.1	0.6	0	0.4	0.3
Materials	0.7	0.3	0	0.1	0.2
Industrials	0.7	0	0	0	0.1
Consumer Discretionary	0	0	0	0	0
Consumer Staples	0.1	0.2	0	0	0.2
Healthcare	0	0.4	0	0	0
IT	0	0	0	0	0
Telecommunication Services	0.5	0	0	0	0
Utilities	0.9	0	0	0.1	0.2
Financials	0	0	0	0	0
Overall	0.4	0.2	0.0	0.1	0.1
Average percentage/4	10%	4%	0%	2%	3%
Min.	0.0	0.0	0.0	0.0	0.0
Max.	1.1	0.6	0	0.4	0.3
	Disclosure items				
SZSE sectors	**G1**	**G2**	**G3**	**G4**	**G5**

Energy	0.7	0.6	0	0	0.1
Materials	0	0.4	0	0	0
Industrials	0.6	0	0	0	0.2
Consumer Discretionary	0	0	0	0	0
Consumer Staples	0.4	0	0	0	0.2
Healthcare	0	0	0	0	0
IT	0.1	0	0	0	0
Telecommunication Services	0.1	0	0	0	0
Utilities	0.5	0	0	0	0.1
Financials	0	0	0	0	0
Overall	0.7	0.6	0	0	0.1
Average percentage/4	18%	15%	0%	0%	3%
Min.	0.0	0.0	0.0	0.0	0.0
Max.	0.7	0.6	0	0	0.2

Note: G1: physical water risks – in quantity; G2: physical water risks – in quality; G3: reputational risks; G4: regulatory risks; G5: regional risks.

Table 6.25 Number of companies disclosing items relating to water risk

	Disclosure items				
Sectors overall	**G1**	**G2**	**G3**	**G4**	**G5**
Energy	9	9	0	2	4
Materials	6	5	0	1	1
Industrials	8	0	0	0	2
Consumer Discretionary	0	0	0	0	0
Consumer Staples	5	1	0	0	2
Healthcare	0	2	0	0	0
IT	1	0	0	0	0
Telecommunication Services	4	0	0	0	0
Utilities	8	0	0	1	2
Financials	0	0	0	0	0
Overall/190	22%	9%	0%	2%	6%
Max. (no. of companies)	9	9	0	2	4
Min. (no. of companies)	0	0	0	0	0
	Disclosure items				
SSE sectors	**G1**	**G2**	**G3**	**G4**	**G5**

Energy	6	4	0	2	3
Materials	6	3	0	1	1
Industrials	4	0	0	0	1
Consumer Discretionary	0	0	0	0	0
Consumer Staples	1	1	0	0	1
Healthcare	0	2	0	0	0
IT	0	0	0	0	0
Telecommunication Services	3	0	0	0	0
Utilities	4	0	0	1	1
Financials	0	0	0	0	0
Overall/95	25%	11%	0%	4%	7%
Max. (no. of companies)	6	4	0	2	3
Min. (no. of companies)	0	0	0	0	0

	Disclosure items				
SZSE sectors	**G1**	**G2**	**G3**	**G4**	**G5**
Energy	3	5	0	0	1
Materials	0	2	0	0	0
Industrials	4	0	0	0	1
Consumer Discretionary	0	0	0	0	0
Consumer Staples	4	0	0	0	1
Healthcare	0	0	0	0	0
IT	1	0	0	0	0
Telecommunication Services	1	0	0	0	0
Utilities	4	0	0	0	1
Financials	0	0	0	0	0
Overall/95	18%	7%	0%	0%	4%
Max. (no. of companies)	4	5	0	0	1
Min. (no. of companies)	0	0	0	0	0

Table 6.25 shows the number of companies reporting information concerning each type of water risk. The results indicate that 22% of the total companies provided information regarding physical water risks in quantity, making it the most frequently addressed aspect compared to other water-related risks. This finding aligns with Table 6.24, suggesting that Chinese listed companies are primarily concerned with the quantity of water availability, while other water-related risks are not prioritised. Significantly, only 9%, 2%, and 6% of companies reported information on G2, G4, and G5, respectively. Furthermore, there is no indication that companies express any concern regarding reputational risks (G3) related to water issues.

6.3.8 Other water disclosures (category H)

Up to this point, this chapter has presented the findings of the content analysis across seven water-related categories. As established clearly by this thesis, water is a multifaceted issue that intricately intertwines both social and environmental dimensions. There may exist additional water-related concerns that Chinese companies address in their reporting not covered by the above seven categories. Hence, category H was devised to capture any other potential water-related issues that emerged during the reporting analysis. Four specific items were identified as areas of concern and focus within the broader spectrum of water-related issues during the analysis process. These items encompass information about the water footprint (H1), information on supply chain issues with regard to water (H2), information on stakeholder engagement with regard to water issues (H3), and water information on community projects and environmental initiatives (H4), such as helping consumers to improve their water usage, repairing and restoring community water, responding to accidents and spills, or investing and building community water infrastructure and facilities.

Panel A of Table 6.26 shows the overall disclosure scores related to these other water-related issues. The results indicate that companies listed on the SSE achieved a higher average score of 2.7 compared to those listed on the SZSE (1.6). This culminates in an overall average score of 2.2. However, this result represents only 14% of the maximum possible score. The primary reason for this result is that the index used for analysis did not include these specific items. The design of category H was intentionally left open to capture new issues that may not have been previously identified in the literature.

Panel B of Table 6.26 further dissects the total disclosure scores within each sector across both stock exchanges. The SSE energy sector stands out for its disclosure of information on other water-related issues, showing a sector average of 5.6, or 35% of the maximum possible score. This score significantly surpasses the overall average of 2.7 for all companies listed on the SSE. This finding implies that, beyond the preceding seven water-related categories (categories A–G), energy companies have a higher propensity to disclose additional water-related concerns in their reports or websites.

The materials, industrials, and financial sectors exhibit sector averages of 4.1, 3.4 and 3, respectively, also surpassing the overall average. In contrast, the IT sector recorded the lowest score among the SSE sectors. This aligns with expectations since IT companies typically have

fewer engagements with water resources and are less dependent on water for their business sustainability and operations.

In addition, the results reveal that the industrial, energy, materials, consumer staples, and financial sectors listed on the SZSE achieved similar scores, with sector-level averages of 2.4, 2.1, 1.9, 1.9 and 1.8, respectively. These scores are higher than the overall average of 1.6 for all SZSE-listed companies. Conversely, the remaining sectors obtained lower-than-average scores, with the telecommunication services sector being ranked the lowest in terms of disclosure of information on other water-related issues.

Table 6.26 Other water-related disclosures

(No. of disclosure items: 4; score 0–4)

Panel A – Overall disclosure on other water disclosure aspects

	Average/16	**Average percentage**
SSE	2.7	17%
SZSE	1.6	10%
Overall	2.2	14%

Panel B – Corporate information disclosure on other water disclosure aspects for each sector in the SSE and SZSE

SSE sectors	**Sector average/16**	**Average percentage**	**Min.**	**Max.**
Energy	5.6	35%	2	9
Materials	4.1	26%	0	7
Industries	3.4	21%	0	7
Consumer Discretionary	1.5	9%	0	6
Consumer Staples	2.1	13%	0	6
Healthcare	1.6	10%	0	5
IT	0.9	6%	0	3
Telecommunication Services	2.9	18%	0	7
Utilities	1.8	11%	0	4
Financials	3	19%	2	5

Overall	2.7	17%		

SZSE sectors	Sector average/16	Average percentage	Min.	Max.
Energy	2	13%	0	4
Materials	1.9	12%	0	3
Industries	2.4	15%	0	5
Consumer Discretionary	1.4	9%	0	4
Consumer Staples	1.9	12%	0	4
Healthcare	1.3	8%	0	2
IT	1.3	8%	0	3
Telecommunication Services	0.8	5%	0	2
Utilities	1.5	9%	0	7
Financials	1.8	11%	0	4
Overall	1.6	10%		

Table 6.27 Water disclosure items relating to other water-related aspects

	Disclosure items			
	H1	**H2**	**H3**	**H4**
SSE	0.1	0.1	0.6	1.9
SZSE	0.0	0.1	0.2	1.3
Overall	0.1	0.1	0.4	1.6
Average percentage/4	1%	3%	9%	41%

	Disclosure items			
SSE sectors	**H1**	**H2**	**H3**	**H4**
Energy	0.3	0.6	1.5	3.2
Materials	0.3	0.2	1	2.6
Industrials	0.1	0.1	1.2	2
Consumer Discretionary	0	0	0.3	1.2
Consumer Staples	0	0.2	0.1	1.8
Healthcare	0	0	0.5	1.1
IT	0	0	0.2	0.7
Telecommunication Services	0	0.2	0.5	2.2
Utilities	0	0	0	1.8

Financials	0.2	0	0.2	2.6
Overall	0.1	0.1	0.6	1.9
Average percentage/4	2%	3%	14%	48%
Min.	0.0	0.0	0.0	0.7
Max.	0.3	0.6	1.5	3.2
	Disclosure items			
SZSE sectors	**H1**	**H2**	**H3**	**H4**
Energy	0	0.3	0.2	1.5
Materials	0	0	0.2	1.7
Industrials	0.1	0.1	0.3	1.9
Consumer Discretionary	0	0	0.2	1.2
Consumer Staples	0	0	0.2	1.7
Healthcare	0	0	0	1.3
IT	0.1	0.1	0.2	0.9
Telecommunication Services	0	0	0	0.8
Utilities	0	0.4	0.1	1
Financials	0	0.2	0.4	1.2
Overall	0.0	0.1	0.2	1.3
Average percentage/4	1%	3%	5%	33%
Min.	0.0	0.0	0.0	0.8
Max.	0.1	0.4	0.4	1.9

Note: H1: information about the water footprint; H2: information on supply chain issues with regard to water; H3: information on stakeholder engagement with regard to water issues; H4: water information on community projects and environmental initiatives (i.e., helping consumers to improve their water usage, repairing and restoring community water, responding to accidents and spills or investing and building community water infrastructure and facilities).

Table 6.27 provides a breakdown of the disclosure scores for each item within the category of other water-related issues. The results reveal that item H4 achieved the highest score of 1.6, or 41% of the maximum possible score. Specifically, this finding suggests that companies listed on both stock exchanges made considerable disclosures regarding this specific aspect of water-related issues. Among these, companies listed on the SSE averaged 1.9 (48%), while companies listed on the SZSE accounted for 1.6 (33%). This result suggests that SSE-listed companies exhibit a stronger inclination towards disclosing information related to H4. The average score of 1.9 for these companies implies that the disclosed information not only meets the minimum coverage but also includes quantitative data, such as monetary figures or physical quantities.

However, it is important to note that these disclosures lack in-depth discussions to provide a broader context or perspective on the issue.

During the examination of companies' public water disclosures relating to H4, it became evident that Chinese companies often engage in philanthropic activities, such as donating money to support the development of local water infrastructure in water-scarce regions. Many reports also indicated that listed companies frequently organise initiatives where their employees volunteer to improve local water utilisation in areas facing water scarcity. Disclosing such information to the public helps to develop a positive corporate social image.

Furthermore, the results clearly indicate that SSE-listed companies dominate in disclosing information regarding stakeholder engagement with water issues (H3). While the overall average score for all companies across both stock exchanges is 0.4, SSE-listed companies achieved an average score that is 14% of the maximum possible score. In contrast, companies listed on the SZSE obtained just 5% of the maximum possible score, which is significantly lower. In addition, both H1 and H2 received the relatively low score of only 0.1 per company on average.

Table 6.28 provides an overview of the information disclosed for each item within the category of other water-related issues. The results indicate that 72% of the companies across both stock exchanges made disclosures related to H4. Both stock exchanges showed similar results, with 73% of SSE-listed companies and 72% of SZSE-listed companies disclosing information on H4.

Table 6.28 Number of companies disclosing each item relating to other water-related issues

	Disclosure items			
Sectors overall	**H1**	**H2**	**H3**	**H4**
Energy	1	6	9	18
Materials	2	1	8	18
Industrials	2	2	9	18
Consumer Discretionary	0	0	4	11
Consumer Staples	0	2	2	14
Healthcare	0	0	3	13
IT	1	1	4	8
Telecommunication Services	0	1	3	15
Utilities	0	1	1	14
Financials	1	1	2	8

Overall/190	4%	8%	24%	72%
Max. (no. of companies)	2	6	9	18
Min. (no. of companies)	0	0	1	8

	Disclosure items			
SSE sectors	**H1**	**H2**	**H3**	**H4**
Energy	1	4	7	10
Materials	2	1	6	9
Industrials	1	1	6	9
Consumer Discretionary	0	0	2	4
Consumer Staples	0	2	1	6
Healthcare	0	0	3	6
IT	0	0	2	4
Telecommunication Services	0	1	3	9
Utilities	0	0	0	7
Financials	1	0	1	5
Overall/95	5%	9%	33%	73%
Max. (no. of companies)	2	4	7	10
Min. (no. of companies)	0	0	0	4
	Disclosure items			
SZSE sectors	**H1**	**H2**	**H3**	**H4**
Energy	0	2	2	8
Materials	0	0	2	9
Industrials	1	1	3	9
Consumer Discretionary	0	0	2	7
Consumer Staples	0	0	1	8
Healthcare	0	0	0	7
IT	1	1	2	4
Telecommunication Services	0	0	0	6
Utilities	0	1	1	7
Financials	0	1	1	3
Overall/95	2%	6%	15%	72%
Max. (no. of companies)	1	2	3	9
Min. (no. of companies)	0	0	0	3

In Table 6.28, the results highlight a disparity in disclosure patterns between companies listed on different stock exchanges. Specifically, 33% of SSE-listed companies disclosed information

on H3, while only 15% of SZSE-listed companies made information available on H3. This finding suggests that there are variations in the disclosure practices of companies listed on different stock exchanges, with SSE-listed companies exhibiting a higher tendency to disclose information related to H3 compared to their SZSE-listed counterparts.

Furthermore, a mere 4% of the companies disclosed information related to H1, and 8% provided information on H2. It is worth noting that the majority of these disclosures came from companies listed on the SSE.

6.4 Conclusion

In this chapter, the results of the content analysis focusing on the eight water-related categories have been presented. The findings strongly suggest the importance of incorporating the existing reporting framework into corporate water disclosure practices. The results of the t-test indicate that companies using one or more reporting frameworks achieve higher disclosure scores compared to those not utilising any specific reporting framework or guidelines. This underscores a positive relationship between reporting framework and the overall disclosure score, showing the significance of structured reporting mechanisms in improving the extent and comprehensiveness of corporate water disclosures.

Moreover, the findings underscore the potential for Chinese companies to enhance their corporate water disclosure practices. While Chinese listed companies have made some disclosures across the spectrum of water-related issues, there remains ample room for improvement in terms of the extent and comprehensiveness of the disclosed information. This revelation is significant not only for stakeholders or the potential information users seeking a more transparent understanding of corporate water information, but also for the companies themselves as they navigate an evolving landscape of environmental and social accountability. As water-related challenges continue to escalate globally, Chinese companies can benefit from more robust disclosure practices, fostering greater responsibility and accountability in their operations while contributing to more sustainable water resource management practices. This chapter's insights serve as a valuable foundation for future efforts aimed at advancing corporate water disclosure standards and practices in the Chinese business context.

The results of the content analysis indicate low disclosure scores overall, suggesting that water-related information remains non-transparent within the current Chinese business context. This finding is consistent with the existing literature on voluntary information disclosure in emerging economies (Zaini et al., 2018). C. Liu et al. (2021) found that the level of water information disclosure among Chinese companies remains inadequate, largely due to a lack of perceived

importance attributed to such disclosures. The content analysis conducted in this study supports this observation, revealing that water-related information is often presented in a disorganised manner, with some companies providing no disclosure relating to water at all. This pattern has also been identified in prior research. For instance, H. Zeng et al. (2020) found that water information disclosure among Chinese companies lacks structure and coherence, with many companies unwilling to disclose meaningful details about their water-related practices. In addition, several factors that may potentially contribute to non-transparent water disclosure outcome have been identified. First, the analysis reveals that the majority of disclosure scores are derived from information related to water consumption and wastewater discharge, which consistently received higher scores compared to other water-related categories. This result is consistent with previous studies conducted in the Chinese business context, which have also found that information on water usage and discharge is the most frequently disclosed among various water-related topics (H. C. Yu, 2022). This is closely related to the water reforms implemented by the Chinese government in recent years (more details can be found in Chapter 2). At the same time, the literature suggests that this is likely due to these aspects having a direct and visible impact on freshwater availability and pollution (Akpor et al., 2014; Tariq & Mushtaq, 2023). In contrast, other important categories such as wastewater treatment and water recycling, which offer potential solutions for reducing water usage and mitigating pollution, received relatively little attention in the corporate disclosures.

Secondly, the disclosure index used to evaluate the water-related disclosures was developed based on a synthesis of existing literature and international reporting guidelines, most of which originate from Western contexts. Consequently, the applicability of this index to Chinese companies may be limited, potentially contributing to the low scores observed in the analysis. Considering this, it may be necessary to revise the disclosure index to better align with the business disclosure environment in China (see Chapter 8 for more details regarding such a revision).

Thirdly, the results reveal an interesting finding that Chinese companies scored 41% of the maximum possible score on information related to community-based projects and environmental initiatives concerning water. These initiatives include efforts such as restoring freshwater ecosystems, constructing community water infrastructure and facilities, and undertaking afforestation projects to mitigate potential water loss. Rather than relying on voluntary disclosure mechanisms, this trend may indicate an alternative approach adopted by Chinese companies to discharge water-related accountability through direct actions and tangible contributions to water conservation and community well-being.

Overall, the low disclosure scores raise questions about the factors influencing companies to exhibit a limited propensity for disclosing water-related information. In response to these concerns, the next chapter analyses a series of interviews undertaken with senior managers accountable for providing or preparing information disclosures. The primary objective of these interviews was to gain insights into the motivations that drive or inhibit water-related information disclosure within corporate contexts.

In addition, to provide a comprehensive understanding of water-related information disclosure among Chinese listed companies, key stakeholders involved in corporate water information were also interviewed. These stakeholders play pivotal roles in shaping, utilising, or relying on such information. The aim of these interviews was to discern the specific needs and expectations of stakeholders regarding corporate water information disclosure. By engaging with both internal information providers/preparers and external stakeholders, this research seeks to unravel the intricate dynamics that contribute to the observed low disclosure scores. The next chapter sheds light on the motivations and expectations that underlie the current corporate water information disclosure practices in the Chinese business context.

Chapter 7. Interview Findings

7.1 Introduction

The purpose of this chapter is to analyse the interview data and discuss the findings relating to research questions 2–4. More specifically, research question 2 examines the motivations for Chinese companies to disclose corporate water information, research question 3 determines the expectation from different stakeholders, and research question 4 investigates to what extent Chinese companies are currently meeting stakeholder expectations concerning water-related disclosure aspects. The analysis of interview data plays a crucial role in deriving meaningful insights to help answer the research questions. Also, it provides a unique opportunity to explore participants' thoughts and experiences concerning water accounting, corporate water information disclosure, and corporate water accountability.

In the Chinese business context, the disclosure of water-related information is not subject to mandatory requirements. However, companies that discharge wastewater are required to apply for a Pollutant Discharge Permit (PDP) from the relevant government department (Chapter 2 for more details).

The interview participants comprised eight stakeholders: managers (M), government officials (G), shareholders (SH), stock exchange managers (SE), employees (E), media (MEDIA), academics (A) and one NGO (NGO). To provide a clearer view of the key findings and similarities and differences between different stakeholder groups, the researcher categorised these eight stakeholders into four analytical groups: preparers/information providers (M), regulators (G), shareholders and stock exchange (SH and SE), and other stakeholder groups (E), MEDIA, A and NGO). It is imperative to grasp the significance of the media's pivotal role as a representative not just for the boarder societal landscape, but equally for the customers using the company's products. It also serves as the conduit through which the collective voices, concerns, and aspirations of society and customers are channelled to companies, thereby shaping the trajectory of companies' strategies and actions.

This chapter consists of analyses of each interview question followed by a summary table (Table 7.1) to illustrate the key points from each stakeholder group. In the following sections, the information gathered from the interviews is analysed to generate themes to better understand and answer the research questions. The semi-structured interviews consisted of two sets of questions. The first set contained the core (common) interview questions designed for all stakeholder groups (Sections 7.2–7.8). The second set contained additional questions for

specific stakeholder groups, including managers, government officials, managers from the stock exchange, shareholders, employees, academics, journalists and the NGO (Sections 7.9).

7.2 Stakeholders' perceptions of corporate environmental responsibility

Interview Question 1: How do you define a company's responsibility to the environment?

7.2.1 Information providers/preparers

It was considered a good strategy to start the interview by asking how the different stakeholders defined corporate environmental responsibility. Corporate environmental responsibility suggests that companies have a responsibility to positively impact the environment through various actions (Fontaine, 2013). These actions include reducing pollution, minimising natural resource consumption and waste, managing emissions, recycling goods and materials, and implementing reuse practices. Corporate managers play a critical role in discharging corporate environmental responsibility and accountability because they are the key group responsible for preparing and providing relevant information.

Corporate managers (information providers) believed complying with government regulations and laws is a fundamental requirement for a company to be environmentally responsible. A few managers mentioned society and felt that societal and local community aspects should also be taken into account.

> In general, as long as we comply with the relevant national laws and regulations, I think it is responsible. (M6)

> Enterprises should cooperate with the society. If the government or society has relevant requirements and measures or laws for environmental protection, enterprises should properly implement them. (M20)

Environmental impact assessment was also brought up by managers during the interviews. Ten out of 21 managers suggested a comprehensive environmental impact assessment could effectively reduce impacts on the local environment. However, they also added that it does not provide an absolute assurance in all situations. Therefore, if a company did cause damage to the environment, it must always take full responsibility for the consequences.

> If the area where the enterprise is located pollutes the environment because of the production behaviour of the enterprise, then the enterprise should be duty-bound to deal with it. (M3)

Furthermore, the terms 'green production' and 'green development' were frequently mentioned by managers during the interviews. These concepts consider both the social and environmental impacts during business growth. This commitment that aligns with the national policy of using fewer environmental pollutants and natural resources. Managers agreed that it is vital for

companies to fulfil their environmental obligations. More specifically, they highlighted several key methods that lead to green production and development, including reducing consumption, conserving energy, adopting clean raw materials, improving waste treatment technologies, and regularly checking and maintaining equipment.

> Companies must prioritise environmental protection throughout their production processes to minimise environmental impact. This involves choosing green raw materials and striving for green production. During production, they should focus on reducing wastewater and pollutants, improving water reuse, and minimising water consumption through technological transformations to achieve green technology and production. (M19)

Promoting the concepts of green production and green development is not an easy task. It requires not only awareness but also a significant amount of financial investment to implement, which is a substantial challenge for many companies. In order to overcome this challenge, managers suggest that a company's leadership plays a crucial role in financial investment and business transition towards green production.

Chinese companies generally adopt a top-to-bottom approach. Therefore, if the managers and the leadership are aware of the importance of environmental responsibility and its potential impact on the surrounding environment, then it is much easier to implement environmental responsibility into corporate practice.

7.2.2 Regulators

China's economy has grown into one of the largest and most powerful in the world over the past few decades. However, this has come at a high cost to the domestic environment, including water, air and soil contamination. Many Chinese companies sacrificed environmental interests for profit and economic development. Therefore, environmental issues have become a major concern for regulators and policymakers. Since the 18th National Congress of the Chinese Communist Party in 2012, laws and regulations related to environmental protection have become stronger every year. The Chinese government has recognised importance of environmental protection and has taken significant steps to address the issue.

Regulators (government officials) emphasised that companies must comply with the relevant environmental laws and regulations. Violations of environmental laws and regulations can result in severe penalties, including fines and even the suspension of business operations. For example, in 2018, the Chinese government imposed a record $1-billion-yuan fine on a leading chemical company for environmental violations. On the other hand, the Chinese government has provided financial support to help companies transition towards sustainable practices. As

one regulator stated, "[A company] must comply with the relevant laws and regulations of the state. It is essential to carry out legal operations based on national laws and regulations" (G1).

Environmental issues have become a significant concern for Chinese citizens and this has promoted the government to undertake initiatives to revise existing environmental laws and introduce new regulations to further improve the corporate impact on the environment. In response, many companies in China have started to adopt more sustainable practices, such as reducing energy consumption and using renewable energy sources.

7.2.3 Shareholders and stock exchange managers

Managers at the Shanghai Stock Exchange (SSE) pointed out that the government has financially supported companies transitioning to green development, including upgrading existing technologies and cleaner manufacturing.

> Last year, the central bank initiated policies to support environmental efforts, including providing 800 billion [yuan] in support for carbon emission reduction tools and 200 billion for clean energy utilisation loans. This demonstrates a shift towards green and low-carbon development. Companies are encouraged to adopt low-carbon energy materials and change their production and operation modes to achieve true low-carbon outcomes. (SE1)

From the shareholders' perspective, environmental, social and governance (ESG) reporting played an important role in corporate information disclosure as it incorporates three key aspects which can serve as an internal guide for information providers in preparing information for disclosure, and to guide businesses towards sustainable development. Shareholders agreed that environmental responsibility is an ethical obligation and a business imperative. One pointed out that companies have an inherent responsibility to protect the environment. Since companies profit from natural resources and ecosystems, they are also responsible for ensuring the natural environment is healthy. Overall, all shareholders expressed a similar opinion that it is not only the right thing to do, it is also essential to the long-term success and viability of the companies.

> Shareholders are now paying special attention to ESG, and many companies have to disclose ESG reports, so from the market point of view, investors will also be more concerned about the risks brought by companies to the environment.
>
> So for a listed company, ESG is also a very important part of the annual disclosure. For example, we disclose our investment in environmental protection every year. (SH6)

7.2.4 Other stakeholders

All other stakeholder groups shared a common perspective that companies need to minimise their negative environmental impact. The NGO representative perceived compliance with relevant environmental regulations as a bottom line for all companies. They stressed the importance of companies' considering the environmental impact of their operations on

surrounding communities and suggested they should consider the interests of all stakeholders while following laws and regulations: “For enterprises, the national standard is the red line, and the people’s standard is the bottom line” (NGO1).

On the other hand, stakeholders from media group identified ESG reporting as a practical framework for companies to discharge environmental responsibility. They viewed ESG reporting as a way to hold companies accountable because it allows stakeholders to evaluate a company’s environmental performance based on ESG information disclosure. Also, it is an effective tool for companies to communicate their environmental efforts to stakeholders.

> If it is a company that continues to do ESG disclosure, they may prepare the content of the announcement in accordance with the relevant format … From our point of view, ESG needs to be disclosed more, but there is only a small portion of listed companies are doing it now. (MEDIA1)

As China places a growing emphasis on environmental protection, there has been a noticeable rise in research on corporate social responsibility (CSR) by scholars in the country. Stakeholders from the academic group pointed out that CSR-related issues have become a hot topic in China, with researchers actively exploring various elements of CSR and its implications for business. This trend reflects China’s recognition of the importance of environmental practices and its commitment to addressing environmental challenges and fostering responsible corporate behaviour: “The responsibility and obligation of enterprises for the environment have received more and more attention in China over the years” (A3).

7.2.5 Overall

In the context of water-related information disclosure by Chinese companies, it is important to note that such disclosure is not mandatory. However, in accordance with the regulations on PDPs in China, companies with a substantial generation, emission, or environmental impact of pollutants are required to apply for, and obtain, a PDP. This regulation is crafted in compliance with the Environmental Protection Law of the People’s Republic of China. Its primary objective is to enhance the oversight of PDPs; establish standardised guidelines for pollutant emissions by companies, institutions, and other producers and operators; effectively manage pollutant discharges; and ultimately safeguard and enhance the ecological environment.

Furthermore, in the construction industry and during large-scale projects, the government may also demand companies to provide environmental-related information, which will be used by the government to perform an Environmental Impact Assessment (EIA). It is crucial to highlight this point, as it may lead to confusion when discussing the interview findings concerning government requirements or regulations regarding water information disclosure. To summarise,

governmental requirements for corporate water information disclosures pertain to two scenarios. First, companies that exhibit significant pollutant generation, emission, or environmental impact are obligated to seek PDPs from the government (K. Ren et al., 2022). As part of the annual permit renewal process, these companies are required to provide wastewater discharge data to the government but are not required to disclose this information publicly. Secondly, companies on major construction projects or large-scale expansions are subject to an EIA conducted by the government (this is a one-time effect, and companies are not required to provide water-related information after the EIA is approved). During this EIA process, such companies are required to provide water-related information to the relevant government authorities as part of their regulatory obligations but are not required to disclose this information publicly.

By examining the responses to the initial interview question, a broad understanding of the perspectives was gathered, along with the concepts held by various stakeholders regarding corporate environmental responsibility. The interviewees' answers have provided valuable insights into the diverse range of viewpoints on this topic. During the analysis, the researcher discovered that the notion of environmental responsibility is primarily influenced by legal frameworks and regulations. Prior literature suggests that regulatory enforcement and the introduction of new environmental regulations can significantly influence corporate behaviour regarding their environmental impact (Halkos & Nomikos, 2021). Interestingly, stakeholders from diverse backgrounds expressed a similar viewpoint when describing corporate environmental responsibility. They consistently emphasised the importance of complying with environmental laws, regulations, and standards during the business activities as a fundamental aspect of responsible corporate behaviour. In other words, they believed that if a company's operations (not disclosure) remain within the boundaries of legislation, then it fulfils its corporate environmental responsibility.

From this perspective, it can be understood that regulatory pressure plays a significant role in shaping corporate environmental behaviour. This finding is consistent with prior literature, which suggests that regulatory constraints have a notable impact on corporate practices. Managers often view environmental information disclosure as a strategic tool to reduce exposure to potential regulatory costs and public policy pressure (C. L. Huang & Kung, 2010; Patten & Trompeter, 2003). Similarly, X. Liu and Anbumozhi (2009) found that the environmental disclosure strategies of listed companies in China are influenced by the government's environmental priorities and regulatory concerns. Consequently, the government regulations on the environment played an influential role in promoting corporate environmental practices (S. X. Zeng et al., 2011). Accountability through disclosure was not highlighted at this stage of the interview. These findings nevertheless provide a valuable starting point for further

exploration and highlight the significance of legal compliance in shaping corporate environmental practices.

Additionally, an interesting consensus emerged during the analysis regarding the pursuit of green development and green production as integral components of corporate environmental responsibility. Stakeholders from various backgrounds shared the importance of adopting sustainable practices, promoting resource efficiency, and minimising negative environmental impacts. This alignment highlights the growing recognition that corporate environmental responsibility extends beyond mere compliance with regulations and encompasses proactive measures to support environmentally sustainable development. The consensus on green development and green production reflects a broader commitment to address ecological challenges and promote a harmonious relationship between business operations and the environment (Park et al., 2010).

7.3 The corporate impact on China's water environment

Interview Question 2: How do you see the corporate impact on China's water environment?

7.3.1 Information providers/preparers

Managers' perceptions of corporate environmental responsibility were first explored, leading to an examination of their views on the corporate impact on China's water environment.

A common theme emerged as 15 out of 21 managers responded by employing a comparative approach. They expressed their opinions by drawing comparisons between water quality in the past and the present. By framing their responses in this manner, managers conveyed their assessments of the changes and developments in the water environment over time.

Only a handful of decades ago, the water resources in China were pristine and free from pollution. However, as industrialisation progressed, it became an undeniable reality that large factories started to release harmful substances into the water environment: "Decades ago, there was no pollution, and the water quality was very good, but with the development of industry, many large factories began to discharge – this is an indisputable fact" (M3).

The illegality of such reckless emissions is readily apparent, and several managers felt that increased emissions of polluted wastewater resulted in severe damage to the water environment in China. They specifically mentioned the key reason for this is: to save the cost of wastewater

treatment: “From what I know, some factories will discharge the pollutants directly into the water body in order to reduce costs, which will pollute the environment” (M14).

At the same time, one manager (M11) pointed out that wastewater management is often an overlooked aspect within industrial processes as many businesses believe that paying the wastewater fees is sufficient for discharge, so they do not pre-treat the wastewater before discharging into the municipal sewer network. However, it was acknowledged by the same manager that the pre-treatment of industrial wastewater before its discharge into water bodies or municipal drainage systems is a necessary and established practice. This procedure serves as fundamental step to mitigate the potential adverse environmental impacts that untreated or inadequately treated wastewater could impose on aquatic ecosystems and public health. By subjecting the wastewater to a pre-treatment process, various contaminants, pollutants, and harmful substances can be effectively removed or reduced to permissible levels, ensuring that the discharged water meets the ideal scenario for municipal sewage treatment plants, and does not compromise the receiving environment’s ecological balance.

> Sewage management is often overlooked by industries, with many believing that paying sewage fees is sufficient for discharge. However, recent government measures, including sewage discharge permits and online monitoring, aim to ensure that enterprises meet discharge standards. (M11)

One manager (M3) suggested it was crucial for the government and policymakers to strive for a balance between development and pollution control. He also pointed out that advancements in technology should be pursued to discover more efficient and cleaner production methods. However, this requires collective efforts from all levels of society and should not solely attribute pollution to companies. Therefore, the government should also demonstrate foresight by formulating contingency plans for future emergencies and ensuring adequate preparedness.

In recent years, the Chinese government has introduced a range of measures aimed at improving environmental protection standards and regulatory enforcement, with particular attention given to enhancing environmental supervision. Previously, companies had a relatively weak sense of environmental awareness. Thus, companies usually assumed that there was no substantial return on investment in the environment. For example, one manager (M18) shared a personal reflection on his career over 20 years. He recalled that foreign companies would allocate significant funds for safety and environmental protection measures. This led him to question the necessity of such investment. The manager’s recollection highlights an interesting point of inquiry regarding the perceived importance and impact of safety and environmental initiatives undertaken by foreign companies. It also indicates a potential discrepancy in the manager’s understanding of the significance of these measures in relation to local/domestic companies.

> I have been working for over 20 years. When I first started, I questioned whether the substantial investments in safety and environmental protection by foreign-funded enterprises were worthwhile. However, over the years, as China has developed and placed increasing emphasis on these areas, it has become clear that investing in safety and environmental protection is essential. It is our responsibility as a society and as enterprises. (M18)

Amid growing public awareness of environmental issues and the government's strengthened focus on environmental protection, some companies have started to acknowledge the relevance of environmental concerns, including a gradual increase in investment related to water conservation and protection.

> In recent years, government and national-level requirements and systems for environmental protection have become more comprehensive, with increased environmental supervision. Previously, companies had a relatively weak awareness of environmental protection and did not see the value in significant investments. However, with the growing national emphasis on environmental protection, enterprises have gradually begun to recognise the importance of protecting the environment, including water resources. (M4)

According to the managers interviewed, there has been a notable increase in the investment in water protection initiatives. This reflects a growing recognition of the importance of protecting water resources. Additionally, the managers acknowledged the strengthened oversight and regulatory power of government bodies and environmental authorities. This enhanced supervision has compelled companies to comply with national standards for sewage discharge. As a result, the combined effect of increased investment and stricter regulatory measures has led to a greater focus on improving China's overall water quality.

> The pollution and damage caused to water resources in the past have been treated and improved. The state has also introduced very systematic governance measures in this regard. (M2)

> The current water environment is definitely much better than in the past. Companies have also invested a lot in this regard, so that the discharge of wastewater has also reached the standard, and the treatment of sewage has also been strengthened. (M12)

In recent times, publicly listed companies have exhibited a heightened level of concern regarding water environmental issues, unlike in the past when certain companies were audacious enough to go against the environmental regulations and make illegal discharges of pollutants. At the time the interviews were conducted, all listed companies in China were required to follow the national standards for wastewater discharge, with severe penalties for non-compliance practices.

> Listed companies now prioritise the water environment and adhere to stringent emission standards, unlike in the past when some companies illegally discharged emissions. They comply with and often exceed national standards due to severe penalties for violations. (M21)

7.3.2 Regulators

Participants from the regulator group shared a common view that China's overall water quality has improved compared to previous years. Government officials claimed that this result can be attributed to two factors: first, the growing environmental awareness among the public, and second, the concerted efforts of the government in implementing stricter environmental protection requirements and regulations. The promotion of environmental consciousness has played a crucial role in driving individuals and companies to prioritise water quality preservation. Moreover, the government's commitment to enhancing environmental protection measures has contributed to the overall improvement in water quality standards.

> Environmental awareness has become a common concept in China today, and it has been widely recognised. (G3)

> Under the conditions of multi-layer supervision and policy constraints, enterprises are fulfilling their responsibilities for environmental protection, and then our water quality results are getting better and better, and the change is obvious. (G5)

A government official from the Ministry of Ecology and Environment referenced the Yangtze River as a representative example to illustrate recent regulatory changes. According to the official, companies located near the Yangtze River are now strictly prohibited from discharging wastewater directly into the river, even if the wastewater has undergone preliminary treatment. Instead, all types of industrial wastewater must be processed through municipal sewage networks and subsequently treated at city-operated wastewater treatment facilities. This regulation reflects the government's commitment to improving the water quality of the Yangtze River and indicates a broader shift towards more stringent control over industrial wastewater discharge in order to safeguard the water environment.

> The water quality of the Yangtze River has been consistently rated as second-class according to national standards in recent years. This improvement is due to protective measures, including prohibiting over 99% of companies from directly discharging water into the river and regulating sewage pipe networks with a COD[23] index limit of 500. Most enterprises comply, with COD concentrations typically below 200, significantly lower than the national standard. (G2)

7.3.3 Shareholders and stock exchange managers

Managers from the stock exchanges pointed out that environmental pollution China was very serious before 2018, including the pollution of water resources. Since 2018, the overall structure of listed companies and the development model have been changed. High-water-consumption companies, including those in the iron and steel, cement and coal industries, have gradually

[23] The COD (chemical oxygen demand) index measures the oxygen needed to oxidise all organic and some inorganic pollutants and is a key test for evaluating water quality and pollution levels.

decreased in the overall proportion of listed companies, while the new energy and technology industries have increased in numbers.

> The industry structure of listed companies has changed. Before, listed companies were mainly dominated by steel, cement and coal, so the proportion of water pollution caused by listed companies at that time was relatively large … Our development model has changed since 2018. If we look at the industry structure of Class A Share listed company, we can find that the proportion of some high energy-consuming industries has begun to slowly decrease, that is to say, there are fewer polluting industries. (SE1)

Moreover, four out of the six shareholders highlighted that companies, especially large ones, are subject to external pressures from both government and customers regarding water. In response to these concerns, leading listed companies have embraced advanced technologies to reduce wastewater discharge, which entails the recycling and reuse of utilised water in various other activities.

> We cater to European and American customers, particularly mid-to-high-end clients primarily in Europe. Due to their adherence to EU standards and their specific needs, they have very high water treatment requirements. From our perspective, we have achieved an almost zero-discharge standard. (SH1)

At the same time, listed companies have made significant efforts to minimise their impact on the water environment, including implementing protective measures and conducting regular inspections and monitoring. These measures are aimed at mitigating potential negative effects on the water environment.

> In our company's system, including the operating procedures, we clearly regulate how to carry out protective and protective measures for the water environment within the scope of our enterprise, as well as some daily inspections and supervision, including the monitoring of sewage, the detection of groundwater, and even the detection of soil. (SH2)

One prominent governmental measure frequently mentioned by the shareholders was the River Chief System.[24] This is one of the important water resource management systems implemented by the Chinese government with the aim of enhancing the protection and management of rivers, lakes, and other water bodies. One academic (A2) suggested that the River Chief System is

[24] The River Chief System is an important water resource management system implemented by the Chinese government with the aim of enhancing the protection and management of rivers, lakes, and other water bodies. Introduced in 2012, this system requires the establishment of river chiefs at various levels of government who are responsible for the maintenance and governance of their respective water areas. The core principle of the River Chief System emphasises the participation and collaboration of local governments, river chiefs, and the general public in driving water environmental protection and management efforts. River chiefs are tasked with overseeing the water quality and ecological conditions of their areas, promoting pollution control, ecological restoration, and collaborating with relevant departments to develop and implement corresponding protection measures. The implementation of this system has to some extent improved the efficiency of water resource management in China and has facilitated the improvement of water environments and the restoration of ecosystems.

primarily focused on companies, particularly those classified as heavy polluters contributing to water pollution. The system is designed to address the specific challenges posed by such companies and aims to hold them accountable for their actions. The intention is to ensure that these companies take responsibility for their pollution and adopt measures to minimise their environmental footprint, thereby promoting sustainable water management practice. Consequently, the stringent requirements imposed by governmental bodies and the expectations set by customers have compelled listed companies to prioritise wastewater management, resulting in the attainment of minimum impact on the water quality.

7.3.4 Other stakeholders

Interviewees representing other stakeholders were consistent regarding the positive transformation of China's overall water quality. In particular, they highlighted the impact of the introduction of new environmental protection laws in 2015 and subsequent stringent environmental supervisions. These measures, they believed, have played a pivotal role in elevating China's overall water quality over the last decade.

> With the introduction of the new environmental protection law in 2015, followed by rigorous central environmental protection supervision and initiatives like Clear Water, Blue Sky, and Pure Land, including the Ten Articles of Water and Ten Articles of Atmosphere, environmental supervision has intensified unprecedentedly. This top-down enforcement, encompassing corporate emissions, law enforcement supervision, and public participation, has become legally mandated. As a result, 2015 marked a turning point, and we have since seen a gradual reduction in sewage outlets. (NGO1)

It is worth noting that a significant proportion of publicly listed companies have established dedicated environmental departments to address issues pertaining to water. These companies consistently allocate substantial financial resources each year to support initiatives related to wastewater treatment and water environmental management. This reflects their commitment to proactively mitigate water-related issues and underscore their recognition of the importance of sustainable water management in achieving long-term environmental objectives.

> Many listed and large companies have professional environmental protection departments or teams, showing a higher level of professionalism in environmental practices. These companies make substantial annual investments in environmental protection. (MEDIA4)

Academics pointed out that the corporate impact on the water environment is actually getting better and better every year. At the same time, they highlighted the importance of considering industry variations and geographic orientations when evaluating the corporate impact on the water environment. It is crucial to recognise that different industries have distinct characteristics and operational processes that can affect water resources differently. Moreover, the geographic orientation of a company's operations can influence the availability and vulnerability of water

sources. Hence, it is imperative to account for those contextual factors when assessing the impact on the water environment.

> In general, the impact of the water environment is actually getting better and better, or the negative impact is getting lower and lower. However, there are structural imbalances, inequalities, or differences in some industries and regions. (A1)

Three out of the five academics pointed out that stringent regulations regarding wastewater discharge and water resource management are observed in major cities and developed regions. Conversely, underdeveloped areas or smaller cities often encounter occasional instances of illegal discharge and pollution, as reported in the media. This discrepancy in enforcement and compliance can be attributed to varying levels of economic and governance capacities across different regions.

> In big cities, sewage treatment is strictly regulated, with real-time monitors installed by the Environmental Protection Department at many companies' sewage outlets. Any discharge exceeding the standard is quickly detected by the relevant environmental monitoring departments. However, in remote areas, there are reports of factories resorting to digging deep wells to illegally discharge sewage, indicating a serious problem. In places with weak supervision, small factories in villages still occasionally discharge sewage into waterways. (A4)

> Although the standards of our industry are relatively strict, there may still be some non-standard enterprises, they have some stealing phenomenon, so the water environment will still cause some pollution. (A1)

In summary, major cities and developed regions benefit from more comprehensive regulatory frameworks and enhanced monitoring mechanisms, efforts are required to strengthen environmental governance in underdeveloped areas to mitigate and prevent such incidents.

An employee union manager perceived that companies, regardless of their size or industry, have an impact on water resources through their operational and production activities. He highlighted the importance of companies prioritising the minimisation of this impact.

> In fact, whether it is a new enterprise or an old enterprise, it will have a certain impact on the water environment in the process of operation and production, which is difficult to avoid. Therefore, how to minimise the impact is what companies need to do. (E1)

In addition, the employee unions interviewed in this research have taken proactive steps to minimise the corporate impact on water resources. They have organised training sessions and discussions with employees on various topics related to water conservation, wastewater recycling and reuse: "In fact, our company will now carry out a lot of training on water conservation, including water recycling" (E2).

Furthermore, financial investments have been made to attain objectives relating to water saving, wastewater recycling and reuse, and zero wastewater discharge.

> From the initial compliance with the basic requirements of the state, to now take the initiative to develop and improve the effective use of water resources, in the process we have invested a lot of cost and energy, and finally realised the recycling of wastewater, zero discharge of wastewater, and made a great contribution to saving water resources. (E4)

In general, employee union managers expressed a positive perception of significant improvements in the overall water environment compared to previous periods. They noted that a substantial reduction in pollution has been achieved, which has led to an enhancement in water quality.

> The pollution phenomena that were obviously exposed in the past have all disappeared. In fact, the country has also made a lot of progress in this regard, and then we as an enterprise have actually made a lot of improvements in this regard. Overall, the water environment is significantly improved. (E8)

7.3.5 Overall

The improvement of the overall water environment in China can be attributed to various factors. First, there has been an increase in the awareness and understanding of water environmental protection among businesses. Companies have recognised the importance of taking proactive measures to address water-related issues and have demonstrated a commitment to investing in water protection initiatives. Also, stakeholders have raised concerns about companies' attempts to cut costs, which has been highlighted as a significant issue. This has brought to attention and confirmed that cost is a considerable factor influencing corporate water-related environmental decisions. Prior literature has also indicated that cost is a significant factor influencing corporate environmental performance and decisions (Wegener et al., 2013). In the context of environmental information disclosure, studies suggest that highly polluting companies often incur greater costs in collecting and disclosing relevant data (Brammer & Pavelin, 2008; Hassan & Ibrahim, 2012). Therefore, the insights gathered from the interviewees are consistent with the existing literature.

Furthermore, the government's role in strengthening environmental regulations and requirements is important. Government regulatory agencies have implemented strict standards for water environment protection, placing greater emphasis on compliance and enforcement. Non-compliant companies that engage in illegal practices or unauthorised emissions face severe penalties from environmental regulatory bodies.

7.4 The importance of water information disclosure and transparency in discharging corporate accountability

Interview Question 3: How do you do you perceive companies' voluntary water disclosure in China? Also, do you think voluntary disclosure and information transparency can be used as a way of discharging corporate water accountability?[25]

7.4.1 Information providers/preparers

In the Chinese business context, the disclosure of water-related information is voluntary. In light of this, corporate managers expressed the view that voluntary disclosure and information transparency are important.

> I agree that information should be made public. (M16)
>
> Yes, I think everyone, including employees and the public, needs to know about the environmental impact of business. (M15)

Additionally, they believed voluntarily disclosing water-related information was becoming an emerging trend among leading listed companies.

> I think voluntary disclosure is a major trend in the future, because the requirements of environmental management are becoming more and more stringent, so enterprises must plan ahead for future development. (M10)
>
> The transparency of data and information is definitely the big trend in the future. (M18)
>
> I think this will soon become a trend in the future, not only listed companies, but also some non-listed companies will gradually begin to make a public announcement or disclose related content. (M20)
>
> Public disclosure of internal operations, along with measures and behaviours related to water resources protection, is a way for companies to fulfil their social responsibility. Such transparency can help the public understand and trust the company more. This positive image can benefit the company in various ways. (M4)

Upon analysing the responses of managers, several commonalities emerged regarding their perspectives on voluntary water information disclosure. These similarities can be summarised into several key aspects, which provide insights into the motivations and potential benefits associated with voluntary disclosure practices.

[25] In the context of corporate water accountability, water-related information disclosure and transparency play a crucial role. As such, it was important to assess participants' opinions regarding the significance of these factors. When asked whether they agreed that water information disclosure and transparency are important, participants were prompted to reflect on the interview topic, which revolves around the disclosure of water-related information.

First, managers recognised that voluntary water disclosure serves as a means of discharging corporate water accountability, allowing companies to benefit from establishing a positive societal relationship and maintaining a trustworthy public reputation. Managers acknowledged that disclosing water-related information voluntarily demonstrates a company's commitment to water stewardship and accountability. By proactively disclosing information about water practices, companies can enhance their public image and build trust with stakeholders. This reflects the understanding that companies have a broader role to play in addressing environmental challenges and promoting sustainable water use.

> I think voluntary disclosure is a good thing. I think it is a good thing for the society for the company to take the initiative to publicise some of the things it has done, and at the same time, it can also establish a good social image by allowing employees and surrounding people to better understand the company. (M17)

> This is a good thing for the people and future generations. (M12)

Secondly, voluntary water information disclosure is viewed as a strategic approach in terms of delivering positive information to stakeholders and attracting customers and investors. 15 out of the 21 managers perceived that voluntary information disclosure can elevate companies' exposure to potential investors and customers. They recognised that stakeholders are increasingly interested in not only the companies' financial performance, but also their long-term impact on the environment. Therefore, voluntarily disclosing information, particularly regarding environmental aspects can demonstrate their commitment to sustainable practices and differentiate themselves in the market. At the same time, it will attract investors who prioritise environmental criteria in their investment decisions. Moreover, customers who value sustainability and environmental stewardship are more likely to favour companies that actively disclose their environmental efforts.

> I think as stakeholders of a company, including investors, consumers and debtors, they should not only pursue the short-term interests of the enterprise, they should pay more attention to the long-term sustainable development of the enterprise. If this is considered, then information on the water environment is more important. If an enterprise can take the initiative to disclose relevant information, I think it will be more credible, at least this proactive attitude will win the respect of the society. (M14)

Nevertheless, six out of the 21 managers expressed divergent points of view on the disclosure of water-related information by companies. First, they argued that each business has distinct water consumption and discharge patterns, which are contingent upon company-specific characteristics. This sentiment was generally expressed by managers from less water-sensitive companies, who perceived it was unnecessary to voluntarily disclose water information if there is no mandatory requirement and in the absence of demand from stakeholders. Consequently, the necessity of disclosure should be evaluated accordingly.

> Our company's involvement in the water environment is minimal, and since there are no government-mandated disclosure requirements and limited public interest, I believe there's no need for us to disclose information in this regard. (M2)

Furthermore, three managers believed that collecting and preparing water-related information would entail additional work, and they considered it unnecessary if it was not required. These concerns suggest that there are challenges and varying levels of commitment among companies when it comes to voluntary water information disclosure.

> Some internal decisions of the company or information related to business interests cannot be disclosed, because it may be used by competitors to make a fuss, so the enterprise cannot disclose all the big and small things, which is really inappropriate. (M3)

> In fact, I think it is better to disclose what is required to be disclosed [e.g., the PDP], too much disclosure will create a burden on the company. (M11)

Thirdly, six managers expressed their concerns regarding voluntary water information disclosure. Specifically, two managers highlighted that it is primarily large companies voluntarily disclosing additional information, including water-related information. In contrast, small and medium-sized companies have fallen short in this regard as they are not actively participating in voluntary information disclosure practices.

> Other information, including the information on the water environment, only the more formal listed companies like us will take the initiative to disclose, and some small and medium-sized enterprises have not done enough in this disclosure. (M9)

Lastly, four managers expressed their concerns regarding the potential drawbacks of voluntary water disclosure. They raised the possibility that companies may selectively disclose positive information while avoiding the disclosure of negative information. This selective disclosure could be seen as an attempt to manipulate the perceptions of stakeholders and potential information users, presenting a biased view of the company's water performance: "Voluntary disclosure can lead companies to share favourable information while hiding unfavourable aspects. Government regulation is necessary to ensure transparency, as relying solely on companies for disclosure is unrealistic" (M4).

7.4.2 Regulators

Regulators emphasised the increasing recognition of resource scarcity, energy concerns, and higher environmental standards. They asserted that socially and environmentally responsible companies must not only comply with the operational regulatory requirements but also consider vital environmental information. In this context, voluntary disclosure becomes crucial for enhancing information transparency and fulfilling corporate responsibilities to both society and the environment. At the same time, regulators pointed out that voluntary disclosure aligns with the contemporary trend where customers demand more information about products, including

their ingredients and environmental impact. By voluntarily disclosing such information, companies empower customers to make more environmentally friendly purchasing decisions.

> Resources and energy are becoming scarcer, and environmental standards are rising. Excellent enterprises should disclose their production, sewage, and resource consumption information. This transparency can lead to competitive advantages and market recognition for environmentally responsible companies. (G2)

Moreover, voluntary information disclosure is crucial for market recognition and public understanding of a company's environmental performance. This especially important for listed companies, and it was considered essential that they fulfil their social responsibility and contribute to society alongside economic development. Larger companies, due to their scale and visibility, are generally perceived to bear greater social responsibility. As such, it becomes imperative for these companies to proactively disclose relevant environmental information to stakeholders and the public.

> Water is precious, as you said. A listed company should not only focus on economic development but also contribute to society and be responsible. The larger the company, the greater its social responsibility. (G3)

Furthermore, it was noted that the Ministry of Ecology and Environment has implemented multiple approaches to monitor environmental information of companies. There are over 1,000 companies currently subject to their online monitoring. However, the government has the authority to decide which information will be available for public scrutiny.

One government official pointed out that NGOs play a crucial role in monitoring emission performance (including water) and reporting illegal activities that against to the environmental regulation. These organisations actively engage in assessing and scrutinising the environmental practices of companies, particularly in terms of their emissions. By conducting independent assessments and investigations, NGOs contribute to the identification of non-compliant behaviours, violations of environmental regulations, and instances of illegal emissions. Ultimately, they will report it to the government and also compile standalone reports to disclose the illegal activities uncovered during their investigations: "Some non-governmental organisations pay close attention to enterprises' environmental activities. They report to us any illegal environmental activities" (G2).

7.4.3 Shareholders and stock exchange managers

Shareholders perceived that voluntary disclosure of corporate water information is an important practice for listed companies as it aligns with principles of information transparency, corporate water accountability, and sustainable development. Also, they highlighted that water-related issues are not limited to individual concerns but are a matter of societal importance. Therefore,

water information disclosure was seen as part of CSR. For listed companies, there is an expectation of disclosing relevant information pertaining to water resources.

> Yes, I think it should be a corporate responsibility, and this information may be included in our report, but I did not pay attention to this area because our company has specific people in charge of this area. I believe companies should disclose water-related information as this should be the company's obligation. (SH1)

> Water resources are now not only a personal concern, but also the general public in the whole society is concerned about this issue. (SH5)

Participants from the stock exchange underscored that there is no mandatory requirement for corporate water information disclosure, at least from the stock exchanges' side. Nevertheless, they believed that voluntarily disclosing water information is important, particularly for large listed companies, in discharging corporate water accountability. The stock exchanges have set guidance to support and encourage companies to actively engage in voluntary disclosure practices. From their perspective, corporate environmental information disclosure is recognised as a good practice and is expected to become more common in the future.

> We see more companies actively disclosing environmental information after 2018 [when the SSE issued its first CSR reporting guideline] … Our stock exchange is guiding and supporting companies to voluntarily disclose environmental-related information. (SE1)

7.4.4 Other stakeholders

In the interviews with other stakeholders, it was noticed that the changes and factors driving voluntary water information disclosure in listed companies can be attributed to several reasons. First, there has been an increase in disclosure guidelines (e.g., the guidelines on environmental information disclosure of listed companies issued by the SSE and the CASS-CSR 4.0 version issued by the Chinese Academy of Social Sciences) pertaining to water information disclosure. This provides a clearer reporting framework which encourage companies to voluntarily disclosure their impact on the environment. Secondly, there is a growing social expectation for listed companies to enhance information transparency regarding their environmental impact. Consequently, listed companies are placing greater emphasis on their societal and environmental impacts and maintain a good corporate image. They recognise the importance of their reputation and social standing in the market. To achieve long-term and sustainable development, listed companies are becoming more proactive and engaged in information disclosure. They understand that transparent and proactive disclosure contribute to building trust and maintaining positive relationships with stakeholders. As a result, listed companies are expected to be more committed to voluntary information disclosure in the future.

> I think this is related to multi-party promotion. On the one hand, there are indeed so many laws, regulations and rules to improve, and on the other hand, our law enforcement is strengthened,

> which also plays a very positive role. Then there are companies, especially the listed companies, which will increasingly focus on its social impact and its own image. For the sake of long-term and sustainable development, they will do more in this regard. (NGO1)

Academics highlighted that there is a growing trend of voluntary water information disclosure among listed companies, especially in highly water-sensitive industries. However, they perceived that there is still considerable room for improvement in terms of the extent and quality of water information disclosed. Despite the progress made, many companies have yet to embrace comprehensive and transparent disclosure practices. They suggested that efforts are needed to encourage and incentivise companies to enhance their voluntary information disclosure, ensuring greater accountability and transparency in relation to water-related issues.

> Overall, disclosures are improving in both quantity and quality. However, specific information regarding water resources remains limited due to the absence of a clear, mandatory framework akin to financial disclosure. Nonetheless, industries with high water consumption and sensitivity tend to have better disclosure practices. (A1)

Moreover, academics raised concerns regarding the quality and consistency of companies' voluntary disclosures. They observed that such information is often disorganised and lacks uniformity in terms of format and content used. This inconsistency can create difficulties for stakeholders to effectively analyse and compare the disclosed information across companies. Additionally, academics have noted a lack of comprehensive and specific guidelines or standards for companies to follow when disclosing information voluntarily. The absence of clear guidance can lead to varying practices and interpretations among companies, hindering the overall comparability and reliability of voluntary information disclosure.

> Regarding voluntary environmental information disclosure by companies, initially, I found public information on this topic to be quite disorganised. To improve this, specific guidelines are necessary, outlining quantifiable indicators, required accuracy levels, and the extent of disclosure needed. (A2)

Managers of employee unions noted that China is a country with scarce water resources and that voluntary information disclosure is therefore a way of fulfilling a company's CSR. Also, it can serve as a competitive advantage for companies. They believe that proactively disclosing water-related information demonstrates the company's confidence in its management of water-related issues. This transparency can indirectly alleviate concerns among customers regarding potential scrutiny by regulatory authorities due to water pollution problems.

> Companies should consider environmental protection as a competitive advantage. By actively disclosing their water-related information, they demonstrate confidence in their water usage and treatment, which can increase customer confidence and mitigate regulatory risks related to water pollution. (E2)

> China is a country with relatively scarce water resources. Companies can take the initiative to disclose more information about water resources, which means that they have the confidence and ability to make good use of water resources, and at the same time, it also reflects the company's sense of responsibility to society. (E4)

7.4.5 Overall

The interviews with diverse stakeholders reveal a strong emphasis on the importance of voluntary water information disclosure and transparency. Participants concurred that voluntary disclosure is an integral part of CSR and represents a contemporary trend in business context and have several benefits. These include fostering trust with stakeholders, cultivating a positive corporate image, attracting customers and potential investors, and enhancing competitive advantage. More importantly, participants agreed that voluntary disclosure of water-related information is a way of discharging corporate water accountability. This finding aligns with the existing literature, as several studies on corporate water disclosure have demonstrated that voluntary disclosure of water-related information can enhance transparency and strengthen corporate water accountability (Burritt et al., 2016; Hazelton, 2015; H. C. Yu, 2022). At the same time, information providers contend that voluntary water information disclosure reflects a company's overall water performance and signifies a heightened awareness of water environmental protection (X. H. Meng et al., 2013; S. X. Zeng et al., 2011).

At the same time, several concerns were identified regarding voluntary disclosure practices. First, four out of the 21 managers expressed apprehension that voluntary information disclosure was a pressure for them as it requires more time and money from the information providers of their companies. Secondly, both managers and regulators emphasised that voluntary environmental information disclosure is not currently a common practice in the Chinese business context, in which only industrial leading listed companies and high-water sensitive industries tend to actively disclose such information in order to meet the expectations of stakeholders. Finally, academics noted the absence of comprehensive guidelines for corporate water disclosure, indicating the need for further improvement in this area. These concerns highlight the challenges and areas for further development in voluntary disclosure practices.

7.5 Stakeholders' perception on good water disclosures

Interview Question 4: How you define good water disclosure by a company?

7.5.1 Information providers/preparers

Managers believed that information transparency and openness are crucial components in establishing excellent water information disclosure.

> I think the most important thing is transparency. (M18)
>
> Generally speaking, I think openness and transparency will be better. (M6)

They emphasised the importance of truthfulness in water-related information disclosure and believed that for the disclosure to be meaningful, the information provided must be accurate and trustworthy: “I think the disclosure should be true, and if it is not true, there is no point in disclosing it” (M17).

Additionally, managers suggested that comprehensive water information disclosure should be made available through multiple channels to ensure accessibility for potential users. Therefore, one of the common suggestions by managers was the creation of a dedicated section for water-related information disclosure on companies’ websites.

> I think there must be different channels for ordinary people to obtain the information disclosed by enterprises. (M21)

> Every company should have a column on its official website to publicise some social and environmental information, including water information. (M9)

Following the above discussion, the researcher further enquired regarding the specific criteria or elements that constitute comprehensive and effective water information disclosure. Based on the collected responses, the prevailing consensus among the managers was the importance of aligning the preparation of water information disclosure with legal operational requirements (i.e., the PDP): “I think a good disclosure should at least meet the government standards and then try to improve their own requirements and do better” (M15).

More specifically, it was observed from managers’ responses that in practice, good water information disclosure must encompass some specific measures such as water consumption, wastewater discharge and pollution, and other relevant environmental impacts. These elements were identified as critical components of comprehensive water information disclosure.

> I think meeting the relevant laws and regulations is the most basic condition. Then if you want to do a better job, you need companies to disclose more detailed information, such as water consumption in production, pollutant treatment and wastewater discharge, and environmental impact. (M19)

Eleven out of the 21 managers briefly mentioned the relevance of CSR reporting as a valuable reference for companies in preparing a comprehensive water-related information disclosure.

> I know that there is a thing called CSR abroad. Many companies will write their content about social responsibility, environment and employees into this report, and then use the company’s media to publish it so that everyone knows what the company’s CSR has done. (M20)

Furthermore, they expressed the opinion that the government should allocate expert personnel to provide assistance to companies in their water-related information disclosure. At the same time, managers perceived the need for water-related information to undergo assurance like financial reporting, which highlights the importance of involving third-party organisations to ensure the

credibility and reliability of companies' water information disclosure. By involving an independent third-party, companies can enhance the trustworthiness of their disclosed information, thereby strengthening the accountability of their water management practices. Nevertheless, it is noteworthy that during the discussion with managers on this specific interview question, they did not mention qualitative requirements for accounting information, such as consistency and comparability. Hence, it is reasonable to assume that they do not frequently disclose such information.

> The government should arrange professional personnel to supervise and guide water … There is also a need for professional third-party organisations to verify listed companies every year. Just like financial reports, they all need to be audited by accounting firms. (M8)

7.5.2 Regulators

Government officials shared similar views as the managers. Additionally, regulators suggested that the quality of good disclosure lies in the details, such as accurate measurement, consistency, reliability, comparability and in-depth reflection. More specifically, government officials highlighted the importance of disclosures on water withdrawal, water consumption, wastewater discharge, wastewater treatment, and pollution. During the interviews, a government official from the water supply bureau emphasised that water pollution is the most significant concern among various water-related issues. In practice, if companies effectively treat their wastewater before discharging it, it will not have a detrimental impact on water bodies. However, the composition of the wastewater, particularly the presence of contaminants, remains a critical problem for some industries. Therefore, it is essential for a company with a strong commitment to water disclosure to incorporate information regarding the proper treatment and management of these substances into their water disclosure practices.

> Pollutant discharge includes the amount of water and the pollutant content, such as COD and BOD.[26] The water environment can tolerate some level of pollution, but high pollutant concentrations in small discharge amounts can have severe consequences, akin to dropping ink into water. (G3)

7.5.3 Shareholders and stock exchange managers

During the interviews with shareholders, intriguing insights were gathered regarding their perceptions of what constitutes good water disclosure. In general, shareholders acknowledged that good water disclosure hinges on alignment with regulatory requirements, in which the disclosed information must adhere to the requirements set by governmental authorities (i.e., the PDP). Also, some shareholders raised the importance of third-party assurance in relation to

[26] BOD measures the oxygen microbes need to decompose biodegradable matter in water. and is a key test for evaluating water quality and pollution levels.

water information. They expressed the view that third-party verification, or assurance, adds credibility and reliability to the disclosed water information, which in turn enhances the company's reputation and strengthens its relationship with customers and investors.

However, conflicting responses among stakeholders were received regarding the criteria for good water disclosure. Three out of the six suggested that disclosing information required by the government is sufficient to be considered good water disclosure. According to their perspective, as long as companies fulfil their legal operational obligations and provide the necessary information required by the government (if any), it can be considered satisfactory water disclosure. In other words, if there is no mandatory requirement for water information disclosure, companies do no need to provide or disclose such information.

> Companies generally tend only to disclose the information required by the government and the stock exchange. We also need to provide relevant information to the third party appointed by our customers. I think if we can meet their requirements, then it should be a good disclosure and there is no need to provide more disclosures to the public. (SH1)

In contrast, the other shareholders believed that good water disclosure should go beyond mere compliance with government requirements. They emphasised the importance of providing detailed and transparent information regarding the company's water situation. According to their perspective, good water disclosure should serve as a social example, allowing society to gain a comprehensive understanding of the company' s water performance and the impacts on the environment. By providing more detailed and transparent information, companies can demonstrate their commitment to water sustainability and accountability, thereby establishing a positive public reputation and contributing to societal expectations of environmental awareness and protection. These shareholders asserted that large companies bear the responsibility of transparency for their environmental information (including water information) due to the scrutiny of stakeholders and the public. As listed companies, they are expected to set a positive example in the industry, collaborate with society, incorporate feedback, and reflect such considerations.

> I believe a listed company's disclosures should be open, fair, truthful, complete and accurate as required. A listed company has the obligation to disclose what it has done and the final effect and impact to the society, and then actively absorb suggestions for improvement … In addition, companies with conditions should set a good example and give full play to their influence to help everyone improve and contribute to social construction. (SH6)

The participants representing the stock exchanges underscored the necessity of implementing a cohesive evaluation framework, such as a scoring mechanism, to appraise the voluntary disclosure of water-related information by companies. In light of the discretionary nature of these disclosures, the establishment of a standardised system assumes paramount importance in order to effectively assess and differentiate companies according to the comprehensiveness and

quality of their water-related information disclosures. It was recommended that the academic community should take a more prominent and active role in contributing to the formulation and enhancement of such a unified system.

Moreover, they underscored the significance of incorporating quantitative data and information as a critical component in crafting a robust water information disclosure. The participants observed that prevailing voluntary environmental information disclosures by companies predominantly consist of narrative content, lacking the essential inclusion of quantitative data to substantiate their assertions. This situation has led to a scenario where companies disclose information selectively, resulting in a lack of uniformity across disclosures, which results in comparability and consistency issues. Consequently, the absence of quantitative information poses challenges in identifying and comparing the quality of disclosures among companies. Their perspective highlights the importance of quantitative information as a pivotal factor in enhancing the transparency and comparability of water-related disclosures.

7.5.4 Other stakeholders

Academic researchers emphasised the significant influence of industrial characteristics on water information disclosure. They recognised that different industries exhibit varying degrees of water sensitivity, meaning that the evaluation of good water disclosure cannot be applied universally to all companies in the market. Instead, it is important to consider the specific context and requirements of each industry when assessing the adequacy and comprehensiveness of water disclosure practices.

> I think this mainly depends on the industry. In some industries, it does not have water-related business. If you let it disclose, it is equivalent to an empty table. Some industries involve more water resources, then it will be disclosed. (A5)

Also, academics suggested that it is not necessary to disclose all water-related information, as excessive disclosure could potentially impose unnecessary pressure on companies. Instead, good water disclosure should be approached from the perspective of the information user and should aim to meet the general and necessary information disclosure requirements. This approach ensures that the disclosed information is relevant, meaningful, and serves the purpose of providing stakeholders with the essential information they need to make informed decisions and assessments regarding a company's water management practices.

> Listed companies are required to disclose necessary and sufficient information. Of course, if it is a transitional disclosure, I don't think it is necessarily a good thing. This can be an additional burden for the company. (A1)

> A good disclosure should be from the perspective of the information user and should be able to meet the general necessary information disclosure on it. I don't think it is necessary to disclose all the information. (A3)

Consequently, they highlighted the importance of standardisation in water information disclosure. Regardless of the amount of information disclosed, there is a need for a unified standard that establishes consistent guidelines and criteria for water disclosure. By establishing a common framework for water information disclosure, standardisation promotes consistency and comparability in communicating relevant water-related insights to stakeholders.

> Standardisation I think is very important for information disclosure. (A1)

> Companies often adhere to disclosure guidelines like the GRI or ESG of the Hong Kong Stock Exchange, which include water-related indicators. These guidelines cover various aspects of water usage, conservation, and compliance. Companies generally follow these benchmarks when disclosing water-related information. (A4)

The NGO participant and media representatives shared a similar opinion on good water disclosure. They highlighted the significance of information reliability, transparency and completeness are the fundamental elements. Also, for disclosure to be considered good, it must adhere to legal requirements, comply with relevant regulations, and maintain authenticity. Additionally, the information disclosed should align with both industry and government established standards. The indicators used in reporting water-related information should accurately and effectively reflect the impact on the water environment.

> There is no perfect disclosure that currently existed … We prefer to see a more complete and systematic disclosure, and we think more detailed and specific disclosure could show a greater corporate responsibility to society. (NGO1)

> I think the first is that the disclosed indicators must be in line with the industry in which it is located, and then this indicator must reflect its impact on the environment, so it should be subdivided. (MEDIA2)

> Environmental issues or water issues may have to cooperate with the government … The content of the disclosure needs to be fair and realistic … So it is good to be able to disclose objective and actual information. Now there are many companies that are forced to provide it, or the government wants them to provide it. (MEDIA3)

Moreover, the process of data collection, including any changes and improvements made over time, is considered crucial in establishing good water disclosure.

> I think a company should collect some raw materials from its early stage and the whole process of operation should be open to the public and the government under reasonable and legal circumstances and accept supervision, and then listen to legitimate rectification opinions and improve them. (MEDIA4)

> We've done those things to improve. For example, how many sewage outlets have been reduced this year, how much has the water quality improved this year, some creatures that were not originally in the water have been seen again because of the management of the river, or after what kind of treatment, the water in this river becomes clear and so on. (MEDIA5)

7.5.5 Overall

Through conducting interviews with the different stakeholders, valuable insights have been obtained regarding their perspectives on the characteristics of good water information disclosure. Several key aspects have been identified to determine the fundamental for a comprehensive water disclosure. First, stakeholders emphasised the importance of information accuracy and reliability. At the same time, stakeholders highlighted the significance of adhering to relevant governmental regulations, ensuring compliance and adherence to legal requirements. Secondly, given the current non-mandatory nature of water information disclosure, stakeholders advocated for the establishment of unified standards or guidelines to promote consistency, completeness, and comparability across disclosures. Lastly, limited insights were provided by participants regarding the specific details of what constitutes good water-related information disclosure. Most of the feedback focused on general attributes such as transparency, credibility, truthfulness, and reliability, rather than identifying specific item that should be included in a comprehensive water disclosure. Only a few participants from the information providers and regulator groups specifically mentioned the inclusion of information on water consumption, wastewater discharge, and treatment. This lack of detailed understanding may also help explain the overall low disclosure scores observed in the content analysis presented in Chapter 6. In addition, the presence of conflicting opinions among shareholders is a common occurrence due to the subjective nature of their viewpoints and divergent opinions are to be expected.

7.6 Stakeholders' expectations regarding the types and use of water-related information they anticipate from Chinese listed companies

Interview Question 5: What water-related information do you expect from the company? What will you use it for?

7.6.1 Information providers/preparers

During the interviews, managers emphasised the significance of water-related information pertaining to water withdrawal/consumption, wastewater treatment and discharge. First, information regarding a company's water withdrawal and consumption serves as a fundamental metric for understanding the company's water usage patterns. This information provides insights into the company's water supply efficiency and can be used as a valuable indicator for forecasting the associated costs related to water consumption, as well as understanding the water footprint of a particular product.

> First of all, through this kind of information, we can grasp the basic water use situation of an enterprise, and at the same time, it is also instructive to understand the water use indicators of our products. (M5)

> I mainly use this information to evaluate the balance between water withdrawal and wastewater discharge and to examine the water supply sufficiency or if there is any extra waste of water resources, so we can manage the cost and do some adjustment about it. (M1)

Secondly, managers stressed the significance of wastewater discharge, particularly the pollutants and contaminants present in the water after its use. It was highlighted that if these pollutants and contaminants are not treated properly, they can have a detrimental impact on water bodies. Therefore, information on wastewater discharge, and the measures taken for its treatment, is essential for a company's water information disclosure.

> The first is the amount of wastewater discharged, and the second is the pollutants contained in the wastewater. These two points may be of more concern to the public. (M18)

> I think there is still a lack of information on the use of environmental protection facilities by enterprises, as well as some key monitoring factors in wastewater. (M13)

Thirdly, managers highlighted the wastewater treatment process. The wastewater treatment process refers to the series of steps and methods employed to remove pollutants and contaminants from wastewater. Hence, information related to the wastewater treatment process enables managers to understand the effectiveness of the treatment in improving the quality of water. It also provides insights into the outcomes of the treatment process, ensuring that the discharged wastewater does not cause pollution to the water environment.

> I usually pay more attention to the test results of a company and some related data, as well as the treatment process and discharge of wastewater. It is mainly to understand the situation of the industry to improve some of our own operations in this regard. (M17)

Managers also expressed the expectation of water information not only from their own company but also from other entities. They recognised that water is not just an individual concern but a matter that affects the entire society. Consequently, having knowledge about the water quality in the surrounding area was also considered significant: "I am concerned about water quality of surrounding residents and the impact on the surrounding water environment" (M16).

Lastly, managers constantly mentioned the high costs associated with data collection. They suggested that information disclosure involves a significant amount of investment. For example, to quantify water consumption and wastewater discharge, companies need to invest in specialised equipment for data measurement, and expertise is required in this context. Therefore, managers posited that any information that companies choose to disclose can be valuable and meaningful.

> As long as the information is disclosed by a company, it is considered important by the company itself. Companies would not engage in activities that are deemed unimportant because data collection, analysis, and information management processes incur costs. Therefore, companies choose to disclose information that they perceive to be advantageous. It would be meaningless and a waste of resources to engage in activities that do not provide any value. (M2)

7.6.2 Regulators

Regulators shared similar viewpoints as the managers regarding the importance of information on water withdrawal/consumption, wastewater discharge, and wastewater treatment infrastructure. They noted the significance of these aspects in assessing the water impact and sustainability of companies.

> In water management, the focus is on water use and intake, considering the ratio of water consumption to displacement and the concentration of discharged wastewater. Attention is also given to hardware facilities like water intake and drainage pipes, ensuring online monitoring completeness and operational normalcy. (G2)

> We are specifically interested in water withdrawal and wastewater discharge. Water extraction is rigorous in China. We monitor companies' water withdrawals to see if there is any violation. We also encourage water conservation and water use efficiency at the same time. Then we also monitor the chemicals and metals in companies' wastewater discharge. (G1)

Furthermore, regulators specifically emphasised the importance of water information used for evaluating the Environmental Impact Assessment (EIA). The EIA serves as a critical tool in assessing the potential environmental effects of a project or development proposal. It ensures that decision-makers consider and address the anticipated environmental impacts in a timely manner, with the aim of avoiding, minimising, or mitigating these effects. Therefore, regulators stressed the need for companies to provide relevant water information, including water withdrawal, consumption and wastewater discharge and treatment, which enables a comprehensive evaluation of the environmental impact of their activities.

> In the early stage of the project, I can use this information to evaluate their EIA. Only after the EIA meets its requirements can the capital construction enter the approval process … In the production process, it must meet the emission standards, which means the company will not be fined and stop production. Otherwise, the corresponding punishment will be waiting for them. (G1)

7.6.3 Shareholders and stock exchange managers

Every shareholder interviewed expressed a belief in the significance of water-related information, albeit to varying degrees. The primary information demand articulated by shareholders pertained to the operational facets, emphasising the adherence to environmental regulations in the utilisation and discharge of water as a crucial aspect for companies.

Shareholders expressed the view that any violation of these regulations resulting in harm to companies, the environment, or society is deemed unacceptable.

> Regular and random government inspections are conducted on our wastewater treatment plant and discharge port. Samples are taken for examination, and regular reporting ensures consistency. Failure in water quality inspection results in production pauses, an outcome we aim to avoid. (SH1)

From the disclosure perspective, shareholders underscored the significance of aligning with the expectations of customers, particularly those from foreign markets, and investors. Shareholders noted that international customers, predominantly from Europe and the United States, often delegate third-party assessments of water information, especially in the areas of water footprint and wastewater treatment. To sustain business relationships with these foreign customers, shareholders stressed the need for information providers to disclose pertinent information voluntarily.

> Our customers are mainly from America and Europe. They normally have higher expectation on our water. Usually, they will authorise a third-party to assess our water through available information, or even come to our factory. Therefore, we must regularly gather information to ensure we can meet the third party's requirements and pass their check. (SH1)

> Although I don't personally involve specific content, I know the importance of water information disclosure, because sometimes customers, investors or third parties who have an interest in us will come to our company to communicate and understand the situation through available information, and then compare with other companies. (SH6)

Three out of the six shareholders expressed a keen interest in obtaining comprehensive details regarding overall water usage and wastewater discharge. Although such information is typically within the purview of operational managers rather than shareholders, some shareholders sought this data for internal assessments of the impact on the environment. At the same time, they aimed to utilise this information for comparative analyses with other companies. Shareholders believed that benchmarking against industry peers provides insights into the relative performance of their own companies, facilitating an understanding of their standing in water information disclosure practices. Consequently, the emphasis on comparisons stems from the desire to gauge the effectiveness of their company's initiatives in this domain and identify areas for potential improvement.

> The first point is that our information undergoes internal audit before disclosure. If any adverse or unfavourable information is discovered during this process, we reflect on why it has occurred. The second point is that we compare the information we disclose with what others disclose, examining the differences. I mean, besides the information mandated by the government, after benchmarking, we conduct further research. (SH3)

> This kind of information can remind me of what needs to be improved. (SH2)

Additionally, shareholders underscored the importance of accessing wastewater information. They contended that regular monitoring of such information provides valuable insights and ideas for preventing major accidents related to water pollution.

> Wastewater information is important for me, mainly to understand in time and then take corresponding preventive measures and countermeasures. Once this information disclosure is delayed or hidden, the harm to us is very big. (SH5)

7.6.4 Other stakeholders

The NGO manager emphasised the importance of water information from three aspects, including environmental regulatory records, emissions situation, and supply chains. First, the past environmental records of a company provide valuable insights into its history of environmental practices, including any past violations, penalties imposed by government authorities, orders for remediation, and instances of production suspension resulting from regulatory non-compliance. The participant's NGO expressed a particular interest in accessing this information as it allows them to trace the reasons behind any misconduct and enables further investigation and monitoring of the company on behalf of society. Therefore, by examining the company's environmental record, the NGO can assess its commitment to environmental compliance, identify areas for improvement, and hold the company accountable for any environmental harm caused by its operations.

Secondly, the NGO manager attached great importance to monitoring a company's wastewater emissions. She emphasised the significance of accessing information about a company's wastewater discharge, including details about discharge quality and location. By having access to this information, the NGO can closely monitor whether a company's wastewater discharges comply with regulatory requirements and identify any potential illegal actions that may indicate attempts to evade supervision. This access also allows the NGO to actively monitor and assess the environmental impact of a company's wastewater discharge, ensuring that it aligns with established standards and regulations. In cases where non-compliance or suspicious activities are identified, the NGO can take appropriate actions, such as reporting the findings to relevant authorities or initiating further investigation.

Thirdly, the NGO manager expressed interest in obtaining information about companies' supply chains. She acknowledged that, in addition to the company itself, other entities within the supply chain, such as subsidiary companies, partners, distributors, and customers, are also important. Hence, the NGO had a responsibility to not only focus on the water information of the company itself but also to extend its attention to those relevant stakeholders. In this context,

the NGO manager recognises the interconnectedness of the various stakeholders within the supply chain and the collective responsibility to uphold high standards of water management. By actively engaging with all relevant entities, NGOs can foster a collaborative and proactive approach towards achieving sustainable water practices and mitigating any potential adverse impacts on the water environment.

> The focus is on scrutinising environmental regulatory records for violations, penalties, and corrective actions. Additionally, water emission information at exhaust ports is monitored to detect evasion of supervision. Reports from listed companies and their affiliates, including annual, semi-annual, and ESG reports, are reviewed to ensure environmental compliance across the entire chain, including subsidiaries, partners, and suppliers. (NGO1)

Journalists and editors from the media expressed a desire for quantitative indicators that accurately reflect the impact of companies on the water environment. Also, they raised the importance of using indicators in company disclosures that are relevant to the industry in which the companies operate. These stakeholders understood the significance of using appropriate and industry-specific indictors to assess the water-related performance of companies. They perceived the value of consistency and comparability in water information disclosure across industries. Therefore, aligning the indicators used in disclosure with industry-specific standards ensures that the disclosed information is relevant, meaningful, and provides a comprehensive assessment of the company's impact on the water environment.

> I think what's really important to me is to quantify the information. This quantification is not to point out the numbers of each section in the report now, but what will happen to the overall efficiency of the company after doing these things that are said in the report. (MEDIA1)

> I think the first is that the disclosed indicators must be in line with the industry in which it is located, and then this indicator must reflect its impact on the environment, so it should be subdivided. (MEDIA2)

Moreover, stakeholders from the media group expressed a significant demand for information pertaining to the investment in wastewater treatment and the wastewater treatment process. They recognised the substantial costs associated with water treatment, which may pose financial constraints for some companies. Additionally, these participants shared a similar viewpoint with managers regarding the importance of understanding the wastewater treatment process. They believed that wastewater treatment plays a crucial role in mitigating the environmental impact of business activities. Therefore, they expected companies to disclose information about their investment in wastewater treatment infrastructure, including the technologies and processes employed.

> If a billion-dollar enterprise invests 20 million in sewage treatment, that's 20%. However, small businesses can't afford such investments. Therefore, I'm more concerned about whether the enterprise's treated sewage meets the standards for entering the sewage treatment plant. If it doesn't, the treatment costs and equipment damage later will be very high. (MEDIA6)

The academics interviewed placed significant emphasis on the importance of corporate water information, recognising its value in conducting research and developing essential metrics for evaluating the water governance and performance of listed companies. Also, they recognised the significance of considering the industry-specific context when expecting water-related information. It was understood that different industries have distinct water usage patterns, challenges, and potential environmental impacts. Therefore, stakeholders in academia stressed the importance of distinguishing between industries and tailoring their expectations for specific water-related information accordingly.

> I think this matter is very important for scholars' research, especially related research. First, we will study this information. Second, it will likely develop into an important metric for evaluating listed companies. (A1)

> If it were me, I might distinguish between different businesses. For example, like the food industry, I may pay more attention to their water information. If it is not a company with high water consumption or high sewage, I may not pay too much attention to its water information disclosure, so it is also a matter of industry. (A2)

7.6.5 Overall

Based on the interviews conducted with a diverse range of stakeholders, it is clear that they commonly place emphasis on water consumption, wastewater discharge, and wastewater treatment. This response is also consistent with participants' earlier comments regarding the characteristics of a good water disclosure. Furthermore, the manager from the NGO considered companies' historical environmental records as important. By examining such information, his NGO was able to assess a company's historical impact on the environment, which enables it to gain a comprehensive understanding of the company's environmental practices and extend support accordingly.

From the media's perspective, interviewees expressed a strong desire for quantifiable and easily comprehensible water-related data. This demand stems from the need to disseminate information to the general public effectively. The media believed that water-related disclosures should be presented in a manner that facilitates broad understanding and engagement, allowing for wider participation in environmental initiatives.

Academic scholars, meanwhile, proposed that the disclosure of water-related information should be tailored to different industries. This consideration takes into account the varying degrees of reliance on water resources among different industry sectors. By customising the focus of water-related disclosures to align with industry-specific requirements and challenges, a more targeted and effective approach can be adopted to address the unique needs and concerns of each sector.

In summary, the findings from stakeholder interviews highlight the diverse perspectives and priorities regarding water-related information.

7.7 Stakeholder expectations and suggested improvements on the current water-related information disclosure in China

Interview Question 6: Does the current corporate water disclosure meet your expectations? If not, what is the gap between current disclosure and your expectations?

Interview Question 7: From your perspective, how can companies improve their current water-related information disclosure?

Stakeholders in the Chinese business context hold diverse expectations regarding water-related information disclosure, influenced by their respective roles as information users, regulators, and members of society. Understanding these expectations is essential for this study, as it provides insight into the drivers and challenges of corporate water disclosure. Ideally, each stakeholder group would actively express its views and expectations on water disclosure practices. However, in practice, not all stakeholders are willing or able to do so. This may be due to a lack of expertise, limited involvement in water-related aspects of corporate operations, or a general reluctance to engage in such discussions.

During the interviews, questions posed to corporate managers and shareholders were not confined to their own companies. Rather, they were asked to reflect on the broader practices of listed companies with which they were familiar. Additionally, each stakeholder group was invited to offer suggestions on how water-related disclosure could be improved from their unique perspective.

7.7.1 Information providers/preparers

From the 21 manager interviews, a notable finding was that seven expressed satisfactions with the current water information disclosure practices. These managers believed that the current disclosures have achieved a level of accuracy and transparency that meet their expectations. At the same time, three managers raised concerns about the water disclosure practices of small and medium-sized companies, suggesting that such companies may lack the necessary resources and capabilities to disclose water-related information to the same extent and quality as listed companies. This highlights potential disparities in the scope and comprehensiveness of water disclosure practices based on company size. This finding aligns with existing literature in the

Chinese context, which suggests that company size is a crucial factor influencing the quality of environmental information disclosure (Y. Luo et al., 2022; S. X. Zeng et al., 2010).

> I am quite satisfied with this now. (M5)
>
> I think it met my expectations. (M6)
>
> Basically, it met my expectations. Since it is a listed company, the accuracy and transparency of public information is relatively high. (M13)
>
> Because we are a listed company, our disclosure is definitely in line with the requirements, so I am satisfied. But some other small, medium and micro enterprises are hard to say. (M21)

Seven managers expressed concerns about the current water-related information disclosure practices. These managers stated that the existing disclosure falls short of their expectations. First, they highlighted the limited attention given to green accounting information, including water information. They noted that the majority of disclosure efforts still primarily focus on financial information, neglecting the crucial environmental dimension. While companies are increasingly recognising the importance of environmental information, disclosure practices in this regard remain limited in terms of quantity and quality. This response is consistent with the existing literature, which has consistently highlighted the need for greater attention to and emphasis on environmental information disclosure (C. Liu et al., 2023). More specifically, the managers expressed their concern that the disclosed information related to water is often too descriptive and basic. They believed that the current disclosure practices fail to capture the full extent of companies' environmental efforts and the associated impacts on water resources. Therefore, these managers suggested the need for more detailed disclosures and analysis that put the issue (i.e., water use and discharge) in perspective.

> I think it didn't meet my expectations … Now the leaders of many companies, including state-owned enterprises, still want to improve efficiency, and they still don't pay enough attention to the environment. (M8)
>
> I think it's definitely not reached yet … A listed company mainly focuses on financial disclosure, and then green accounting information is disclosed less. The green accounting information I refer to is environment-related information, which accounts for very little of the entire listed company's disclosure. (M14)
>
> I think that at present, many companies disclose some basic information without very detailed content. As far as I know, when producing a product, each process will do a water assessment, which includes information about the amount of water used and the amount of wastewater. However, the collection and calculation of this information will indeed cost a lot of investment, so I think most companies are still not detailed enough in this regard. (M19)

Another key aspect highlighted by these managers was the absence of experts and a unified standard in the field of water-related information disclosure. They expressed their belief that all companies should adhere to a common set of rules and guidelines when preparing and disclosing water-related information to achieve consistency and comparability. This would

ensure consistency and comparability across different entities, enabling stakeholders to make meaningful comparisons and assessments. At the same time, the managers raised concerns regarding the lack of experts in this area. They believed that water-related information disclosure is a specialised task that requires the expertise of professionals who possess specific knowledge in this domain. Therefore, they suggested that companies should engage professionals with a deep understanding of water management, environmental regulations, and reporting frameworks to ensure accurate and reliable disclosure.

> I don't think the current water disclosure is perfect enough … There is really no explicit provision to disclose which water-related content, if there is a clear provision in the future, I think it will be better. (M9)

> I think the first is that the investment of professional talents is not enough … If you want to disclose in depth and detail, you need professional people to do it. (M11)

Lastly, these managers found accessing relevant and detailed water-related information to be challenging. They noted that while some water-related issues are disclosed in company annual reports, the level of detail provided is often limited. The disclosed information tends to be descriptive in nature, lacking in-depth insights and specific details that would enable a more comprehensive understanding of water management practices. Consequently, managers highlighted the need for more specific and detailed information, particularly regarding the process of wastewater control and discharge. They emphasised the importance of understanding how companies manage and treat their wastewater, as well as their contingency plans for handling accidents or incidents that may impact water quality.

> Actually, personally speaking, if I want to access water-related information about a company, I don't know where to search for it. In other words, I don't have a reliable channel to obtain accurate information. (M4)

> Most of the information is disclosed in the company's annual report. I think the company should disclose the wastewater generated in the production process, as well as the standards and control of wastewater discharge, and the emergency treatment plan after the accident. I think this information is more important. (M16)

The final seven managers did not explicitly state whether the current water disclosure met their expectations or not. However, it is worth noting that these managers still provided feedback on the matter. These managers acknowledged that they lacked expertise in the area of water-related information disclosure, and that they have not closely followed the disclosures of their companies. As a result, they were unable to provide any comment on whether the current water-related information met their expectations or not.

> It's not easy for me to comment on this issue, because I don't know much about this aspect. (M20)

> Generally speaking, the information is now very transparent, and there are no secrets, at least in developed areas, but I don't know about some other places, because I don't know much about this, so I can't talk nonsense. (M18)

Regarding any improvements, the managers emphasised the importance of top-level managers and business leaders having a certain level of knowledge and understanding about the importance of water information transparency (i.e., to the public and to potential information users). They regarded this as a crucial factor in driving improvements in water-related information disclosure within the company. At the same time, they suggested that when business leaders recognise the significance of water resources and advocate for responsible practices, it becomes easier to initiate and promote water disclosure practices throughout the company. Consequently, a top-down approach was seen as instrumental in fostering a culture of transparency and accountability in water-related information disclosure.

> Firstly, I believe that personnel involved in management should have a certain understanding of the laws and regulations pertaining to national water resource management. Additionally, appropriate expertise should be allocated, and dedicated water resource management professionals should be appointed. (M5)

> Starting from leadership, it's crucial to convey environmental priorities downward. If company directors or chairpersons don't emphasise environmental protection, the company's performance is likely to suffer. Leadership needs a clear understanding of regulations and laws, ensuring everyone understands the importance of complying. This knowledge should be communicated from the top down to those responsible for environmental protection, leading to proper information disclosure and fulfilling the company's responsibilities. (M9)

Mandatory water disclosure and the establishment of unified disclosure standards with specific requirements (i.e., what specific information regarding water consumption, wastewater discharge and other related activities need to be disclosed) were suggested by managers for improving the corporate water information disclosure. They believed that government intervention through a standardised disclosure framework would enhance transparency and ensure that relevant water-related information is communicated consistently and clearly to stakeholders.

> In fact, the level of water-related information disclosure varies among domestic listed companies. Some companies excel in this aspect, while others perform poorly. This discrepancy can be attributed to the varying levels of awareness and understanding within each company, with some companies potentially lacking awareness of this issue. (M6)

> It is necessary to differentiate industries and establish standards based on each industry. This ensures consistency in the disclosure of data and facilitates comparison among companies within the same industry. Therefore, the first step is to establish standards and then implement them effectively. (M21)

Managers also suggested that water-related disclosures must be authentic, clear, and complete to be useful to stakeholders.

> The first aspect is the content of disclosure, which must ensure that the disclosed information is truthful, accurate, and complete. It is crucial to verify that the disclosed content does not

> contain any false records, misleading statements, or significant omissions. Additionally, the disclosed information should be concise, clear, and easily understandable, allowing individuals to grasp the information directly. (M7)

7.7.2 Regulators

Government officials expressed satisfaction with the current state of water information disclosure. However, it is important to acknowledge that these officials play a key role in establishing and enforcing relevant regulatory requirements. As such, their responses on this question may reflect a potential conflict of interest, given their dual roles as both regulators and evaluators of disclosure practices.

They believed that water information disclosure and transparency has improved over time, reflecting companies' progress in meeting regulatory expectations. They also emphasised that their expectations are flexible, acknowledging that comprehensive disclosure requires time and resources. Rather than expecting all companies to disclose at the same level, they assessed individual companies based on progress over time, focusing on improvements relative to past disclosure practices.

> I think, at this stage, laws and regulations require companies to disclose information, and they are doing it now. From the perspective of the company's own management or development to reveal or disclose more of its information. I think many of our companies are now exploring or trying. If we compare now to a few years before, companies are more transparent than in the past, and more and more companies are starting to disclose more information to the public. (G2)

> Because the intensity of management has been increasing in recent years, and everyone's awareness is also increasing. It should be said that within the scope of our jurisdiction, most of the key enterprises can basically do it in this area. Some of their main pollutants and indicators, through our online monitoring, can be publicised in a timely manner. (G3)

Government officials identified several key considerations for companies to enhance their current water information disclosure. First, they acknowledged that achieving improvements in water-related information disclosure may be costly. While this may not pose a major challenge for large companies, it presents a constraint for small and medium-sized companies. Secondly, they shared the perspective of the managers that improving the quality of the management team is crucial. Managers and business leaders should possess knowledge and understanding of water-related regulations to enhance current disclosure practices. Thirdly, fostering awareness of corporate social and environmental responsibility is essential for improving water-related information disclosure practices.

> Yes, companies need to make money to be able to survive before thinking about other things. Next, they need to consider improving the quality of their management team. Next, entrepreneurs, in addition to making money, also have a social responsibility, as well as environmental responsibility. (G1)

Moreover, government officials emphasised the importance of understanding the purpose and significance of water-related information disclosure in order to enhance current practices within companies. They highlighted that disclosure serves not only to meet governmental requirements but also to demonstrate a company's social responsibility and enable society to gain insights into its actions and performance in relevant areas. Once this understanding is established, companies should actively engage in regular and systematic public disclosure of information. By adopting these measures, companies can effectively enhance their water-related information disclosure and meet the expectations of stakeholders and the wider society.

> To achieve good information disclosure, companies must understand its purpose. This includes fulfilling corporate social responsibility by letting the public know about their environmental actions. Establishing an information disclosure mechanism is crucial, deciding what to disclose, when, and by which department. Following this system strictly, companies should disclose their environmental information, including water-related data systematically. They should also interact with the public, collecting feedback to improve disclosure quality and meet public expectations. This process helps companies improve their information disclosure and form positive interactions with society. (G2)

7.7.3 Shareholders and stock exchange managers

One manager from the SSE specifically pointed out that companies heavily dependent on water resources have made significant progress in water-related information disclosure. However, there was room for improvement among companies that are not heavily reliant on water resources. This suggests that a more comprehensive approach to water information disclosure across all industries is necessary to ensure consistency, comparability, and robust reporting practices.

> I think that at present only water as the main business and water-related companies do a good job in disclosure, and some other companies that have an indirect relationship with water are still lacking in water resource information disclosure, whether from the perspective of dimensions or indicators. (SE1)

The other stock exchange manager provided insights on good water information disclosure. He explained two fundamental factors that contribute to the comprehensiveness of water information disclosure. First, there is no unified evaluation system that can effectively measure companies' water disclosure in terms of quantity and quality. He suggested academic institutions could be valuable contributors in this endeavour, as their expertise and research can inform the design and implementation of comprehensive evaluation frameworks. Therefore, he argued, collaboration between academia and industry in developing such a system is needed.

> I think the first thing to do is to establish a unified evaluation system. In fact, the academic community should study a lot more than us, such as various scoring or classification standards, but at present, in fact, many of our disclosures are qualitative, and relatively few are actually implemented at the data level. Therefore, the first level must first have a quantitative evaluation mechanism. (SE2)

In the formulation of policies that support and encourage voluntary water information disclosure, it is crucial to shift the direction towards favouring the interests of companies that have good water disclosure and performance. This means that policies should focus on supporting and incentivising companies that actively participate in water-related information disclosure. The policy should be designed to channel the government fiscal subsidies to those companies that contribute to the conservation and protection of water resources and verify and disclose this information.

> The third level may be that the policies should be formulated in a more favourable direction. For example, the central bank's policy, although it is to lend to commercial banks, also has the requirements of enterprises, that is, only a real water treatment enterprise, or enterprises related to the environment can get the funds. (SE2)

From the perspective of shareholders, four of them agreed that the current water information disclosure aligned with their expectations. However, while they perceived the current water information disclosure as satisfactory, their discussions were frequently rooted in the absence of penalties imposed on the company for violating pertinent operational requirements. In other words, they believed that as long as a company is not penalised for violations or non-compliance, it is considered to be performing well in terms of disclosure. The other two shareholders indicated that they could not comment on this because they did not have a comprehensive understanding of water information disclosure.

> Yes, I am satisfied with our company's current water information disclosure. We haven't been recertified or penalised by the government because our company invests a lot in wastewater treatment every year. (SH1)

> Yes, I believe the current water information disclosure by listed companies meets my expectations. (SH2)

During the interviews, the researcher realised that shareholders often confused operational requirements and disclosure requirements. Nevertheless, one shareholder highlighted the importance of regular disclosure of information related to water consumption and the company's approach to wastewater treatment and discharge, emphasising the need to communicate this information to relevant stakeholders.

Although four shareholders believed that current disclosure practices meet their expectations, the need for stronger government oversight (i.e., making water-related information mandatory disclosure) and the implementation of a unified disclosure standard was consistently mentioned as potential improvements. This view aligned with suggestions raised by other stakeholders.

> I believe this is an important question. Currently, most companies focus on disclosing information to meet legal requirements. However, I think this is not enough. There should be more government intervention at a macro level to guide, support, and manage policies and funding. This intervention would help companies be more competitive under fair conditions. I

> suggest that the government should take a more active role in guiding and supporting companies to improve their water-related information disclosure practices. (SH3)

> I think the country should focus more on public infrastructure, technological investment, and regulations. For example, if pipelines outside industrial areas are well-built, it would encourage companies to upgrade their internal pipelines. This approach would be effective in driving improvement. (SH6)

7.7.4 Other stakeholders

The NGO manager noted that stakeholder expectations evolve with social and economic development. While past environmental disclosures were limited, he believed current practices meet expectations and was optimistic about future improvements. The NGO manager further recommended that companies learn from industry leaders to improve their disclosure practices and emphasised the importance of staying informed about the latest policies and guidelines to ensure compliance with evolving standards.

> In the past, there were many aspects that were not satisfied, but in recent years, things are changing, and some companies are even made more advanced disclosure compared to others. In the future, I believe all companies will get the most ideal disclosure. (NGO1)

> I believe there are two aspects to consider. Firstly, companies should refer to and learn from leading and exemplary companies in the same industry regarding their information disclosure practices. These companies serve as valuable sources of good practices and case studies, and the gap between them and other companies may not be as significant. If leading companies in the industry can disclose certain information, it implies that other companies can also achieve similar levels of disclosure. Secondly, companies should stay abreast of the changing domestic and international landscape and respond to policy calls by disclosing relevant and up-to-date information. It is important to adapt and evolve with the changing times, ensuring that the disclosed information remains current and aligns with evolving regulatory and industry requirements. (NGO1)

From the media's perspective, their expectations aligned with societal expectations. They believed that there exists a gap between the current water disclosure practices of companies and the interests of the public. Consequently, they stated that the current water information disclosure does not meet their expectations, and this can be attributed to the overall low level of water information disclosure among Chinese listed companies. Despite industries with heavy pollution being more likely to disclose information relating to the broader environment, they felt there was a relative lack of focus on disclosing water-related information. Also, other industries were not paying enough attention on water-related issues as well.

> Most companies, except heavy polluters, are not required to disclose environmental information. Of over 5,000 listed companies, only a small portion are required to disclose, and the ratio of ESG disclosures in China is lower compared to the US and Europe. (MEDIA2)

> For me, it definitely has not met. Mainly because, as a member of the media, I pay attention to the impact of companies on the water environment. I hope that companies can take some concrete actions or provide actual data every month to show us the changes that have actually occurred to the general public. (MEIDA5)

Media stakeholders believed that in order to improve the current water-related information disclosure of listed companies in China, it is necessary to focus on the overall policy environment. As a country with a centralised system led by the Communist Party, it is relatively easy to promote a policy from top to bottom. Therefore, if the central government takes the lead in driving the implementation of water-related information disclosure policy, it can have a significant impact on companies and facilitate the improvement of disclosure practices throughout the country. Also, two journalists suggested that disclosing water-related information somewhere publicly available such as the website and making it a mandatory disclosure could be another effective approach to enhance the quality of information. They believed that such efforts could enhance the overall transparency and accountability of corporate water reporting practices.

> In my opinion, for listed companies, the most effective approach would be through legal regulations. As China operates under a centralised system, it is relatively easier to promote initiatives from top to bottom. Therefore, implementing regulations and policies from a legal perspective would have a significant impact on listed companies and facilitate the desired changes. (MEDIA2)

> I believe that the China Securities Regulatory Commission should incorporate this aspect as an important piece of information and require companies to disclose it to somewhere publicly available. I think that such a measure can help shareholders and the general public to gain a more comprehensive understanding of companies. By disclosing water-related information on companies' official website, investors and the wider public can assess a company's environmental performance and sustainability practices, enabling informed decision-making and fostering greater transparency and accountability in the corporate sector. (MEDIA6)

The academics interviewed identified that the current water disclosure did not meet their expectations. They noted several gaps regarding water-related information disclosure. First, in the context of water-related information disclosure, a notable absence exists in terms of a standardised framework or guidance that could facilitate and incentivise companies to disclose relevant information.

> Overall, it is not perfect. Our system construction is also in the process of continuous improvement, so your research topic is also very interesting, because we now, especially in the Chinese mainland, do not have a complete system requiring disclosure of water-related information. Of course, we may not have such detailed requirements in social responsibility reports, or even financial reports, so to a certain extent, the disclosure of water resources information is more of a voluntary behaviour. (A3)

Secondly, academics pointed out that the existing water-related information disclosed by companies is often vague and descriptive. Also, there was a concern regarding the accuracy of the information provided in companies' reports.

> I think the expected value is definitely not achieved. Information disclosed by many companies is still relatively vague and general, and it is not very accurate, including water consumption, water withdrawal and investment in water treatment equipment, etc., so I think there is still a lot of room for improvement. (A2)

Furthermore, academics argued that the Chinese companies primarily focus on economic interests, with minimal attention directed towards the environmental dimension. Additionally, the extent and comprehensiveness of the disclosed water-related information was also inadequate, falling short of academics' expectations of detailed data and explanations to put water-related issues in perspective. Water plays a critical role in numerous environmental issues and is of significant importance in environmental information discourse research. Academics acknowledged, however, the limited current research on water-related information disclosure in China.

> In China's current industrialisation stage, companies prioritise economic aspects often overlooking water information disclosure and social responsibility. This differs from more developed regions like Europe and the United States, where disclosure standards are higher. (A1)

> In fact, water information disclosure is very weak. People are now more concerned about air quality and greenhouse gases. Water is not enough, and neither is soil. (A4)

Academic researchers contributed valuable insights into improving corporate water disclosure practices. First, they emphasised the significance of continuous training as a fundamental element in cultivating effective water information disclosure practices. They recommended that companies allocate sufficient resources to invest in comprehensive training programs, with a particular emphasis on the commitment and involvement of top-level managers.

> From the perspective of companies, I think we should increase training efforts so that companies can recognise the importance and significance of this matter. I think it's the first step, a very important one. The second is that on this basis, the finance department, including the treasurer, the CEO, both the chairperson and the general manager need to take action to push this forward. Although it may not do particularly well at first. But you just have to do it to get better and better. If you don't do it forever Not good. (A1)

Secondly, two out of the five researchers emphasised the cost implications associated with reporting water information, including data collection and management. They stressed the need for companies to consider these costs when seeking to enhance their water information disclosure practices. More specifically, companies aspiring to engage in water-related information disclosure must possess specialised equipment capable of quantifying water-related data (i.e., measuring the volume of water consumption, wastewater treatment, or wastewater discharge). This enables companies to effectively utilise data for disclosure preparation. However, that specialised equipment is expensive and usually requires skilled individuals to operate. Consequently, academic researchers raised this concern for companies interested in participating in the practice of water-related information disclosure: "In addition to manpower, you also need to have some financial or financial support. Many things need to be supported by costs and funds" (A1).

Thirdly, four out of the five academics highlighted the importance of external assurance as a means to ensure the reliability and credibility of disclosed water information: “Our country now also advocates environmental auditing, so when doing external auditing, can we get more environmental auditing? I think this is a place worth practicing” (A2). Lastly, two researchers whose work focuses on corporate environmental information disclosure emphasised the importance of distinguishing between companies operating in different industries, as their level of involvement and impact on water resources vary. It is unrealistic to expect uniform water information disclosure across all industries. However, companies should develop long-term and sustainable plans for strategic water resource management. They should also provide information on specific actions implemented as part of their plans, such as water efficiency measures and the assessment of water-related impacts in production processes.

> For high water sensitivity and low-sensitivity companies, there may be differences in information disclosure. However, as a company, it should integrate the cognition and strategy of resources into long-term planning and disclose the actions that may be implemented under the planning. For example, water efficiency, and the possible environmental and social impacts of the production process. I think these need to be disclosed in the corresponding report. (A3)

7.7.5 Overall

In summary, the interviews with various stakeholders reveal a lack of consensus regarding the current state of water information disclosure among Chinese listed companies. Nonetheless, these interviews provide valuable insights into the diverse expectations across stakeholder groups. A key issue identified is the absence of a unified reporting guideline, which has led to inconsistencies in both the extent and quality of disclosures (S. Hu et al., 2024; L. Zeng et al., 2024; Y. Zhou et al., 2024). Stakeholders consistently emphasised the need for professional measurement and external verification to enhance the credibility of disclosed information, though a shortage of relevant expertise remains a challenge. It was also recognised that expectations surrounding disclosure should be dynamic and responsive to societal and economic developments. While limitations persist in China’s current voluntary disclosure system, some stakeholders expressed optimism that improvements will occur as corporate environmental accountability and relevant regulations continue to evolve. Others advocated for transitioning from voluntary to mandatory disclosure, underpinned by clear standards that guide companies on what specific water-related information to report. Such a shift is viewed as essential for advancing transparency and accountability. Furthermore, the findings highlight the importance of raising awareness among managers and business leaders about the significance of water disclosure. In the Chinese context, equipping leadership with appropriate knowledge and understanding is critical to promoting more effective dissemination of environmental information and implementing meaningful disclosure practices (Zhao et al., 2024).

7.8 Stakeholder perceptions on adopting the existing reporting guidelines

Interview Question 8: Do you think the existing international frameworks, for example the GRI, ESG and ISO, are good or the best for Chinese companies to disclose water-related information? If not, what do you think are the challenges for companies to implement these reporting frameworks?

7.8.1 Information providers/preparers

From the perspective of the managers interviewed, there was a widespread view that the existing disclosure frameworks commonly used internationally may not be entirely appropriate for Chinese companies. One key point emphasised by managers was the recognition that each country has unique circumstances, and therefore the selection of a disclosure framework should align with the China's national context. Besides, China has experienced an unprecedented escalation in environmental protection legislation in recent years, marking a notable departure from the past. Consequently, 10 out of the 21 managers contended that once domestic operational requirements are fulfilled, there would be no imperative to consider additional disclosure obligations imposed by other countries or the international community. However, some managers did emphasise that they would meet their stakeholders' requirements if they demanded information disclosure in accordance with international standards.

> The environmental protection standards have evolved and become more stringent in recent years. In the past, environmental concerns were often compromised for the sake of economic development. However, there has been a significant improvement in environmental awareness, and the government has implemented strict regulations and standards. Therefore, I believe that domestic companies should prioritise meeting domestic standards at the very least. (M4)

> I feel that it still depends on the specific circumstances of each country because international standards can vary among different countries. (M21)

> This certainly does not apply universally, just like how laws differ among countries due to their unique national contexts. However, if there is a demand from the client in this regard, we will still strive to accommodate it to the best of our abilities. (M11)

> I think the current international reporting framework is not the best for every company in China … For example, a few years ago, we had customers come to our factory to take samples of our discharged wastewater. We strictly followed our country's operational standard, but their requirement is higher than our country's standard, including some indicators that our government does not require. In more detail, our customers require the discharged water temperature cannot to go beyond 37 degrees, but our country's standard says not more than 40 degrees, which caused a conflict between the two standards. This situation also applies to many other indicators such as salt, metal, and copper content. (M1)

On the other hand, 11 managers held the view that foreign reporting frameworks are more detailed in some areas and more comprehensive compared to the domestic disclosure framework. They argued that adopting international reporting standards or guidelines has the

potential to enhance awareness and improve the effectiveness of the current water information disclosure practices in China.

> I believe that if these foreign standards are implemented in China, they would drive the entire disclosure environment, possibly due to their higher level of professionalism and more detailed reporting. (M13)

> In general, international requirements are usually higher than domestic ones. However, foreign clients also set their requirements based on the specific circumstances of the company, and they would not excessively demand beyond what the company can achieve. (M19)

7.8.2 Regulators

In the context of water information disclosure, regulators held the perspective that adherence to international disclosure standards and guidelines is not essential for companies primarily engaged in domestic operations. The rationale behind this viewpoint lies in the recognition that different countries have distinct regulatory frameworks and varying levels of emphasis on water information disclosure. Therefore, companies operating solely within a domestic context should focus on complying with the relevant national laws and regulations governing water information disclosure.

However, things change when a company has a global presence and serves international markets. In this scenario, regulators emphasised the importance of meeting the demands of overseas customers and investors and other international stakeholders while also complying with the applicable national laws and regulations. As international markets may have different expectations and requirements regarding water information disclosure, the use of international information disclosure standards becomes necessary for companies seeking to maintain a competitive edge and ensure transparency and accountability in their operations.

It is worth emphasising that the adoption of international information disclosure standards should be approached with a contextual understanding of the company's global reach and the specific demands of its overseas markets. The decision to implement international standards should be guided by the need to align with the expectations of international stakeholders while ensuring compliance with domestic regulations. Striking a balance between these considerations is crucial for companies operating in a globalised business environment and seeking to navigate the complexities of water information disclosure effectively.

> In this case, it doesn't make much sense if a company sells purely domestically. If the company is going for export, meeting the foreign manufacturer's or raw material supplier's requirement is mandatory, such as ISO 14000 or 9000 certification system or taking the US certification system. European Union system. The company must disclose relevant information following foreign standards. Overall, it is based on the needs of enterprise development. I don't think the

> international reporting framework is necessarily suitable for all Chinese companies. It may still be based on the industry's situation in a region, then the enterprise's own production and operation process, and of course, its supply chain system to determine. (G1)

> I am not aware of the extent of the gap between international standards and our current domestic standards. However, I believe that our domestic standards are relatively strict. If we were to strictly adhere to international standards, they may not necessarily be applicable to our domestic enterprises or align with our domestic standards. This is my personal understanding. (G3)

7.8.3 Shareholders and stock exchange managers

Four out of the six shareholders interviewed thought the current international reporting frameworks (e.g., GRI) are not suitable for Chinese companies. First, shareholders mentioned an important distinction between large and small companies. In this context, only large listed companies possess the capability to fully adopt to international disclosure frameworks.

> I don't think the current international reporting frameworks fit all companies in China because we are a very large company, so we have the ability and the financial foundation to achieve all those things. Also, we have a specific department and people in charge of this area (environmental information disclosure). However, for some smaller companies or companies with only a few hundred employees, I don't think they have the ability to do all those things. I think those leading companies in the industry or other large listed companies are doing fine, but the real problem is for those smaller companies. (SH1)

Secondly, shareholders emphasised the existing disparity between companies in China and those in Western contexts concerning the cultivation of CSR, environmental responsibility, and accountability. Chinese companies tend to prioritise adherence to operational standards over information transparency and disclosure. Consequently, initiatives such as adopting international reporting frameworks for voluntary disclosure may not be perceived as favourable by these companies, as they may not directly contribute to the company's financial performance. Nevertheless, shareholders concurred that the adoption of international reporting frameworks is a commendable practice. They emphasised that such practices require time for companies to adapt, and there may be a need for indigenisation of the details within international reporting frameworks to align with the Chinese business culture and environment.

> I believe that everyone is willing to embrace advanced practices, but there are inherent differences between Chinese and foreign enterprises. Chinese companies are bound to incorporate China's unique culture and characteristics, and they started relatively late in terms of social responsibility and environmental initiatives, which are not as well-established as in foreign counterparts. Therefore, when Chinese companies integrate some more advanced international disclosure policies, there is a need for a set of disclosure standards tailored to the Chinese business environment, a process known as localisation. However, this process is relatively slow. (SH6)

7.8.4 Other stakeholders

The academic researchers highlighted that foreign disclosure frameworks and guidelines have valuable reference value for domestic companies in China. By learning from and adopting these methods and frameworks, domestic companies can undergo significant transformation. For example, referencing international disclosure frameworks or guidelines can furnish information providers with valuable insights on how to improve their existing disclosure practice. However, it is essential to consider the unique national conditions and make necessary improvements to better align with the Chinese context. Many companies in China already refer to international frameworks like GRI for non-financial information disclosure, especially in social responsibility and environmental reporting. For example, Chinese companies listed in Hong Kong or on international securities markets face additional regulatory information disclosure requirements (e.g., ESG reporting requirements). Domestically, the introduction of China's carbon reduction policy and incorporation of global disclosure guidance will likely lead to the development of localised disclosure requirements for China.

> I think it has great reference value, because compared with some foreign enterprises, our domestic enterprises are still in their infancy. So, if a large number of companies can learn from this method and follow this framework, I think it is also a big change. Of course, we have to combine our own national conditions and make some improvements, then I think it will be better. (A2)

> Many Chinese companies refer to ESG and GRI for non-financial information disclosure. These frameworks are used in social responsibility and environmental reports. Companies listed in Hong Kong or abroad also face regulatory disclosure requirements. With China's carbon reduction policy and global disclosure guidance, a local disclosure guide for China may be developed. (A3)

> This topic is quite significant. In China, regulatory bodies like the State-owned Assets Supervision and Administration Commission and the stock exchanges are increasingly focused on ESG issues. ESG is not just about information disclosure but also about ratings and investment. This includes sensitive topics like human rights and trade union organisations. This raises the question of whether such disclosure guidelines are suitable for China's national conditions. (A4)

In addition, scholars identified several challenges that Chinese companies face in implementing international reporting guidelines. First, companies often struggle to determine which information is crucial to disclose, making it difficult for them to establish a starting point for their reporting efforts. Secondly, the disclosure of environmental information, including water-related information, can be costly (i.e., purchase measuring equipment and assign expertise/professionals to oversee the pertinent responsibilities), leading to some companies not making any disclosures at all.

> First of all, many companies do not know what to disclose, so they sometimes have no way to start. Secondly, there is a very important factor, environmental information disclosure, including water information is actually more costly. So not all companies are willing to invest human and financial resources to do this … If the disclosure of environmental information is not done well, it may have strong negative effects, but even if it is done well, it will not bring

> direct and significant benefits to the company. So, I think this is also an unspeakable secret for many companies. (A2)

Media professionals shared their perspectives on this matter, which generally reinforced the viewpoints of other stakeholders. One key observation made by the media was the financial requirements associated with information disclosure. While companies are listed entities, the varying scale and capacities of these companies result in divergent willingness to allocate substantial resources to information disclosure practices.

> When it comes to disclosure, companies consider an important factor, which is budget. Many privately-owned companies, due to their financial performance, often question the necessity of spending tens of thousands of yuan on disclosure activities each year … From a broader perspective of benefiting future generations and promoting sustainable development, disclosing environmental information is undoubtedly beneficial for the surrounding communities and society at large. However, this endeavour may unintentionally create pressure on certain businesses. The cost of engaging in disclosure practices is relatively high, and smaller enterprises, particularly those not classified as heavily polluting industries, may not demonstrate a strong inclination to disclose information. (MEDIA2)

7.8.5 Overall

Based on inquiries conducted with stakeholders, it is evident that the voluntary disclosure of corporate water information was considered good practice in terms of the fulfilment of corporate environmental responsibility and the discharge of corporate water accountability. Also, adoption of the international reporting frameworks for water accounting provides excellent guidance for companies to prepare and disclose water information, despite some stakeholders holding different opinions. This variety of perspectives can be attributed to several factors. For example, there exists a large disparity in the scale of domestic listed companies, making it challenging to establish a standardised approach to disclosure. The diverse sizes and structures of these companies hinder uniformity in the application of international frameworks (see Chapter 5 for details of the sample of companies in this research). Also, not all companies have the same exposure to water-related issues.

Furthermore, the cost associated with disclosure poses a significant challenge for many companies. As a resource-intensive endeavour, disclosure requires financial investment, such as costs associated with collecting, organising, and preparing the information. This financial burden often leads companies, particularly those facing economic constraints or operating in challenging business environments, to hesitate in allocating significant resources to disclosure activities. Participants who agreed that international reporting standards are beneficial also suggested that incorporating them requires careful consideration, as adjustments may be needed before these standards can be directly applied to companies operating in China. Table 7.1

summarises the key findings from the semi-structured interviews with the diverse range of 54 stakeholders.

Table 7.1 A summary of the findings derived from core interview questions

	Information providers/preparers	**Regulators**	**Shareholders and stock exchange managers**	**Other stakeholders**
Q1. How do you define a company's responsibility to the environment?	1. Adherence to government regulations and laws constitutes a foundational prerequisite for a company's environmental responsibility. 2. An environmentally responsible company should also take into account the broader societal and local community implications. 3. Conducting an environmental impact assessment (EIA) before commencing significant operations in imperative. 4. The promotion and adoption of the principles of 'green	1. Companies are obligated to adhere to pertinent environmental laws and regulations that pertain to their business operations. 2. Breaching environmental laws and regulations can lead to severe penalties, fines, and in extreme cases, the suspension of business operations.	1. China has financially supported companies transitioning to green development and help them to be more sustainable. 2. Environmental responsibility is an ethical obligation and a business imperative. Thus, companies have an inherent responsibility to	1. Mitigating adverse environmental impacts. 2. CSR and ESG reporting serve as effective and practical tools for companies to communicate their environmental initiatives to stakeholders. 3. Academic researchers think environmental responsibility represents both an ethical obligation and a critical business imperative.

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
	production' and 'green development' should be actively pursued.		protect the environment.	
Q2. How do you see the corporate impact on China's water environment?	1. Industrialisation has resulted in detrimental effects on the water environment. 2. The management of wastewater is frequently disregarded and overlooked within industrial processes. 3. There has been a notable upsurge in investment in	1. The Chinese government has made a significant effort to enhance environmental protection in recent years. 2. Water quality have been significantly	1. The trend of new energy and technology industries is on the rise, characterised by lower pollution levels and reduced water resources consumption.	1. Stringent environmental laws/regulations. 2. The corporate influence on the water environment is progressively improving every year, marked by a decrease in water pollution and an increased on protecting the water environment.

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
	water protection initiatives in recent years.	improved compared to previous years. 3. Increase public awareness.	2. Companies are facing more external pressures from both government and customers regarding water. Hence, many companies have adopted advanced technologies to reduce wastewater discharge and use more recycling and reuse of utilised water in various activities.	

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
Q3. How do you do you perceive companies' voluntary water disclosure in China?	1. Voluntary water disclosure is poised to emerge as a prominent and important trend in the future. 2. Voluntary water disclosure serves as an indication of a company's dedication to water stewardship and accountability. 3. Voluntary water disclosure represents a strategic approach in terms of delivering useful information to stakeholders, while simultaneously attracting customers and investors. 4. Voluntary water disclosure has the potential to increase a company's competitive power in the market.	1. Water is a limited resource, and disclosing information is a means of discharging corporate social and environmental responsibility. 2. Improve information transparency. 3. Voluntary water disclosure will be pivotal in gaining market recognition and fostering public comprehension of a company's water management and performance.	1. Water-related issues are not limited to individual concerns but are a matter of societal importance. 2. These disclosures are not mandatory in China. 3. Voluntary disclosure of corporate water information is an important practice for companies as it aligns with principles of information transparency, corporate water	1. A burgeoning trend of voluntary water information disclosure is noticeable among Chinese listed companies, particularly in high-water sensitive industries. 2. Companies use voluntary water disclosure to discharge the corporate environmental responsibility and accountability. Also, companies use voluntary information disclosure to build a positive public image. 3. There remains a substantial scope for enhancement in the quality and uniformity of corporate water disclosures. 4. Water information disclosure is seen as a part of corporate social and environmental responsibility, and it aligns with principles of transparency, accountability and sustainability development.

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
	5. Water-related information disclosure and information transparency are important to serve as a means of discharging corporate accountability. 6. Voluntary disclosure is more prevalent among big companies when compared to small and medium-sized companies.		accountability and sustainable development.	

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
Q4. How you define good water disclosure by a company?	1. Transparency, comprehensiveness, truthfulness and openness are key principles of good water disclosure. 2. Employing multiple channels to ensure accessibility for potential users in imperative. 3. Incorporating specific measures pertaining to water consumption, wastewater discharge, and other pertinent water-related concerns is essential. 4. Third-party organisation to assure the credibility and reliability of disclosed water information.	1. Good water disclosure lies in the details, such as accurate measurement (i.e., consistency, reliability and comparability) and in-depth reflection. 2. Important of water pollution.	1. Third party assurance adds credibility and reliability to the disclosed water information. 2. Some shareholders think as long as companies fulfil their legal operational obligations and provide the necessary information required by the government (if there is any), then it is enough. There is no need to	1. It is important to take into account the distinct context of each industry when evaluating the sufficiency and comprehensiveness of water disclosure practices. 2. Effective water disclosure should be approached with a focus on meeting the needs and expectation of information users. 3. The attainment of quality water disclosure necessitates standardisation in its application. 4. Third-party assurance is essential to ensure the credibility and reliability of the disclosed information. 5. A good water disclosure should serve as a societal benchmark, enabling the broader community to gain a comprehensive understanding of the company's water management

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
			provide additional disclosure. 3. Detailed and transparent information. 4. Quantitative data is one of the critical components in crafting a robust water information disclosure.	performance and its repercussions on the water environment.

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
Q5. What water-related information do you expect from the company?	1. Water withdrawal in volume and cost. 2. Water consumption in volume and cost. 3. Wastewater discharge and treatment (i.e., treatment processes and infrastructure) in volume and cost. 4. Cost associated with collecting data and preparing information disclosure.	1. Same as these expectations from managers, including water withdrawal, water consumption, wastewater discharge and wastewater treatment. 2. Water information used for evaluating the EIA.	1. Water consumption and wastewater information. 2. Water information disclosure should align with the expectations of customers and investors. 3. Benchmarking against industry peers provides insights into the relative performance of their own companies.	1. Quantitative data that accurately reflect the corporate impact on the water environment. 2. Investment in wastewater treatment and treatment processes. 3. Water information encompassing historical records, water discharge information and the water-related issues between the company and its supply chain. 4. Information on violation and penalties. 5. Details of wastewater discharge.

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
Q6. Does the current corporate water disclosure meet your expectations? (for corporate managers and shareholders, this question sought a general overview of listed companies they were familiar with in terms of water information disclosure, not limited to their own companies)	1. 1/3 had expectations met, 1/3 did not have expectations met, and 1/3 gave neutral responses.	1. The regulators were satisfied with the current water information disclosure.	1. Shareholders and managers from the stock exchanges believed that the current water information disclosure meet their expectations. 2. Managers from the stock exchange highlighted that there is still room for improvement. 3. A comprehensive approach to water information disclosure across all industries is necessary to ensure consistency and comparability.	1. For some stakeholders, the current water information disclosures meet their expectations (NGO manager and employee union reps). 2. For others, the current water information disclosures do not meet their expectations (i.e., media and academia). a) Due to the lack of sufficient attention being given to the disclosure of water-related information. b) Greater emphasis is placed on economic development than on environmental dimensions. c) Lack of a standardised reporting framework or disclosure guidelines. d) Current disclosure is vague and descriptive.

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
Q7. How can disclosures be improved?	1. A top-down approach can be a more efficient and suitable strategy in China. 2. Senior managers or business leaders should possess a requisite level of knowledge and comprehension concerning the significance of water-related information. 3. Mandatory disclosure with specific water disclosure standards that direct companies to disclose water-related information. 4. Provide more granular details regarding water consumption and wastewater treatment. 5. Enhance the credibility and trustworthiness of water-	1. Increase financial investment in relevant equipment (i.e., for measuring and capturing water-related information) and recruit more experts in environmental (including water) information disclosure. 2. Incorporating feedback and public opinion from society.	1. Government intervention, such as introducing mandatory disclosure requirements with disclosure standards will be significant for improving the current corporate water disclosure. 2. Creating a unified evaluation system that can effectively measure companies' water disclosure in terms of quantity and quality.	1. Learn from industry-leading companies in regard to water information disclosure. 2. Constantly staying informed about the latest reporting guidelines relating to water information disclosure. 3. Formulating comprehensive and unified reporting guidelines. 4. The implementation of a mandatory water information disclosure policy should be led by the central government through a top-down approach. 5. Incorporate external assurance mechanism of water information. 6. The industry to which a company belongs can significantly influence its approach to water information disclosure. As such, companies should adopt disclosure practices suitable to their specific industry to effectively

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
	related information, which are vital for stakeholders.			communicate their long-term sustainable plan for water resources management.

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
Q8. Do you think the existing international frameworks are good or the best for Chinese companies to disclose water-related information?	1. Every nation has distinct circumstances, and therefore, the choice of a disclosure framework should align with the current national context. 2. Foreign reporting framework can be more detailed in certain areas and offer greater comprehensiveness. 3. Adhere to the international reporting frameworks, such as GRI, for their information disclosures, and may require a long adaptation process.	1. The choice to adopt an international reporting framework should be driven by the objective of aligning with the expectations of international/domestic stakeholders, all the while ensuring conformity with domestic regulations, if applicable. 2. No domestic frameworks or standards.	1. Some shareholders think the international reporting standards are not suitable for Chinese companies. 2. The size disparity among listed companies should be considered when contemplating the adoption of widely accepted international reporting standards because not every company is willing to	1. Companies can learn from international reporting frameworks/requirements. 2. Companies often struggle to determine which information is crucial to disclose, making it difficult for them to establish a starting point for their reporting efforts. 3. Water information disclosure can be costly, making it unaffordable for small companies.

	Information providers/preparers	Regulators	Shareholders and stock exchange managers	Other stakeholders
			allocate resources to this practice.	

7.9 The influence of different stakeholders on water information disclosure

Managers acknowledged that water is an important component within the broader scope of environmental considerations. However, they admitted that their companies did not have a separate disclosure policy specifically for water-related issues. Instead, water is addressed as part of their general environmental information disclosure practices.

> Certainly, there are such policies in place. However, water is just one aspect within the broader environmental theme. Our disclosure policy is designed to be comprehensive and holistic, encompassing various environmental aspects, rather than being solely focused on water resources. (M2)

Sixteen out of the 21 managers noted that expectations of stakeholders, including investors, shareholders, customers and social sector stakeholders, played a significant role in motivating their companies to disclose water-related information. Conversely, if there is no explicit demand or expectation from stakeholders for such information, or if companies cannot see the benefit, they will not disclose that information.

> You also need to consider the needs of society. For example, some shareholders or investors want to understand your environmental impact or behaviour, you should also consider their demands reasonably. (M20)

> The driving force mainly comes from three points. The first is the social responsibility of enterprises. The second is the requirements of the government. The third is the demands of the people. Integrating the needs of these three parties can become a community of interests. (M18)

In addition, managers agreed that voluntary information disclosure serves as a means of discharging corporate accountability. They also acknowledged that, as listed companies, they had a duty to minimise their environmental impact and to demonstrate social responsibility by disclosing relevant information to stakeholders, thereby setting a positive example for society.

Regarding the stakeholders who may be interested in water-related information, 14 managers identified government departments as the primary stakeholders due to their regulatory authority and oversight responsibilities. Nevertheless, managers also acknowledged that, beyond the government, other stakeholders, including customers, investors, media, and local communities are increasingly interested in such disclosures. These stakeholders use the information to assess a company's water performance and management practices, enabling them to make more informed decisions regarding their business relationship with the company.

> The information we disclose is intended for the entire society and not targeted at specific individuals or groups. Therefore, the entire society is an important target audience for our disclosure efforts. (M6)

> The primary recipients of information disclosure are undoubtedly government departments as they oversee our operations. (M18)

> Government departments, investors, distributors, suppliers, customers, and even the company's employees themselves are concerned about the sustainability of the company. In the case of a large, listed company, employees tend to focus on their own department or immediate

> surroundings and may not have a comprehensive understanding of the overall situation of the company. Therefore, disclosing certain information is beneficial for employees to understand their own company. (M2)

> The general public and news media, including local newspapers, are also stakeholders who show interest in the company's information. With the emergence of social media, companies sometimes choose to disclose information on these platforms as well. (M3)

> The residents in our vicinity are also concerned about water information since water resources are closely related to their daily lives. (M21)

Seventeen managers held the view that disclosing water-related information does not pose significant challenges. However, some issues were constantly mentioned, such as the costs associated with colleting and measuring water-related data (i.e., purchasing relevant equipment) and the recruitment of experts in the field of environmental information disclosure.

> At present, we have not encountered any major challenges. We simply follow the established procedures and carry out our tasks step by step. (M5)

> We haven't encountered any difficulties. Our disclosures are done in accordance with the requirements, ensuring accurate and transparent reporting without any hidden information. (M14)

> We haven't encountered any difficulties because these are routine operations that we carry out on a daily basis. In the end, we gather and compile all the information for summary and organisation. (M19)

> We haven't encountered any difficulties or challenges so far. (M21)

Furthermore, eight managers highlighted that when their company first engaged with water information disclosure, they faced uncertainty regarding what information to disclose and the formulation of a proper disclosure report. However, they explained that this issue can be mitigated by referring to the practices of other companies in the same industry and learning from their experiences.

> The most challenging part is the first time we disclose information because we are unsure of how to proceed. Therefore, we have to learn from and seek guidance from our peers in the industry. (M17)

Government officials raised concerns about water withdrawal and wastewater discharge practices. They emphasised the strict regulations governing water extraction in China and emphasised that water withdrawal information plays a crucial role in monitoring violations related to the extraction of water resources. Additionally, monitoring the wastewater discharged ensures compliance with regulatory requirements (i.e., operational requirements). Moreover, access to information on water withdrawals and discharge aids the government in gaining a comprehensive understanding of whether a company's water consumption and discharge ratios are within normal limits and enables effective monitoring.

> We are specifically interested in water withdrawal and wastewater discharge. Water extraction is rigorous in China. We monitor companies' water withdrawals to see if there is any violation.

> We also encourage water conservation and water use efficiency at the same time. Then we also monitor the chemical and metals in companies' wastewater discharge. (G1)

> In fact, in our water management, we pay particular attention to your water usage and water withdrawal. First, in terms of quantity, it refers to the ratio between your water consumption and wastewater discharge, such as whether the water consumption and wastewater discharge have reached a normal ratio. The second aspect pertains to indicators, specifically whether the concentration of wastewater discharged by the company meets the emission standards. This concerns both the quantity and quality of water, and it is an area of particular focus for us. (G3)

2. What are the objectives of Chinese-specific water-related disclosure policies and regulations?

One government official emphasised that the underlying principle of water-related policies is to enforce companies' adherence to legal frameworks. Also, government officials believed that if companies are complying with those policies, this has the potential to alleviate adverse environmental impacts. In this case, they were more concerned about private disclosure of water information to the government to monitor actions than public accountability.

> The idea is to require all companies to comply with laws and regulations and reduce the environmental impact and damage. In future, the overall standard will be raised. The number of categories will increase, and the intensity of monitor control will increase. Then after the process is improved, there may be more adjustments to the current situation. (G1)

For managers within the stock exchange, the primary impetus behind disclosure policy formulation is to promote increased environmental information disclosure among Chinese listed companies. The overarching goal is to function as an incentive mechanism, encompassing the issuance of disclosure guidelines and guiding listed companies on how to disclose environmental information. Currently, Chinese listed companies are in the nascent stages of environmental information disclosure. Consequently, sustained policy support will be imperative to assist companies in improving and standardising their disclosure of environmental information.

There is an important distinction between policies instituted by the stock exchanges and those made by the government. Government regulations are characterised by their mandatory compliance, predominantly concentrating on managerial and operational prerequisites, and do not impose specific disclosure mandates on listed companies in relation to environmental aspects, including water resources. On the other hand, stock exchanges provide guidelines that assist and guide companies interested in voluntarily disclosure of environmental-related information. In other words, stock exchanges do not enforce policies mandating companies to make disclosures. Instead, they offer suggestions and measures that encourage companies to voluntarily disclose their corporate impact on the environment.

From the analysis of shareholders' influence on water disclosure, an intriguing observation emerged, indicating that these stakeholders do not exert significant influence over the company's water information disclosure. They mentioned that the director of the company is

responsible for disclosure matters. Shareholders were predominantly concerned with disclosure of financial-related information, with voluntary water information disclosure not being their primary focus. They believed that as long as the company complies with regulatory requirements for its operations, shareholders are unlikely to become actively involved in influencing water information disclosure.

> According to company law and other relevant regulations, a shareholder is the owner of the company's asset. From this perspective, a shareholder can only choose the director to present the shareholder on the board. For information disclosures, it is the administrative department's job. Shareholders and directors are different. For disclosure, the director has more influential power than a shareholder unless we find the director is violating the law or regulations; otherwise, we will not intervene in their job. (SH1)

Managers from labour unions highlighted the importance of water quality information, particularly in relation to employee drinking water safety. In many industrial areas, companies have established dedicated water stations where water is filtered and treated for reuse. Transparency about post-treatment water quality is viewed as essential, as it reflects a company's commitment to employee well-being and environmental responsibility. Also, union managers mentioned that companies often offer training sessions and educational lectures, usually delivered by internal engineers or external academics focused on water conservation and wastewater regulations. More specifically, a structured, three-tiered training programme is commonly implemented, including distribution of environmental handbooks, mandatory induction training with assessments, and periodic departmental or company-wide sessions. Additionally, employee feedback on water-related concerns is encouraged through various communication channels, including anonymous mailboxes and online platforms, with dedicated departments responsible for responding and resolving issues. These practices underscore a proactive approach to employee engagement within companies.

> I think water quality is very important, not only from the production point of view, but the staff's drinking water quality is also very important, I think it is necessary to do regular water quality inspection, take care of the staff's water safety. (E1)

> We invite internal engineers from the company to give lectures to employees, and also invite external teachers to conduct lectures. In addition to that, we also carry out various projects and conduct an annual summary every year to evaluate the benefits of our project implementation. (E2)

> First of all, we will issue an environmental management system manual to each employee, and then our company also has classrooms, and we will hire some teachers or professionals to give lectures to our employees. (E5)

> Firstly, we provide skill training to new employees before they start working. There will be an assessment, and only those who pass the assessment will receive a work permit to begin their duties. This is the first step for new employees, and they cannot independently perform tasks without the work permit. In terms of salary and benefits, there are differences between employees with and without work permits, which serves as an incentive for them to pass the assessment quickly and become proficient in their roles. (E8)

> Employees can provide feedback through their supervising managers or directly to our labour union. Once we have collected this information, we will address it specifically and respond to employees' concerns and inquiries. (E4)

> Our company has a dedicated department responsible for communicating and interacting with employees. If employees have any questions, they can directly approach this department for inquiries. We also have an anonymous suggestion box where employees can write letters and submit them. Additionally, our company has an online communication platform where employees can engage in discussions with company leaders or department managers. In short, there are various channels available for communication. (E5)

Stakeholders from the media group noted that the media landscape in China differs from that of Western countries. The majority of media organisations operate under the supervision of the Communist Party, imposing certain constraints on the dissemination of news and information to the public. This strict regulatory environment necessitates a rigorous auditing process, ensuring that any content intended for public disclosure is verifiable, truthful, and accurate. Consequently, the key message conveyed by media participants was that media reporting in China lacks the degree of freedom of media in Western countries.

> In China, the media landscape is different from that of foreign countries. Media operate under the supervision of the Communist Party and must strictly adhere to government policies. Unlike foreign media, there is no capital control, but sensationalising news or exposing insiders for attention is prohibited. Party-run media have strict requirements for information release and disclosure, and leaders can step down if news is released improperly. Unlike foreign media, Chinese mainstream media have less freedom. (MEDIA3)

Despite the comparatively limited freedom of media in China, stakeholders within the media group maintained that they still possessed influence in the realm of corporate information disclosure. Three out of the six media stakeholders emphasised the supervisory role of the media in monitoring companies' environmental activities and performance. In cases where a company violates regulations or laws, media entities have the power to expose and bring attention to such misconduct.

> The media plays a supervisory role in monitoring companies' environmental practices. Failure to address environmental issues leading to pollution and penalties can damage a company's reputation, attracting negative news coverage. Media outlets pay attention to such news, conduct interviews, and may receive reports from victims, amplifying the negative impact on a company's brand reputation. (MEDIA1)

> As a supervisory role, the media also discloses articles about companies' illegal business activities and activities that harm the interest of small investors. (MEDIA2)

In addition, the media can exert influence through its role in propagating information. They considered themselves as communicators bridging government departments and the public, responsible for disseminating government policies to the people in a positive manner. The media stakeholders acknowledged that at each stage of social development, new polices are formulated and existing regulations are revised. Therefore, they believed that they helped the government to promote policies so that the general public has a better understanding of the concepts behind policies.

> As media professionals, we are committed to closely monitoring and cooperating with various government departments during each stage of policy implementation. We aim to effectively promote positive guidance through our coverage. Throughout this process, certain exemplary companies and industry leaders emerge at different stages. By highlighting these companies, we strive to inspire and encourage other companies to improve their information disclosure practices. As media representatives, we see ourselves as spokespersons for government departments, disseminating their policies and acting as catalysts for companies to excel in their information disclosure efforts. (MEDIA4)

> Our role as media professionals is to disseminate information. We highlight local businesses' wastewater treatment efforts and regulatory agencies' supervision. We publicise positive results and, if outcomes are lacking, we inform the public indirectly, indicating ongoing or evaluated initiatives. (MEDIA5)

Academics, meanwhile, identified water information disclosure as an important research topic that warrants greater attention across various academic disciplines, including accounting, finance, economics, and management studies.

> This topic is highly relevant in both academic and practical communities, particularly after 2010. It is widely discussed at conferences related to accounting, finance, economics, and management. Serious exploration of environmental and water-related topics is welcomed and valued in these discussions. (A3)

Academics emphasised the importance of research in establishing disclosure standards. By integrating the concept of water information disclosure into business practices, companies would be motivated to meet these standards. Although their influence may not be direct, they can indirectly affect regulatory departments because the latter often consult academics when formulating relevant laws and regulations. The expertise and insights provided by academics contributes to the development of effective regulatory frameworks and guidelines for water information disclosure.

> If you are an accounting researcher or a scholar, I think if you want to influence the enterprise, the most worthwhile direction is to be able to raise your research to accounting standards or industry standards, I think this is the most direct … By meeting standards or obtaining certification, enterprises can embed this concept into the practice of production and operation. I think this is a direction that we can try or work hard in our research (A2)

> We are more in fact not to directly affect the enterprise but will affect some regulatory departments. In fact, the regulatory department needs some support from the academic community. They will use the way of the topic, the way of the research report, or the way of collecting opinions to solicit our opinions (A4)

Furthermore, academics have the potential to contribute to companies' understanding of current policies through delivering lectures within the organisational setting. Such engagement serves a dual purpose. First, it aids companies in gaining a deeper comprehension of the prevailing policies and regulations that govern water-related matters. This enables companies to align their practices with the established standards and requirements. Secondly, academics can leverage their expertise in information disclosure to disseminate knowledge and foster a heightened awareness among company managers regarding the significance of water and environmental protection. By imparting relevant insights and promoting best practices, academics can

effectively contribute to the improvement of water information disclosure and the overall environmental performance of companies.

> We can engage directly with companies regarding value accounting. Currently, companies may generate value without considering environmental damage or costs. By using environmental management accounting tools, we can calculate the cost of environmental damage. This forces companies to re-examine their true economic and social contributions, which can significantly influence their operations and emphasis on the environment (A2)

> The main avenue for academic influence, in my opinion, lies in conducting promotional activities and delivering lectures … These events often involve the participation of companies, making them influential in the corporate sphere … Local governments periodically invite scholars from relevant fields to deliver lectures or provide interpretations of national policies and related matters … These interactions enable scholars to have a better understanding of policies, which they can then effectively convey to the business community. In essence, this influence manifests at both the local level and through nationwide promotional lectures (A5)

The NGO manager stated that her organisation's focus was on industrial pollution, and their goal is to improve the quality of people's living environment.

> Our vision is to provide everyone with a high-quality living environment … As for how we plan to achieve this over the next decade, I believe it is by staying true to our initial aspirations and consistently taking action to address industrial pollution (NGO1)

The NGO manager emphasised several approaches taken by her organisation to promote the remediation of industrial pollution. First, the organisation monitors the pollution sources of companies and discloses this information in its reports, aiming to attract the attention of supervisory authorities, the media, and the public in order to strengthen industrial pollution control: "We begin with pollution supervision to information transparency and disclosure. Just like other big data monitoring systems, we are using it as well" (NGO1).

Secondly, the organisation conducts on-site inspections using drones and infrared detection systems to verify the accuracy of information provided by companies.

> We to go to the field of the enterprise, or use some other technological and innovative means, such as drone aerial photography, or with the help of some infrared thermometers, these ways to promote the solution of a pollution problem in the enterprise. (NGO1)

Thirdly, if the organisation discovers environmental pollution by a company, it contacts the company's customers, suppliers, and general public to exert pressure and compel the company to undertake environmental rectification measures: "When we find that the company has environmental problems, we will contact its upstream customers and promote our entire supply chain" (NGO1).

Fourthly, if a company has been penalised for violating environmental protection regulations and still enjoys preferential tax benefit, the organisation will notify the relevant tax department and investigate the improper financial benefits obtained by the company.

> Green tax is when we cooperate with the tax department. For some companies that have environmental penalties exceeding 10,000 yuan, but still enjoy tax benefits, we will go to the

> joint tax department to return the tax benefits that they should not have. We have currently taken back more than 50 million Chinese yuan. (NGO1)

Lastly, the organisation maintains a positive relationship with insurance companies, and if a company causes environmental damage, they will request the insurance company to increase its insurance premium or even deny insurance applications, thereby compelling companies to disclose their information to the public.

> Green insurance is to start with environmental liability insurance, to hope that when insurance companies give insurance to companies, they should do a good job to evaluate those companies' environmental performance. If their environmental performance is poor, insurance companies can elevate the insurance cost, or perhaps reject the application, and therefore, force the company to disclose rectification information (NGO1)

Concerning NGO influence on corporate water information disclosure, the manager noted that through her organisation's investigations and engagement efforts, many listed companies and their suppliers have been compelled to proactively disclose their environmental information. Additionally, they have successfully caused infringing companies to pay fines to the Ministry of Ecology and Environment. Furthermore, the NGO's reports receive high visibility, with a wide readership reaching many individuals, including government authorities, media, shareholders and the public.

> Our organisation's impact extends beyond individual cases. For instance, our reports have influenced companies like Xiaomi to supervise their suppliers and disclose environmental pollution information. This has garnered significant media attention and led to substantial penalties and ecological damage compensation. Similar reports have also influenced Apple's governance of suppliers in China. Collaborating with the environmental protection department, our reports have effectively promoted environmental governance, rectification, and serious treatment by enterprises (NGO1)

7.10 Conclusion

In this chapter, insights have been gathered from 54 interviewees representing eight key stakeholder groups who responded to a series of semi-structured interview questions. A common theme that emerged from the discussions is the widely held belief that voluntary disclosure of water-related information plays an important role in enhancing both transparency and corporate water accountability in China. From the perspective of accountability theory, voluntary disclosure of water-related information serves as a mechanism through which companies demonstrate their willingness to discharge accountability for their environmental impacts, particularly in relation to water resources. According to several interviewees, their companies typically report water-related information to the government, though this is often driven by operational pressures rather than a proactive commitment to transparency.

The findings also reveal growing recognition of a broader range of stakeholders, including customers, media, and environmental NGOs, whose interests and expectations increasingly

shape corporate disclosure practices. This shift aligns with stakeholder theory, which posits that companies are accountable not only to shareholders or regulators but also to a diverse range of stakeholders who are affected by or can affect corporate actions. At the same time, the findings of this chapter align with prior literature suggesting a growing demand and expectation from stakeholders for environmental information, which in turn motivates companies to engage in voluntary disclosure (S. X. Zeng et al., 2011). In the absence of mandatory government requirements for water disclosure in China, stakeholder pressure has emerged as a key driver for voluntary disclosure. Companies are increasingly expected to be answerable to these stakeholders by providing information regarding their water-related activities.

Importantly, the findings also suggest a gradual shift from a government-dominated environment (traditionally characteristic of the Chinese context) towards a more stakeholder-inclusive model. For example, while the media has historically operated under strict governmental control, there is evidence that some media outlets are now engaging in more independent and investigative reporting on corporate activities and their environmental impacts. Similarly, environmental NGOs are gaining prominence and influence, with their activities and reports contributing to heightened awareness and pressure on companies to disclose their environmental performance, particularly with regard to water conservation and pollution. These developments collectively reflect an evolving landscape in which corporate water accountability is no longer solely influenced by government but is increasingly shaped by a broader set of societal expectations. This indicates a potential transition towards a multi-stakeholder accountability framework wherein various external actors play a growing role in encouraging transparent and responsible corporate water practices.

Nevertheless, challenges persist, with interviewees highlighting the necessity of expensive specialised equipment and personnel for accurate data measurement and presentation. Despite the associated costs, stakeholders recognised the value of such information for better assessing companies' water usage and management situation. The discussion often veered towards conflating operational regulations with disclosure requirements, prompting occasional redirection from the researcher back to the topic of water-related information disclosure.

Regarding internationally recognised disclosure frameworks like the GRI, concerns were raised by many participants regarding their direct applicability to Chinese companies. Variations in company size, industry, business culture, and measurement pose challenges to their adoption. Consequently, participants advocated for the gradual integration of these frameworks into Chinese companies, acknowledging the need for local disclosure guidelines and standards to align with the unique Chinese business landscape. This transition process is expected to require significant time and effort for companies to adapt effectively.

The next chapter presents a detailed analysis of the consolidated findings derived from Chapter 6 (content analysis) and Chapter 7 (interviews). Building upon these findings, a revised corporate water disclosure index is introduced, accompanied by elucidations on the modifications made. The objective of the revisions was to provide an optimally tailored index suitable for the intricacies of the Chinese business environment.

Chapter 8. Discussion

8.1 Introduction

This chapter utilises the findings of this research to develop a revised water disclosure index for the Chinese business context. Initially, the water disclosure index was developed considering the requirements of Western water reporting frameworks, disclosure guidelines, and relevant literature (see Chapter 5). Therefore, it represents the ideal disclosures that can be expected or conceptualised from a perspective of total transparency about water (use, discharge, pollution, treatment). However, expecting this level of disclosure in the Chinese corporate context is unrealistic, especially without mandating water disclosure and implementing disclosure standards to guide companies in their disclosures and reports.

The water disclosure index used to measure corporate water disclosure in Chapter 6 is one of the most comprehensive corporate water information disclosure indexes available within the international business context. Its broad scope and thorough consideration of various disclosure aspects position it as a valuable resource for companies beyond the confines of the Chinese environment, giving it both local and global relevance. A further practical contribution of this research lies in the refinement of the disclosure index to suit the Chinese business environment. Such an adaptation ensures that the index aligns optimally with the specific characteristics and nuances of the Chinese corporate landscape, enhancing its applicability and effectiveness within this context.

8.2 Water policy (A)

The water disclosure index developed in Chapter 5 has eight water-related disclosure categories labelled from A to H:

A. Water policy
B. Water consumption
C. Wastewater discharge
D. Wastewater treatment
E. Water recycling and reuse
F. Information assurance
G. Water risks
H. Other water-related disclosures

As revealed by the findings from the content analysis in Chapter 6, category A received the highest average percentage of the maximum possible score (37%) of all the disclosure categories, underscoring the pivotal role of water policy within the corporate water disclosure

index. Stakeholders interviewed in the study concurred that water policy constitutes a crucial element in corporate water information disclosure. They emphasised that a well-crafted water policy can serve as a roadmap for formulating comprehensive water information disclosure. Such policies should encompass both the short-term and long-term water-related goals and targets (i.e., water usage, wastewater discharge, wastewater treatment, water recycling or reuse, and other water-related considerations) that a company should aim to achieve. At the same time, stakeholders contended that a company's water policy can be viewed as a commitment to demonstrate corporate responsibility and accountability in water management and practice.

Water represents a significant environmental concern, and the provision of pertinent information about water policy can be instrumental for stakeholders in evaluating a company's water-related objectives. Some information providers expressed apprehension about the challenges associated with establishing a water-specific disclosure policy. First, it is important to acknowledge that companies often confront a multitude of environmental challenges (depending on the location and industry type), with water being just one among them. Therefore, when contemplating the necessity of implementing a water-specific disclosure policy, it becomes imperative to also consider the policies for addressing other environmental issues. This raises the question of whether it is necessary to establish a distinct disclosure policy for each environmental concern of the company. Based on the content analysis and interview responses, it is evident that water-related policies do exist, but they are frequently integrated with other policies, thereby forming a combined (environmental) disclosure policy for the company.

While there is nothing wrong with combining water with other disclosure policies, the analysis highlighted that water disclosure policies are currently very general and descriptive. In other words, these policies lack detailed information on specific water-related targets and/or goals that the companies aimed to accomplish. Often, they merely tell the audience that the company values water, but no further explanation is given. Moreover, given the unique water circumstances of each company, the involvement of experts possessing an in-depth understanding of a company's specific water situation becomes a critical factor in devising tailored water disclosure policies. In this area, the water disclosure index could directly contribute to filling the gap by serving as a useful tool for Chinese listed companies to develop specific water policy information disclosure. Importantly, the content analysis revealed that some companies attained the maximum score on item A1, indicating the viability of this particular item and the significance of retaining it within the index.

Other stakeholders, including managers of the employee unions, journalists and the NGO manager believed that understanding a company's water-related policies is crucial. This understanding helped them better grasp the company's voluntary stance on water issues and

enabled them to compare subsequent disclosure content to assess the company's compliance with these policies. They all agreed that water policy should be retained in the index.

Table 8.1 Adjustments to water policy

	Disclosure item	Revised
Water policy	A1. The company discloses information on its corporate water policy/statement relating to water consumption, discharge, wastewater treatment, pollution, and water recycling and reuse. The policy includes information on water-related targets and goals and water-related strategy.	No change required.

8.3 Water consumption (B)

In the water consumption category, the companies in this research received only 19% of the maximum possible score on average. This result indicates that Chinese listed companies do not currently offer a comprehensive level of disclosure within this category.

In the index, there are six disclosure items relating to water consumption. The first two items (B1 and B2) are concerned with the description of water consumption and the total volume of water consumption, respectively. The findings revealed that 43% of the companies in the sample provided information on the description of water consumption (B1), while 33% disclosed details on the total volume of water consumed during the reporting period (B2). This result is within a reasonable range considering the study includes companies from various industries, including industries like telecommunication, IT and financial services, which were not heavily dependent on water resources and not expected to achieve a high score for disclosing information regarding their water consumption. However, in the overall analysis of corporate water information disclosure, a noteworthy observation emerged. The quantitative information pertaining to water consumption, such as the volume of water consumed by companies, was frequently presented alongside, or blended with, the general description of water consumption practices. In this situation, the researcher needed to tease out and identify the quantitative information from the general information regarding water consumption.

Information providers and regulators showed a strong interest in water consumption information during the interviews. Information providers emphasised that access to water consumption information as management accounting information could facilitate the optimisation of the overall water utility, enabling them to implement changes and adjustments to improve water efficiency and reduce unnecessary water use in specific production processes. Government officials, meanwhile, emphasised the importance of understanding a company's water

consumption situation. They believed this knowledge could enhance their ability to verify reported records, providing a basis for comparison during on-site supervision. Additionally, having access to accurate water consumption information could aid in regulatory compliance and enforcement efforts, ensuring that companies adhere to water usage regulations and standards.

Information providers explained that mixing quantitative information with general descriptions regarding water issues stemmed from the voluntary nature of water-related information disclosure. Without a standardised requirement mandating such disclosures, companies varied in their approaches to reporting water consumption based on the perceived importance of this information to their stakeholders. Essentially, companies that are not heavily reliant on water resources may not allocate a dedicated section in their reports for disclosing water quantity. Instead, they may integrate this information into a broader discussion of their overall water consumption practices. An index that applies to Chinese companies in general should take this into consideration. After discussions with the interviewees, merging quantitative information (B1) with descriptions (B2) emerged as a viable option to resolve this issue, because the consistent application of the 5-point scale for measuring water consumption information inherently encompasses the measurement of quantitative information. This adjustment would ensure that any future quantitative information related to water consumption by companies would be effectively captured by B1 (see Table 8.2 for the revisions to this category). Moreover, this change could potentially encourage companies with lower water dependence to disclose their water consumption information under this item. This would ensure that these companies have relevant information to disclose, thereby avoiding a situation where a disclosure item is irrelevant to them.

Information pertaining to water consumption per unit of product or per-dollar revenue (item B3) – that is, water intensity – received relatively limited attention from information providers. The index reveals that only 21% of the companies disclosed information related to this specific aspect, with only 11% of the maximum possible score on average. Item B3 assumes significance as it not only measures the water consumption per product or revenue but also serves as an indicator of water efficiency and consumption rates. During the interviews with information providers, they agreed that information relating to B3 can offer valuable insights for stakeholders, including investors and customers, as they assess a company's water performance and incorporate it into their decision-making processes. For example, investors consider this data when making financial decisions, while customers may factor it into their product-purchasing decisions. However, they also acknowledged the challenges associated with implementing this measure. After careful consideration, it was determined that reporting on item B3 is practicable. More importantly, measuring B3 is not a difficult task. As long as a company

provides information on water consumption, it can be calculated based on the either the product unit or revenue. Therefore, it should not be excluded from the index. This is because it remains a valuable item necessary for certain stakeholders and for constructing a comprehensive water disclosure index.

Item B4 pertains to any changes in water consumption over the disclosure period. The analysis indicated that 47% of the companies reported information about changes in their water consumption. However, the disclosed information falls short and only met 25% of the index's maximum possible score on average. This outcome implies that companies' disclosures were often quite general, lacking in-depth information or explanations regarding the potential implications of these changes on the company's water consumption patterns or their environmental impact. Managers from the stock exchanges and other stakeholders, including academic researchers, journalists, and the NGO manager underscored the significance of reporting changes in water consumption. They emphasised that such disclosures send a clear signal to external stakeholders regarding the company's dedication to reducing water consumption and the efforts invested in achieving water conservation goals. Additionally, shareholders stressed the importance of providing detailed information on changes and their positive impact on the water environment rather than simply presenting results. Item B5 (total cost of water consumed or used in monetary terms) should also remain in the index, but information providers are encouraged to consider improvements in their disclosure practices for this specific item. For example, the methods undertaken to reduce water consumption, resources allocated to achieve the task, and the potential impact on the surrounding environment.

Freshwater is a vital natural resource for businesses. Insights from the content analysis and interviews reveal that Chinese companies predominantly use water from two primary sources (item B6). The most common approach involves procuring freshwater directly from municipal water supplies governed by the Water Conservancy Bureau or private local water supply companies. This method is favoured for its convenience, as companies pay the cost per megalitre of water used. The second source involves obtaining usable water from the company's recycling processes. Many large manufacturing industries possess their own water recycling systems and infrastructure. Consequently, some previously used freshwater can be recycled and repurposed for various business activities, including cooling, as well as for the daily needs of workers and facility operations. In this context, it is imperative to report the type of water source to ensure transparency for water users.

The Chinese government has imposed stringent regulations on taking water from rivers and extracting underground water (see Chapter 2 for more detail).[27] Companies seeking to use water from rivers and/or underground water resources must undergo a thorough assessment process to obtain the necessary licences. However, this stringent procedure is often impractical for most companies. As a result, withdrawing water from rivers and underground sources is not a common or feasible option for the majority of companies in China. Journalists and the NGO manager noted the possibility of collecting rainwater. However, this approach is fraught with uncertainties and instability, which is why companies typically do not regard it as a primary way of sourcing water. Instead, it is seen as a water storage method for backup purposes. Consequently, the categorisation of water withdrawal by source type should change to municipal water supply; private water supply;[28] and recycling and natural environmental sources, including rainwater, oceanwater, or underground water (if applicable).

[27] Companies in China cannot withdraw water from rivers. According to the Water Law, water resources belong to the State and the State Council, on behalf of the State, holds the ownership of these water resources, including rivers, lakes, and underground water. If a company wants to withdraw water from the river, it has to apply for a permit, and the relevant government department will process this application with a comprehensive evaluation. Also, the company will need to pay not only the water cost, but additional money for protecting the water resources. This whole process is very complicated and unusual for businesses to pursue. Also, this is more relevant to operational functions, not disclosures. However, it would be good to disclose if companies do get permission for using river water. The water disclosure index does not set any limitations on companies' disclosure of water-related information.

[28] In China, 'private water supply' refers to the provision of water services by entities other than the government. Some urban areas have private companies managing water utilities through public-private partnerships. These companies operate under government oversight and provide services such as water distribution and treatment. This is more common in large cities where municipal governments outsource water management to improve efficiency and infrastructure.

Table 8.2 Adjustments to water consumption

	Disclosure item	Revised
Water consumption	B1. Description of water consumption and the volume of water consumption (in megalitres or cubic metres).	B1. Description of water consumption including water quality and the total volume of water consumption (in megalitres or cubic metres).
	B2. Total volume of water consumption (in megalitres or cubic metres).	Merged with B1.
	B3. Water consumption per unit of product, water consumption per dollar of revenue, or another operational measure to reflect water intensity.	No change required.
	B4. Change in water consumption (in monetary terms or physical quantities).	No change required.
	B5. Total cost of water consumed or used (in monetary terms).	No change required.
	B6. Water withdrawal by source type (surface water/groundwater/seawater/third-party) and location.	B6. Water withdrawal by source type (municipal water supply/private water supply/recycling water/natural environmental sources, including rainwater, river water, lake water, oceanwater or underground water) and location.

8.4 Wastewater discharge (C)

Wastewater discharge was a subject of considerable interest among all stakeholder groups. The findings from the content analysis revealed that, on average, information disclosed about wastewater discharge scored 25% of the maximum possible score. While this result falls well below the expectations of the index, it represents the second highest-scoring category of disclosures in this study. Within the index, there are six disclosure items related to wastewater discharge.

Items C1 and C2 pertain to the description of wastewater generated from business activities and the total volume of wastewater produced during these activities. The findings demonstrate a notable disparity between C1 and C2, with C1 scoring an average of 37% of the maximum possible, considerably higher than the 5% achieved by C2. This discrepancy suggests that the information provided regarding the description of wastewater is closer to expectations compared to the information related to the volume of wastewater generated during operations. Moreover, it is noteworthy that 64% of the companies in the sample disclosed information on C1, whereas only 9% reported on C2. This result indicates that companies are more inclined to disclose descriptive information than quantitative information regarding the wastewater generated from their business activities.

Information providers and government officials interviewed in the study emphasised that industrial wastewater exhibits significant variability based on industry type and specific production processes. Not all forms of industrial wastewater can be directly discharged into municipal sewage pipelines or bodies of water. In certain cases, treatment is required prior to release (the topic of treatment will be discussed in the wastewater treatment section). Therefore, providing information related to how wastewater is produced during business activities is of considerable importance in demonstrating corporate water accountability to relevant stakeholders. The researcher also asked information providers about the discrepancy between C1 and C2, as indicated by the content analysis. They explained that collecting data on the quantity of wastewater generated is challenging and requires specific measurement equipment. Moreover, many information providers did not consider this information important because they rarely received requests for it from relevant stakeholders, and this item does not apply to all types of companies. Participants from other stakeholder groups and regulators emphasised that the quantity of wastewater generated within a company is less critical than that of wastewater discharged, especially discharged into the natural environment.

The disclosure items related to wastewater discharges within the index are items C3–C6. C3 and C4 represent the description of wastewater discharged (qualitative information) and the total volume of wastewater discharged (quantitative information), respectively. The results obtained from the content analysis reveal that C3 achieved the highest average score in this category at 47% of the maximum possible. Furthermore, 75% of the companies in the sample reported information regarding this aspect in their disclosures, making it the most frequently reported item. In contrast, C4 received significantly less attention, with fewer than half (45%) of the companies providing information on this specific item.

Based on the content analysis findings, the researcher inquired of the information providers about the disparity between descriptive disclosures of wastewater discharge and specific

quantities. Their responses highlighted that wastewater discharge is a sensitive topic, and disclosure of specific discharge amounts could impact certain stakeholders, such as investors and customers. Also, given the presence of the Pollution Discharge Permit system, companies e already report specific discharge amounts to the relevant government departments. Thus, they felt there was no additional need to disclose this information to the public. However, regulators and participants from other stakeholder groups expressed differing viewpoints. Regulators prioritised this information as it aids in assessing companies' compliance with the operational requirements of wastewater discharge regulations. Journalists and the NGO manager utilised this information to scrutinise whether companies are causing negative impacts on the water environment. If such impacts are identified, they report these situations to notify the public.

Other stakeholders did not show a strong inclination to separate quantitative information from the descriptions of wastewater discharge. Given that C4 not only specifies the volume of wastewater discharge but also includes the associated costs, such as wastewater discharge fees and investments in improving wastewater discharge methods, companies can effectively describe their wastewater discharge while using quantitative data to complement the content in their disclosures. In this situation, merging C4 with C3 could potentially enhance the index. This proposed adjustment holds potential benefits in two significant ways. First, when examining the public disclosure of corporate wastewater discharges, the description often incorporates quantitative information. In other words, companies that received the maximum score (4) for the description of wastewater discharge not only elucidated their wastewater discharge approach but also included quantitative data, such as the volume of discharged wastewater and the costs associated with this process. Consequently, consolidating C3 and C4 would streamline the index and enhance its user-friendliness for those utilising it to assess the information disclosed on wastewater discharge in a Chinese business context.

It is worth noting that wastewater generated by a company will either be discharged (or treated prior to discharge if highly polluted) or reused for other business-related purposes. Given the limited information available on the quantities of wastewater generated (C2), the quantities of wastewater discharged (C4), and the opinions from interviewees, it is worth considering combining C1–C4 and categorising them into one single item in the revised index.

Item C5 concerns wastewater discharged based on its destination (river/land/sea/independent sewage treatment) and location. Nearly half of the companies in the sample (49%) provided information about this specific aspect. Notably, a significant portion of wastewater was discharged into municipal sewage treatment facilities for centralised treatment through municipal sewage pipelines. Information providers emphasised that this method simplifies wastewater discharge, as companies are primarily responsible for the associated costs without

the burden of treatment. Instead, municipal wastewater treatment plants manage the treatment process. It is worth noting that, in very rare cases, some companies undertook wastewater treatment before releasing it into natural water bodies. However, such a practice is subject to stringent requirements (those requirements refer to business operations and do not relate to information disclosure), rendering it unsuitable for most businesses. Regulators also expressed a similar opinion on this matter. They thought centralisation is more effective in preventing sewage leakage and consequent pollution of the water environment. Also, centralised wastewater discharge aids relevant departments in monitoring a company's wastewater discharge volume and inspecting the contaminants in wastewater. Consequently, regulators strongly advocated for retaining C5 in the index.

Currently, the index development considers rivers, land, and oceans as locations for wastewater discharge in Western contexts. Responses from different stakeholders indicated that discharging wastewater to these locations is restricted in China. Therefore, it is necessary to make some changes to C5 to ensure it is more applicable to companies in China by describing the destination more specifically. Stakeholders believed that "municipal sewage treatment facilities, independent sewage plants, or natural water bodies" could be a more appropriate categorisation, potentially rendering this item more suitable for the Chinese business context (see Table 8.3 for the adjustments made). Also, this refinement would offer a more precise indication and rationale for the provision of information concerning the location of wastewater discharged (item C5). For example, information providers could disclose the name of their local wastewater treatment plant or relevant facilities. This practice would significantly facilitate tracking pertinent information and give the public and stakeholders an account of where the companies discharge their wastewater.

Lastly, the change in wastewater discharged (item C6) is a crucial component within the wastewater discharge category. Information providers and regulators mentioned that it allows companies to report significant information regarding any changes (reduction or increase) during the reporting period. Shareholders also acknowledged the importance of information regarding changes in wastewater discharge. They expressed that they lead busy lives and find it challenging to monitor operational activities such as wastewater discharge constantly. They also emphasised that monitoring wastewater discharge is not their responsibility. However, as decision-makers, they found such information valuable in certain circumstances, such as companies investing in improving their wastewater discharge. Therefore, they expected to see comparative information to understand what has changed over time, as this enables them to quickly grasp the situation. Also, information regarding C6 was valuable for other stakeholders, such as the NGO manager and the media representatives, as it allowed them to monitor the efforts made by companies, not only in terms of changes in wastewater discharge volume but

also in assessing the environmental consequences resulting from those changes. Consequently, item C6 should be retained in the index without any modification.

Furthermore, various stakeholders interviewed, including information providers, shareholders, government officials, labour union employees, journalists, and the NGO manager, have all expressed concerns regarding companies' wastewater discharge. They recognised that wastewater can include a range of pollutants, contingent upon its source and business processes. Inappropriately discharging these pollutants significantly threatens water quality, potentially causing substantial harm and degradation to aquatic environments. Consequently, stakeholders asserted that companies should give high priority to wastewater discharges, both in terms of information disclosure and operational considerations. The heightened level of attention from stakeholders on this issue included a suggestion to introduce further clarification. For example, specifying potential contaminants associated with wastewater could be advantageous for index users, providing them with additional guidance for effective implementation in actual disclosure practices. This refinement would enhance the utility of the index, aligning it more closely with stakeholder concerns and expectations. Also, the contaminants contained in wastewater are measurable. Hence, a 5-point scale can be used to capture any quantitative information that is disclosed in corporate reports.

Table 8.3 Adjustments to wastewater discharge

	Disclosure item	Revised
Wastewater discharge	C1. Description of wastewater generated from business activities (i.e., how wastewater is produced during business activities) and the volume of wastewater produced during business activities (in megalitres or cubic metres).	C1. Description of wastewater generated and discharged (i.e., how wastewater is produced and discharged) and the total volume of wastewater generated and discharged (in megalitres or cubic metres).
	C2. Total volume of wastewater produced during business activities (in megalitres or cubic metres).	Merged with C1.
	C3. Description of wastewater discharged and the volume of wastewater discharged (in megalitres or cubic metres).	Merged with C1.
	C4. Total volume of wastewater discharged (in megalitres or cubic metres).	Merged with C1.
	C5. Wastewater discharged by destination (river/land/sea/independent sewage treatment) and location.	C2. Wastewater discharged by destination (i.e., municipal sewage treatment facilities/independent sewage treatment/self-treatment facilities/natural water body) and location.
	C6. Change in the cost of wastewater discharged (in monetary terms) or in physical quantities of wastewater discharged.	No change required.
Additional item on wastewater discharge receiving heightened attention from stakeholders		
	C4. Description of contaminants contained in wastewater (i.e., BOD, COD, physical pollutants, nitrogen and phosphorus compounds).	This new item will be measured in the same way as C1 and C3, using a 5-point scale (0–4).

8.5 Wastewater treatment (D)

The analysis revealed that 71% of the Chinese listed companies in the sample provided information on the description of wastewater treatment (D1). However, the overall average for this item was only 39% of the index's maximum possible score.

Insights obtained from interviews with the media representatives and the NGO manager underscore their interest in wastewater treatment methods and processes. They perceived wastewater treatment as a pivotal measure in preventing water pollution. Information elucidating wastewater treatment was viewed as a crucial signal to the public, signifying a company's commitment to water environmental protection and accountability for societal health concerns by eliminating harmful elements from used water before discharging it. They criticised the prevailing corporate water disclosure of wastewater treatment as overly general, with many companies merely touching on the topic without delving into impacts on society and the environment. Therefore, they expected companies to offer more comprehensive details regarding wastewater treatment, including the treatment method and detailed information on the treatment processes.

Shareholders and academics highlighted that not all companies produce wastewater. While daily wastewater can be directly discharged through municipal wastewater pipelines, companies generating industrial wastewater containing contaminants unsuitable for direct discharge must pre-treat it. Therefore, disclosing information about how a company treats its wastewater can be significant for ensuring corporate water accountability. Consequently, various stakeholders suggested that companies providing detailed explanations of their wastewater treatment methods would better communicate and disseminate pertinent information to the broader society, facilitating a clearer understanding of the specific wastewater treatment practices adopted by the company. Therefore, D1 should be retained in the index.

Item D2 represents the total quantity of wastewater treatment, with the caveat that not all types of businesses necessarily require wastewater treatment plants or infrastructure For example, IT and financial companies tended to disclose less information regarding D2, primarily due to their low water dependency nature and the fact that they do not treat wastewater as they generally do not have production processes creating wastewater. Nevertheless, for companies that do possess such facilities, information related to D2 signifies their capacity to treat their own wastewater. As discussed above, this area was a shared concern of shareholders, academics, and other stakeholders. However, the content analysis results reveal that D2 received less attention than D1, with only 27% of companies disclosing information about the total wastewater treatment volume. This suggests that information providers prefer descriptive information over quantitative data.

During the interviews, journalists and the NGO manager expressed concern regarding companies' disclosure of wastewater treatment details. They argued that if a company discloses such information, quantitative data should be available to support their claims. However,

companies scored very low on item D2 on average, which led to scepticism regarding the accuracy of the information disclosed. Academics also highlighted the importance of quantitative information for their studies. The researcher inquired about this issue with information providers. They explained that not all companies have wastewater treatment facilities to treat used water, and those who disclose such information would instead include it in D1, accompanied by qualitative information. However, they did not provide sufficient explanation as to why some companies provided general information on wastewater treatment without quantitative data in support.

In the light of this, integrating D2 into D1 is viable option. The 5-point scoring scale (detailed in Chapter 5) for D1 has the capacity to incorporate both qualitative information and quantitative information disclosed by companies regarding the volume of wastewater treated into the measure (see Table 8.4 for changes to this category).

The content analysis revealed that only one of the 190 companies in the sample made a disclosure regarding the proportion of its wastewater that had undergone treatment (D3). It is crucial to highlight that the calculation for determining the proportion of wastewater treatment involves presenting the figure as a percentage. This percentage is derived by dividing the total volume of treated wastewater by the total volume of wastewater generated from business activities (formula: D3 = D2/C2). Consequently, companies must possess data on both items (C2 and D2) to calculate and report on D3. Notably, the index's results indicate a low score for both C2 and D2. This deficiency directly influenced the outcome for D3.

The researcher raised this concern and deliberated on it with various stakeholders during the interviews. Some stakeholders argued that this item is unnecessary, as it does not provide meaningful insights into a company's wastewater treatment. Others believed that this item is unsuitable for the current stage of corporate water disclosure in China, given that many companies have only recently begun practising environmental information disclosure. Based on these findings, it is reasonable to conclude that D3 is not applicable to companies in China, at least for now. Information providers did not disclose information on this item, and stakeholders did not express a need for it. Therefore, excluding D3 from the index enhances its suitability for adoption by current Chinese companies and simplifies the process for future indexes.

The content analysis results indicate that only 3% of companies disclosed information regarding changes in wastewater treatment (D4). Upon inquiring about this result, information providers explained to the researcher that not all companies have wastewater treatment facilities. They also mentioned that wastewater treatment practices are relatively consistent because setting up treatment facilities is costly, involving the purchase of equipment or even the construction of

treatment plants. As a result, there are typically few changes to disclose, and most information is included in the description of wastewater treatment. Additionally, shareholders and other stakeholders showed limited interest in D4, unlike other items in this category, such as D1 and D2. Considering this context, removing D4 from the index could be a viable change to enhance its applicability to fit in the Chinese business context. Moreover, if a company made changes regarding their wastewater treatment, they could disclose such information in D1.

Twenty-six per cent of companies disclosed information on the total cost invested in wastewater treatment (D5), with the majority operating in the energy and material industries. This finding aligns with the stakeholder sentiment that heavy industrial companies need to pre-treat their wastewater before discharge.

From the interviews, information providers expressed satisfaction in the disclosure of such information, as it demonstrates their commitment to wastewater treatment. They believed that public disclosure of these costs enhances their water accountability and helps build a positive public image, portraying them as environmentally responsible companies. This, in turn, makes it easier for them to attract investors and customers. Shareholders also believed that if a company invests significantly in treating wastewater, it should be publicly known, as it reflects the company's environmental responsibility and accountability. Participants from the media and the NGO manager believed that disclosing such information signals to the public that companies are aware of their impact on the water environment. It demonstrates that these companies have taken measures to prevent potential pollution from their wastewater. Additionally, they considered this information important for better understanding companies' attitudes towards wastewater treatment. This information also helps the media and NGOs prepare reports for the general public. Therefore, D5 is a valuable item that provides information needed by a variety of stakeholders, and it should be retained in the index.

Table 8.4 Adjustments to wastewater treatment

	Disclosure item	Revised
Wastewater treatment	D1. Description of wastewater treatment (i.e., describe the process of wastewater treatment) and the volume of wastewater treatment (in megalitres or cubic metres).	D1. Description of wastewater treatment (i.e., describe the process of wastewater treatment) and the total volume of wastewater treatment (in megalitres or cubic metres) and any changes in wastewater treatment (in physical quantities).
	D2. Total volume of wastewater treatment (in megalitres or cubic metres).	Merged with D1.
	D3. The proportion of wastewater that has been treated (percentage of total wastewater).	Removed from the index.
	D4. Change in wastewater treatment (in monetary terms or physical quantities).	Removed from the index.
	D5. Total cost invested in wastewater treatment (in monetary terms).	No change required.

8.6 Water reuse (E)

The practice of water reuse has garnered much attention in the realm of corporate water disclosure. Notably, over half (51%) of the Chinese listed companies in this research disclosed their water reuse practices (E1). Insights from interview participants underscore the importance of water reuse as a pivotal strategy for water conservation. Information providers believed disclosing information about a company's water reuse activities, including the technologies employed, methods, and detailed processes, is necessary to fulfil water accountability. Also, such disclosures demonstrate a company's commitment to valuing water resources and reducing water consumption through reuse.

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Consequently, item E1 serves as an effective metric for assessing the extent and comprehensiveness of information disclosed in this critical area. In addition, stakeholders from the academic and media groups mentioned that reporting on water reuse signifies the growing recognition of water recycling and reuse as a sustainable practice and an essential component of corporate responsibility. Moreover, the disclosure of information on E1 is especially crucial for

academics in their research. It aids in enhancing their understanding of current water reuse methods and technologies used in businesses. This information enables them to gather sufficient data to advance their research aimed at improving existing technologies for reusing water resources. Regulators also expressed strong interest in this information. They highlighted that water reuse is a beneficial practice for both companies and environment, but achieving it is challenging, requiring companies to invest money in purchasing relevant equipment or facilities, and recruiting expertise to ensure effective water reuse. Therefore, having access to this information enables the government to better support companies by establishing policies, facilitating the recruitment of experts, and even providing financial assistance during the policymaking process.

In addition, managers from the labour unions considered information of water reuse as important for them. In large factory areas, water points are provided for workers, and much of the water used at these points comes from recycled water. In essence, the quality of this recycled drinking water directly impacts the health of the workers. Therefore, a comprehensive understanding of the company's reused water processes and the quality of the reused water was crucial and necessary for union managers. Consequently, the stakeholders' responses indicate that E1 is important as it provides meaningful information to them and therefore should be retained in the index.

Item E2 focuses on capturing the quantitative information pertaining to the volume of water reused. The content analysis indicated that only 18% of companies reported information for this item. Information providers noted that having a separate item to report the total quantity of water reuse was not necessary. If they chose to disclose this information, they would do so under item E1. Additionally, some responses suggested that the reason over half of the companies made disclosures on E1 but only 18% reported on E2 is because they did not consider E2 to be of higher value than E1. Overall, stakeholders were interested in the method or approach used in water reuse and the water quality after recycling, but not as concerned about the total volume of water recycled.

Additionally, academics and the NGO manager acknowledged the importance of quantitative information. However, they agreed that if companies could provide such information while describing their water reuse practices, that would be acceptable to them. Considering the stakeholders' answers, it would be appropriate to integrate E2 into E1. This adjustment would enable E1 to encompass any quantitative water reuse data comprehensively. Such a modification in the index structure would facilitate a more effective and streamlined assessment of water-related information on reuse practices and ensure that valuable quantitative insights are not overlooked when disclosing qualitative information relating to water reuse.

The index scores shed light on the limited attention given by Chinese companies to the disclosure of certain aspects of water reuse. Specifically, the index results revealed that only 8% of the companies reported information on the total volume of water reused as a percentage of their total water consumption (E3). E3 is not a difficult item to report, companies which have available information on water consumption and reuse can easily access information about this item. However, it is crucial to note that since not many companies have disclosed information on the total volume of water recycled or reused (E2), it would be unlikely to see high disclosure scores for E3. Furthermore, during the interviews, employee union managers and journalists expressed minimal interest in E3. They perceived this item as having lower priority since it related to information not highly meaningful to them. In contrast, regulators, shareholders, academics and other stakeholders found this is item interesting because it indicates the percentage of water reused from total water consumption. This item communicates a company's water conservation efforts to the public, as water reuse directly reduces the amount of freshwater being withdrawal and consumed by the company. Despite some stakeholders recommending the removal of E3 due to perceived low interest, it remains important for companies to disclose this information. Moreover, this item holds substantial value for those who utilise such information. Therefore, E3 was retained in the index.

Information concerning changes in water recycling and reuse (E4) and the associated costs invested in water recycling are integral components in shaping the disclosure category of water recycling and reuse. While this item may not have performed well in the index, stakeholders argued for the continued importance of disclosing such information. Shareholders highlighted that investments in water recycling equipment and the substantial maintenance costs associated with these investments should not be overlooked. Information providers are responsible for acknowledging and disclosing this information, and it could be critical in the assessment and decision-making processes of shareholders and investors.

In light of these considerations, the removal of E4 and E5 from the index is unwarranted. These items remain relevant in ensuring that stakeholders, including employees, shareholders and other relevant stakeholders receive the essential information required for making informed decisions and evaluations. Furthermore, the index results highlight the ongoing necessity for enhancements in disclosure practices. As corporate responsibility and sustainability continue to gain prominence, the transparency and comprehensiveness of water recycling and reuse disclosures become imperative. Monitoring changes in water recycling and reuse reinforces the index's effectiveness in meeting stakeholders' diverse needs within the corporate water disclosure practice.

Table 8.5 Adjustments to water recycling and reuse

	Disclosure item	Revised
Water recycling and reuse	E1. Description of water recycling or reuse and volumes of water recycled or reused (in megalitres or cubic metres).	E1. Description of water reused (i.e., method and total volume of water reused).
	E2. Total volume of water recycled or reused (in megalitres or cubic metres).	Merged with E1.
	E3. Total volume of water reused as a percentage of the total water consumption.	No change required.
	E4. Change in the cost of water reused (in monetary terms) and in the physical quantities of water reused, or in a percentage increase/decrease.	No change required.
	E5. Total cost invested in water reuse activities (in monetary terms).	No change required.

8.7 Information assurance (F)

In the current Chinese business context, water-related information disclosure operates within a voluntary regime. Numerous stakeholders have expressed concerns about the reliability and credibility of relevant information within such a regime. In this context, information assurance emerges as a crucial element, playing a significant role in ensuring the reliability of the disclosed information. Information assurance mechanisms serve to instil confidence in stakeholders by verifying the accuracy and validity of the disclosed water-related information. As voluntary disclosure inherently poses challenges to credibility, information assurance mechanisms become paramount, offering a means to enhance the trustworthiness and accountability of companies engaged in water-related information disclosure practices.

While information assurance plays a crucial role in ensuring the reliability of companies' water-related information, the index scores reveal that this practice is not widespread among Chinese companies. Less than half of the companies (42%) disclosed information about the assurance provider in their assurance report, and only a small proportion of these companies included external assurance in their reports (7%). Most companies used internal assurance (35%), typically conducted by the board of directors. These results underscore a notable gap in adopting information assurance practices, raising questions about water-related disclosures' overall reliability and credibility in the Chinese business landscape.

This concern was further discussed with information providers and the other stakeholders. Information providers noted that the key factors influencing the decision between internal and external assurance are primarily the associated costs and the level of trust stakeholders place in the assurance process. External assurance, while typically more expensive, is often perceived as more credible and trustworthy by stakeholders. This increased trust stems from the independent nature of external auditors, who are viewed as unbiased and objective compared to internal auditors. Some information providers indicated that their company invested additional financial and human resources in preparing voluntary sustainability/CSR disclosures, but they believed this investment did not necessarily yield appreciable returns. Therefore, they felt that spending extra money for an external audit in these areas was unnecessary. Other information providers mentioned that conducting business with foreign customers typically demands a higher standard of information disclosure. Many foreign customers required them to provide an external assurance report on their sustainability reporting to maintain the business relationship. Shareholders did not express strong feelings about internal or external assurance. Regarding internal assurance, they stated that they had confidence in their directors to ensure that disclosed information is accurate and reliable. Concerning external assurance, they believed that it was primarily for foreign investors and customers who often require companies to provide assurance for reports and disclosures relating to environmental dimensions. Shareholders all agreed that publicly disclosing assured information is necessary, whether it is internally or externally assured, as it demonstrates a company's accountability to the public and relevant stakeholders.

In contrast, other stakeholders, such as journalists, academics, and the NGO manager, all emphasised the significance of information assurance. They mentioned that any information disclosed by listed companies must be assured to ensure its truthfulness, reliability, and accuracy. Failing to achieve this would be highly irresponsible behaviour, ultimately leading to erroneous judgements by information users. They asserted that external assurance provides a more robust and valid process, which is currently lacking in internal assurance. Therefore, they expected companies to use external providers to provide assurance on disclosed water information.

The content analysis results indicate that all company reports with external assurance included water-related information within the scope of assurance. However, the reports with internal assurance did not explicitly state whether the disclosed water-related information was within the scope of assurance. During the interviews, information providers explained that internal assurance is conducted by the board of directors, and it covers all information disclosed in the reports. Therefore, any water-related information disclosed in a report that is assured by the board of directors is considered within the scope of assurance. They believed there was no need to explicitly state this in the report.

Other stakeholders, including journalists, employees, and the NGO manager, did not focus on the scope of assurance. However, they felt that it was necessary to state whether water-related information disclosure is within the assurance scope. They believed that if companies include this information in their reports in the future, it would significantly improve current water information disclosure practices. Additionally, shareholders and managers from the stock exchanges also agreed that if water-related information undergoes assurance, information providers should state this in their assurance reports.

Journalists, the NGO manager, and labour union managers emphasised the importance of information regarding assurance opinion (F3) and standards (F4). They highlighted that assurance adds reliability to voluntarily prepared disclosed information. The assurance opinion and standards provided in the assurance report helped them understand whether there were issues with the disclosed information and the process/methods used during assurance. Academics and shareholders also stressed the significance of providing assurance opinions and standards in assurance reports. They mentioned that, despite the majority of companies conducting internal assurance on their disclosed information, it is still important to disclose the opinion and the process used to assure the information in order to ensure the appropriateness of information assurance. Consequently, all four items relating to information assurance are essential and should stay in the index (see Table 8.6).

Table 8.6 Adjustments to information assurance

	Disclosure item	Revised
Information assurance	F1. Assurance provider.	No change required
	F2. Assurance scope.	No change required
	F3. Assurance opinion.	No change required
	F4. Assurance standards.	No change required

8.8 Water risks (G)

It was widely acknowledged by all stakeholders who participated in the interviews that water is a precious natural resource that is critical in the operation of most companies. China encompasses an extensive landmass, and the allocation of water resources is notably imbalanced. Generally, water resources in the northern regions are relatively scarce in comparison to the southern regions (all stakeholders identified this). Consequently, the geographical location of companies and the specific industry to which they belong can lead to distinct water-related risks.

The water risk disclosure category offers companies an avenue to thoroughly and effectively report any water-related risks encountered during their operations. The content analysis findings revealed that companies reporting on water risks primarily concentrated on water availability (G1), with 22% of companies incorporating relevant information in their public reports or disclosures. In contrast, the other dimensions of water risks (G2–G5) received notably less attention from information providers. Notably, there was no instance of a company reporting on reputational risks (G3). Shareholders believed that if companies are operating in compliance with regulatory requirements, there should be no risk for them. Reputational risk only exists for those who do not comply with government regulations or engage in illegal actions, which was absolutely unacceptable in their view.

The information providers and regulators interviewed concurred that water represents a vital natural resource in the operations of many companies. Given that many companies rely on municipal water supplies, there was a prevailing belief that such water supplies should be capable of providing a sufficient and stable freshwater source for continuous company operations. Consequently, relatively minimal concern was expressed regarding physical water risks (G1 and G2). This trust in local authorities' decision-making related to water provision extended to the belief that as long as companies covered their water usage costs, regulatory risks concerning water use (G4) would not be a significant issue.

Furthermore, most stakeholders perceived that municipal water supply systems must be developed following comprehensive assessments. Hence, if the government decides to support companies with freshwater, it was assumed that it would take regional water risks into consideration before implementing such actions (G5). This underscores stakeholders' confidence in the government's commitment to responsible water resource management.

An interesting finding derived from the interviews is that some information providers and journalists recognised that certain small to medium-sized companies may be exposed to reputational risks (G3) due to the absence of a wastewater treatment system. Consequently, it can be challenging for these companies to prevent contamination of local water sources. Several factors contribute to this situation, primarily linked to inadequate investment in establishing a comprehensive wastewater treatment system or infrastructure. Some smaller companies seek to minimise costs associated with wastewater treatment and opt to discharge untreated wastewater into local rivers or underground sources. This cost-saving approach places them at significant reputational risk, as they contribute to water environment pollution. In contrast, large listed companies rarely encounter such issues, as they have extensive and well-funded wastewater treatment systems in place. Consequently, these stakeholders did not perceive these companies to be facing substantial reputational risks in this regard. These companies' size and financial

capacity allow them to prioritise comprehensive wastewater treatment, mitigating the potential for reputational harm due to water pollution.

The reason for the low index scores on water-related risks has been elucidated by the above discussion. While it may appear that large Chinese listed companies do not face substantial water-related risks during their business operations, it is crucial not to overlook the small to medium-sized companies. This study examined the 190 largest companies listed on the two Chinese stock exchanges, and thus the index results do not fully represent the complete landscape of water-related risks experienced by Chinese companies. Therefore, it would be more appropriate to refine the water-related risks category by consolidating all relevant items into a new item:

> G1 – description of water-related risks (including physical water risks in quantity and quality, reputational risks, regulatory risks, and regional risks).

This modification will render the index more concise, and the new item will effectively encompass all information pertaining to water-related risks. At the same time, the information in the parentheses can serve as guidance for index users in reporting information on different types of water risks. In addition, considering the diverse types of water-related risks that companies may face, it is important to recognise that not all companies encounter the same issues. Using the initial scoring system would not provide a meaningful basis for comparison of best practices. Therefore, a revised 4-point scoring system will be employed to assess corporate disclosures concerning water-related risks (see Table 8.7).

Table 8.7 Adjustments to water risks

	Disclosure item	Revised	New scoring approach for water risks
Water risks	G1. Physical water risks – in quantity.	G1. Description of water-related risks (i.e., physical water risks in quantity and quality, reputational, regulatory and regional risks).	A 4-point scale (0–3) will be used to measure the comprehensiveness of the disclosure items: 0 = no information disclosed. 1 = an information item disclosed with minimum coverage and discussion about the issue. Information is disclosed only in general terms (i.e., narrative only). 2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but no explanation puts the issue in perspective. 3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets)
	G2. Physical water risks – in quality.	Merged with G1.	
	G3. Reputational risks.	Merged with G1.	
	G4. Regulatory risks.	Merged with G1.	
	G5. Regional water risks.	Merged with G1.	

8.9 Other water disclosures (H)

In the process of reviewing corporate water disclosures, several recurring water-related concerns emerged in companies' reports. These concerns do not neatly align with the established disclosure categories outlined in the index. Consequently, these issues have been included within a distinct disclosure index category named 'Other Water Disclosures'. The items within this category represent unique findings derived from the Chinese business context, constituting a significant contribution to future studies seeking to explore this area.

The initial item within this category pertains to water footprint (H1). In a business context, water footprint measures the total volume of water consumed directly and indirectly by a company, its products, and/or services. The content analysis revealed that the majority of the companies reporting on water footprint were primarily concentrated within the energy, material, and industrial sectors. These sectors are considered highly water-sensitive industries, as water plays an indispensable role in their operational processes (this was acknowledged by various stakeholders, including the managers, regulators, journalists, academics, and NGO manager). Consequently, the disclosure of information concerning water footprint was more common among those companies' reports and disclosures.

The presence of water footprint disclosure in the Chinese business context indicates this item's applicability. However, H1 overlaps with other water consumption items, and this view is supported by stakeholders, such as journalists and the NGO manager. They believed comprehensive disclosures on water consumption should cover information on water footprint. Although some companies report on this item, information providers explained that it was only foreign customers and investors who required such information, thus suggesting that retaining it in the index is unnecessary. At the same time, the academics suggested further research in this area to encourage companies across different sectors to realise the importance of water footprints and their potential impact on the environment. This, in turn, could promote responsible water management practices.

The second item concerns information on supply chain issues pertaining to water (H2). The examination of corporate water disclosures revealed a trend among energy companies to provide information about the water-related aspects of their subsidiaries and suppliers. However, the disclosed information remains notably general, with only limited content addressing the water-related issues within their supply chains.

The NGO manager argued that large listed companies should set a positive example by adhering to social and environmental responsibilities and imposing similar standards on their distributors and suppliers. This approach would ensure a cascading effect, promoting sustainable practices throughout the company's entire supply chain and business ecosystem. Shareholders and information providers, meanwhile, emphasised the difficulty of controlling the supply chain. They noted that a listed company has a diverse range of distributors and suppliers throughout its supply chain, making it challenging to request water-related information from every part of it, at least for now. They believed this situation may improve in the future as environmental responsibility and information transparency become more prominent. Consequently, they considered this item not applicable to current business practices in China.

Academics highlighted the potential for future enhancement of transparency regarding water-related issues within the supply chain. Regulators, meanwhile, noted that since water information disclosure is voluntary in China, how companies prepare their information disclosure is up to them. It is challenging for companies to compel others to disclose such information, but they can encourage and promote distributors and suppliers to voluntarily disclose water information. Therefore, they suggested that H2 should not be included in the index for now. However, if companies choose to disclose such information, it can be considered a positive contribution to improving the current corporate water disclosure practices.

This study focuses specifically on current practices of water disclosure and water accountability within the Chinese business context. While water supply chain issues are acknowledged as important, they fall outside the scope of this research. Nonetheless, these areas present valuable opportunities for future investigation.

Water is a complex issue with both social and environmental dimensions. Listed companies not only disclosed water-related information within the confines of their operations but also extended their disclosure to other dimensions. This included information on stakeholder engagement regarding water issues (H3) and details on water in community projects and environmental initiatives (H4).

Stakeholder engagement primarily takes the form of installing relevant water facilities to provide employees with a safer and more convenient water supply or upgrading existing facilities. During the interviews, employee union managers especially highlighted the importance of ensuring employees' water use safety. They emphasised that transparency in water information is vital for the well-being of employees. These participants stressed the need for companies to be accountable for their employees' drinking water safety.

Moreover, listed companies actively provided extensive water-related training to their employees. This training is conducted through various channels, including regular online and offline classes led by academics from universities or industry experts. The aim is to promote awareness of water conservation and efficiency. Some companies go a step further by organising employee competitions incentivising participation, with prizes to encourage and nurture environmental awareness among their workforces. A commitment to employee training and engagement reflects a proactive stance in fostering a culture of responsible water use within the corporate environment. Besides, certain companies routinely extended invitations to their prominent customers for on-site visits, affording these clients a more immediate insight into the company's production capabilities and processes. The overarching objective of this approach is

to augment clients' comprehension and confidence in the company's practices. This proactive initiative not only grants customers firsthand exposure to the intricacies of manufacturing operations but also facilitates a more comprehensive introduction to the company's environmental responsibilities and commitments. Information providers mentioned that their companies create opportunities to showcase their wastewater treatment procedures, emissions control protocols, or other state-of-the-art facilities. They also tend to announce any new equipment they have installed and the new technologies that help them achieve better results in water management.

The content analysis revealed a notable commitment among Chinese listed companies towards advancing community projects and proactively initiating environmental endeavours (H4). The results showed that 72% of companies disclosed pertinent information concerning these activities. Notably, the predominant mechanism for fulfilling corporate water responsibility and accountability was through contributions to impoverished water resource areas, involving donations for the development, construction, or restoration of community water facilities and infrastructure.

China, with its expansive land area, grapples with formidable challenges related to the availability of freshwater resources in numerous regions. Against this backdrop, prominent listed companies have undertaken philanthropic measures by allocating financial resources to those regions. This financial support is channelled towards the establishment of relevant infrastructures and facilities, ensuring that local communities gain unimpeded access to clean and safe water resources. Furthermore, these companies arrange regular annual volunteer initiatives, mobilising their workforce to visit water-scarce areas. During these engagements, employees actively participate in the rehabilitation and rejuvenation of community water facilities, thereby contributing to the enhancement of local water utilisation practices.

This finding aligns with the expectations of various stakeholders involved in the corporate sphere. Notably, managers tasked with overseeing information disclosure emphasised that, as substantial listed companies, their responsibilities extended beyond merely satisfying the financial interests of shareholders and investors. They acknowledged a broader societal and environmental obligation, underscoring the need to proactively contribute to community welfare and champion positive environmental initiatives. In their view, this proactive stance is not only a moral imperative but also an essential aspect of their corporate duty. Consequently, they advocated for robust actions that go beyond economic returns, asserting the need for substantive engagement with societal and environmental concerns. The act of disclosing such information to the public serves as a tangible demonstration of their commitment to corporate water

responsibility and accountability.

The media representatives and the NGO manager echoed these sentiments. They posited that the size of a company correlates with the scope of responsibilities it should shoulder. This perspective emphasises a positive relationship between a company's size and the extent of its societal and environmental obligations. Furthermore, these stakeholders contended that companies stand to gain tangible benefits by disclosing favourable information to the public. Such proactive information disclosure is instrumental in cultivating a positive corporate image, potentially attracting a more extensive customer base and garnering increased investor interest. In essence, these stakeholders perceived information disclosure as a moral obligation and a strategic business practice that can yield favourable outcomes for listed companies.

Importantly, the scoring system for measuring the comprehensiveness of disclosure items H3 and H4 deviates from that applied to other items. While the maximum score for measuring other disclosure items is set at 4, denoting exceptionally comprehensive disclosure aligned with best practices (e.g., GRI or other standards/guidelines, industry benchmarks, regulatory requirements/guidelines), a different criterion was established for H3 and H4. Given the absence of benchmarks for these two items, specifically, there are no clear rules or examples defining the best way to measure donations to community projects and/or environment initiatives, as it is inappropriate to judge a company's water accountability and responsibility based on how much money they donate to the local community. Thus, the maximum attainable score for H3 and H4 is capped at 3, which is warranted when the impacts of the item are distinctly outlined in quantitative terms, complemented by comprehensive explanations and contextual information (i.e., comparative data, tracking against objectives and budgets).

Table 8.8 Adjustments to other water disclosures

	Disclosure item	Revised	New scoring approach for other water disclosures
Other water disclosures	H1. Information about the water footprint.	Removed from the index.	A 4-point scale (0–3) will be used to measure the comprehensiveness of the disclosure items: 0 = no information disclosed. 1 = an information item disclosed with minimum coverage and discussion about the issue. Information is disclosed only in general terms (i.e., narrative only). 2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but no explanation puts the issue in perspective. 3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets).
	H2. Information on supply chain issues pertaining to water.	Removed from the index.	
	H3. Information on stakeholder engagement with regard to water issues.	H1. Information on stakeholder engagement with regard to water issues.	
	H4. Water information on community projects and environmental initiatives.	H2. Water information on community projects and environmental initiatives.	

8.10 The final version of the corporate water disclosure index and its contribution

This chapter has conducted a comprehensive re-examination of the novel water disclosure index developed in this research, incorporating insights gleaned from the content analysis and the interviews. The index, initially formulated from a synthesis of literature, existing reporting frameworks, and recommendations from water information disclosure experts, was found to align significantly with the needs and expectations of stakeholders in the Chinese context. Despite this alignment, minor adjustments were deemed necessary to enhance the index's appropriateness for the unique characteristics of the Chinese business environment. These adjustments, informed by stakeholder expectations and the nuances of the local context, were deemed necessary to optimise the efficacy of the index. The final iteration of the corporate index, reflecting these refinements, is provided in Appendix H. Additionally, Tabel 8.9 presents an overview of the final index, which offers practical value by guiding companies in enhancing

their practices for water-related information disclosure. The index will also serve as an important resource for regulators, supporting the development of regulations concerning water-related information disclosure.

The adjustments made serve not only to address contextual nuances but also to benefit users of the index. As presented in Appendix H, the refined index represents the most comprehensive guide to water-related information disclosure practices for Chinese companies. This final version amalgamates theoretical foundations (including existing literature and modern reporting frameworks), empirical insights, and stakeholder expectations, positioning it as a robust tool for fostering water information transparency and corporate water accountability among Chinese listed companies.

Stakeholders interviewed for this research consistently emphasised the need for a consistent, unified, and tailored reporting framework that is well-suited to the Chinese context to facilitate water-related information disclosure practices among Chinese companies. This index directly responds to this imperative, offering valuable guidelines for companies to enhance their corporate information disclosure. More importantly, introducing a corporate water disclosure index represents a significant contribution to the current landscape of water accounting literature. This initiative effectively addresses the gaps in the current Chinese corporate water accounting and accountability literature, thereby enriching the existing body of knowledge in this domain. The establishment of such a framework not only meets the immediate requirements articulated by stakeholders but also lays a foundation for advancing transparency and accountability practices within the unique dynamics of the Chinese business environment.

Table 8.9 Final version of the water disclosure index for Chinese companies

Disclosure categories and definition	**Disclosure items**
A. Water policy Corporate water policy refers to mechanisms that allow companies to integrate decisions about water use and discharge into their core management processes and business planning. Many companies disclose water policy that support corporate water-related decision-making and enhance accountability.	A1. The company disclose information on their corporate water policy/statement relating to water consumption, discharge, wastewater treatment, pollution, and wastewater recycling and reuse. The policy includes information on water-related targets and goals and water-related strategy.
B. Water consumption Water consumption is an essential element in corporate water disclosures because it reflects a company's overall water usage during production and operation.	B1. Description of water consumption including water quality and the total volume of water consumption (in megalitres or cubic metres). B2. Water consumption per unit of product, wate consumption per dollar of revenue, or another operational measure to reflect water intensity. B3. Change in water consumption (in monetary terms or physical quantities). B4. Total cost of water consumed or used (in monetary terms). B5. Water withdrawal by source type (municipal water supply/private water supply/recycling/natural environment sources (including rainwater, river water, lake water, oceanwater or underground water)) and location.
C. Wastewater generated and discharged Discharge refers to a company's water release (output). In most cases, when water has been used, and there is no further need for it, it is treated and discharged as	C1. Description of wastewater generated and discharged (i.e., how wastewater is produced and discharged) and the total volume of wastewater generated and discharged (in megalitres or cubic metres). C2. Wastewater discharged by destination (i.e., municipal sewage treatment facilities/independent sewage

Disclosure categories and definition	Disclosure items
wastewater. If wastewater is not treated it may then cause pollution.	treatment/self-treatment facilities/natural water body) and location. C3. Change in the cost of water discharged (in monetary terms) or in physical quantities of wastewater discharged. C4. Description of contaminants contained in wastewater (i.e., COD, BOD, HOD, physical pollutants, nitrogen and phosphorus compounds).
D. Wastewater treatment Wastewater treatment is used to deal with wastewater of reduced quality. Understanding a company's treatment of wastewater reveals its approach to avoid potential damage to the environment.	D1. Description of wastewater treatment (i.e., describe the process of wastewater treatment) and the total volume of wastewater treatment (in megalitres or cubic metres) and any changes in wastewater treatment (in physical quantities). D2. Total cost invested in wastewater treatment (in monetary terms).
E. Water reuse Water reused indicate a company's reuse of water resources.	E1. Description of water reused (i.e., method and total volume of water reused). E2. Total volume of water reused as a percentage of the total water consumption. E3. Change in the cost of water reused (in monetary terms) and in the physical quantities of water reused, or in a percentage increase/decrease. E4. Total cost invested in water reuse activities (in monetary terms).
F. Information assurance Information assurance is the practice of assuring the quality (i.e., overall integrity and credibility) of water-related information contained in the corporate reports.	F1. Assurance provider (external/internal assurance, and the name of the assurance provider). F2. Assurance scope (identifying if water disclosure is included in the assurance scope). F3. Assurance opinion (the assurance opinion in the assurance report. For example, limited/reasonable assurance opinion). F4. Assurance standards (whether the assurance process/standard is disclosed in the assurance report).
G. Water risks	G1. Description of water-related risks (i.e., physical water risks in quantity and quality, reputational, regulatory and regional risks).

Disclosure categories and definition	Disclosure items
Water risks deal with company's exposure to water risk factors, including water scarcity.	
H. Other water disclosures This category is designed to capture other possible water-related issues which could be find during the analysis of reporting.	H1. Information on stakeholder engagement with regard to water issues. H2. Water information on community projects and environmental initiatives (i.e., helping consumers to improve their water usage, repairing and restoring community water, responding to accidents and spills or investing and building community water infrastructure and facilities).

8.11 Contributions to academic knowledge and theory

A water disclosure index has been used in previous studies to examine corporate water disclosure performance across various contexts (Ben-Amar & Chelli, 2018; Burritt et al., 2016; Farooq et al., 2025; C. Liu et al., 2021; Morikawa et al., 2007; Wicaksono & Setiawan, 2022; H. C. Yu, 2022; N. Yu et al., 2025; H. Zeng et al., 2020). These studies typically draw on indicators derived from established international reporting frameworks, such as the GRI and ESG standards, or adopt indices developed by earlier researchers, most notably Morikawa et al. (2007). However, several limitations are associated with these existing disclosure indices. First, international reporting frameworks differ in their thematic focus and objectives; some prioritise social dimensions, while others emphasise environmental concerns. Consequently, when researchers adopt indicators from a single framework, they may overlook other critical aspects of water-related disclosure, resulting in an incomplete evaluation.

Secondly, many existing indices tend to concentrate on a narrow set of water-related issues, such as water consumption, discharge, and risks. Other important categories, such as corporate water policy (include water-related targets and goals), wastewater treatment practices, information assurance (particularly relevant in contexts like China where disclosure is largely voluntary), and context-specific disclosures (e.g., the content analysis revealed that Chinese companies like to disclose information related to their environmental initiatives and stakeholder engagement efforts), are frequently omitted. This limited scope constrains the comprehensiveness of these tools.

Third, existing indices are generally developed from a research-oriented perspective, aiming to evaluate what companies disclose rather than considering the expectations and informational needs of disclosure users. In contrast, the water disclosure index developed in this study is not only grounded in a thorough review of prior literature and existing reporting frameworks, but also incorporates empirical insights gathered through interviews with different stakeholders. These interviews explored stakeholder expectations and their views on what constitutes meaningful and relevant water-related information in corporate disclosures. As far as the researcher is aware, this stakeholder-informed approach has not been employed in previous studies. Therefore, the index proposed in this research offers a more robust, applicable, and practical tool for assessing corporate water disclosure. It bridges the gap between academic assessment and real-world relevance by combining academic knowledge with stakeholder perspectives, thereby enhancing both its theoretical contribution and its potential utility in practice.

Fourthly, prior studies on water information disclosure have predominantly employed disclosure indices with a binary scoring system, which limits the ability to assess the quality or depth of the disclosed information. In other words, these indices function primarily as checklists, evaluating only the presence or absence of specific disclosure items without capturing the comprehensiveness of the information provided. Addressing this gap, the scoring system proposed in this research introduces a more nuanced approach that enables the assessment of the completeness of water-related disclosures. Notably, the scoring system has been designed with dynamic scaling tailored to each individual disclosure item, allowing it to accommodate both qualitative and quantitative forms of information. This ensures that the assigned scores more accurately reflect the level of detail and substance disclosed. Consequently, the index and scoring system developed in this study contribute to the advancement of the current literature by offering a more refined tool for evaluating corporate water disclosures. This index not only supports future academic research by enabling more robust assessments across various contexts but also serves as a practical guideline for companies aiming to improve the comprehensiveness of their water disclosure practices.

This research has been guided by stakeholder theory and accountability theory, which together provide a framework for understanding why companies are expected to disclose water-related information. The instrumental branch of stakeholder theory posits that companies should strategically manage relationships with key stakeholders to achieve objectives such as reducing risk, improving financial performance, and gaining long-term sustainability (Jamali, 2008; Ruf et al., 2001). This outcome-oriented perspective was reflected in the interview findings, which identified the government (regulators) as one of the most influential stakeholders driving corporate water information disclosure practices. Although water-related disclosure remains

voluntary in the Chinese business context, regulatory stringency and enforcement of environmental laws and policies still play a significant role in incentivising companies to disclose water-related information proactively.

This finding is not unique to China. Prior studies have also identified regulatory pressure as a major determinant of corporate water disclosure practices (Burritt et al., 2016; Farooq et al., 2025; C. Liu et al., 2021; H. Zeng et al., 2020). On the other hand, the normative branch of stakeholder theory emphasises that companies have ethical responsibilities to all stakeholders, not just those with economic or political power. Guided by this principle, this study adopted a multi-stakeholder approach, considering the perspectives of various groups beyond shareholders and government authorities which have been traditionally seen as the most influential actors in China (see Chapter 2 for the background and roles of the various stakeholder groups within the Chinese context). The findings also indicate a potential shift in the Chinese corporate context towards a broader stakeholder focus orientation. Interviewees reported that other groups such as customers, employees, media, and NGOs are demonstrating increasing interest in water-related information. Managers (i.e., information providers) also acknowledged that the expectations of these stakeholders were within their consideration, particularly in a setting where water disclosure is not legally mandated. This insight aligns with earlier research on water information disclosure in China (C. Liu et al., 2021).

Furthermore, the stakeholder interviews revealed that voluntary disclosure serves as a key mechanism for discharging corporate water accountability and communicate water-related information to the potential users. This supports the theoretical perspectives of normative stakeholder theory and accountability theory, which argue that companies should provide accounts of their environmental impact to all stakeholders – not just those with power or influence. However, the content analysis findings (see Chapter 6) also suggest that many Chinese companies discharge their accountability not only through disclosure but also through action-oriented initiatives. For instance, companies may engage employees in community water projects (e.g., maintenance or restoration of water infrastructure) or make financial donations to water-scarce regions. This action-based approach to accountability may reflect a culturally embedded practice within the Chinese business environment, indicating that corporate responsibility can be expressed not only through information transparency but also through tangible community engagement. This highlights a potentially underexplored area in the literature and suggests that future research should continue to examine the diverse mechanisms by which companies in China discharge their water-related accountability.

Chapter 9. Conclusion

9.1 Introduction

The aim of this chapter is to summarise the key findings of this study and present the main conclusions derived from the research. Additionally, this chapter discusses the contributions made by the study to both academic knowledge and practical applications, highlighting its value to stakeholders such as regulators, practitioners, and scholars. Furthermore, the limitations of this research are identified along with potential directions for future research, offering opportunities to build upon and expand the insights gained from this study.

9.2 Reflections on the findings of this research

Freshwater scarcity is one of the most pressing issues confronting humanity in the 21st century (Cosgrove & Loucks, 2015; Postel, 2000a). The complexities and multifaceted nature of water-related issues make it a global concern (Gleick, 2000b). As an indispensable natural resource for human survival, water is alarmingly scarce (Abedin et al., 2019; Porkka et al., 2016). Currently, less than 1% of the earth's total water resources are available as freshwater suitable for human use (Gleick, 2000b). This stark reality highlights the finite nature of water resources, rendering it neither inexhaustible nor abundant. This scarcity is set to escalate into profound societal challenges. The repercussions of inadequate water supply extend beyond human survival, posing significant threats to sustainable development (Connor, 2015; Grey & Sadoff, 2007). Limited access to water undermines economic growth, impedes technological progress, and jeopardises overall well-being (Bukhari et al., 2024; Mukherjee et al., 2020). Compounding this crisis is the detrimental impact of industrial pollution, which has severely degraded water ecosystems (Akhtar et al., 2021; Chowdhary et al., 2020; Rajaram & Das, 2008; H. Ren et al., 2007). Such pollution exacerbates water scarcity and creates critical environmental challenges, with dire consequences for ecosystems and public health. Addressing these interconnected issues requires immediate and comprehensive action to mitigate water scarcity and preserve the integrity of water systems for future generations.

Historically, water-related issues have not been a prominent focus within accounting research. Much of the existing literature on water issues has emerged from the natural sciences, reflecting a disciplinary emphasis on understanding and addressing the physical and ecological dimensions of water challenges. However, in recent years, there has been a growing recognition of the significance of water in the business and accounting domains (Bebbington & Unerman, 2018; Chalmers et al., 2012; Christ & Burritt, 2017b; Egan, 2018; Tello et al., 2016). This shift is driven by the increasing awareness that industries are among the primary contributors to water pollution and resource depletion, necessitating a closer examination of corporate water

activities. The evolution of social and environmental accounting has opened new avenues for exploring corporate accountability in non-financial dimensions. These dimensions encompass the social and environmental impacts of business operations, including their water-related responsibilities.

Water is inherently a regional issue, with each country facing different challenges based on its geographical characteristics and resource availability (Biswas, 2008; R. K. Mishra, 2023). Research on water issues in the business context has predominantly been conducted within Western frameworks, reflecting their unique socio-economic and regulatory environments. Moreover, widely recognised reporting frameworks and guidelines for corporate accountability, such as the Global Reporting Initiative (GRI), are also Western-oriented in their development and application. However, the specific water-related challenges faced by companies in China have remained underexplored, despite China's significant role in the global economy and the fact that many of its water issues parallel those in other nations.

Reflecting on the findings of this research, the unique contribution of this study lies in the development of a water disclosure index with a comprehensive scoring system. The index was specifically designed to assess the extent and comprehensiveness of water-related disclosures, a topic previously under-researched in the Chinese corporate context. Given the absence of clear understanding on water disclosure in China, the initial index was developed with reference to frameworks and knowledge from Western contexts. The findings revealed that water-related disclosures among Chinese companies were generally poor, with most information limited to general terms. A significant portion of the index items were absent from corporate disclosures, resulting in low scores that fell significantly short of expectations. An intriguing observation that emerged during the analysis was that many companies, regardless of industry, disclosed extensive information related to community support and environmental initiatives. For example, numerous companies reported donating to communities facing water stress or funding infrastructure projects to improve water access. Additionally, many companies organised employee participation in volunteer programs for community water projects. This dimension of corporate activity was not initially captured in the disclosure index, highlighting an unexpected area of focus in corporate water-related communications. This finding indicates a strong commitment to community engagement and demonstrates corporate awareness of the importance water. Poor disclosure on water performance metrics alongside significant community-related water initiatives raises important questions about the intention behind these activities.

While this 'storytelling' could be interpreted as efforts to enhance corporate image, insights from the interviews provided a more nuanced perspective. Many Chinese companies, especially

large listed ones who see themselves as a good example to other companies and society, expressed a desire to improve transparency regarding their water activities and performance. However, the absence of standardised and effective guidelines for reporting emerged as a significant barrier, preventing companies from effectively communicating their efforts and discharging their water accountability. Reflection on this finding led to a revision of the initial index based on insights gained from interviews. The revised index is tailored to better align with the Chinese business environment and specifically brings stakeholder expectations into consideration, making it a practical guideline for companies to provide more consistent and comparable disclosures. The revised index therefore provides a pathway for improving water-related transparency and accountability, thus supporting both corporate and stakeholder objectives.

Water-related risks, such as scarcity and pollution, served as important drivers for this research. The water-related risks category of the disclosure index developed in this study aimed to capture information from corporate reports and websites about the water-related risks companies face in China, and how these issues are communicated to the stakeholders and public. However, the findings reveal disappointing results. The category on water risks scored the lowest among the eight index categories, achieving only 3% of the expected disclosure. Notably, none of the 190 sampled companies addressed the item representing reputational risks, which is an essential aspect linked to public perceptions of corporate water activities (i.e., overconsumption and pollution). This absence is particularly concerning given that listed companies, dependent on public capital, should focus on their corporate reputation. The limited disclosures predominantly focused on qualitative aspects, with many companies merely acknowledging the importance of maintaining a stable water supply to sustain operations. Critical dimensions such as the impact of water quality on operations and regulatory considerations around water use are largely absent from the disclosures.

This finding contradicts expectations grounded in existing literature and highlights a significant gap between assumptions developed from the literature and corporate practices. The lack of comprehensive water risk disclosures underscores a broader issue of inadequate corporate awareness regarding their social and environmental impacts. This gap raises two possible explanations: either companies deliberately withheld information that might negatively affect them, or they genuinely perceived that there were no issues related to their water performance. The latter assumption is unlikely, as interviews conducted during this research reveal substantial room for improvement in water-related disclosures. Several interviewees even accused other companies of engaging in practices such as water spills, overconsumption, and illegal discharges of untreated wastewater to unauthorised locations, often to evade the costs of proper treatment and/or regulatory fees. These undisclosed activities strongly correlate with the water-

related risks identified in the index, including reputational, regulatory, and regional risks. The failure to report such critical issues not only highlights a lack of transparency but also raises concerns about deliberate concealment of adverse activities. Therefore, this finding could be a concern for regulatory authorities, emphasising the urgent need for stricter oversight and enforcement mechanisms to ensure companies disclose comprehensive and accurate water-related information on water risks.

The findings also highlight the important role of adopting existing (Western) reporting frameworks in enhancing corporate water disclosure quality.[29] This finding underscores the importance of integrating recognised reporting standards to improve transparency and consistency in corporate disclosures. Furthermore, the analysis revealed notable differences between companies listed on the Shanghai Stock Exchange (SSE) and those on the Shenzhen Stock Exchange (SZSE). Companies listed on the SSE exhibited higher average disclosure scores, which can be attributed to the SSE's higher concentration of companies from traditional, water-dependent industries such as manufacturing, energy, coal, mining, and petrochemicals.

Conducting interviews to complement the content analysis was pivotal to this research as it provided meaningful insights into corporate accountability within the Chinese business context. The interviews provided important and valuable insights into three main areas regarding water information disclosure in China: the motivations driving such disclosures, stakeholders' expectations, and the challenges companies face in discharging corporate water accountability to stakeholders. Despite the 54 interviews being conducted online rather than in person due to the COVID-19 pandemic, they yielded valuable reflections. One notable challenge was to conceptualise 'accountability' because the term does not have a direct equivalent in Chinese, leading many participants to equate it with 'responsibility', which does not fully capture its broader implications. This required the researcher to consistently clarify and exemplify the concept during interviews. This challenge reveals a broader issue that accountability, as understood in Western contexts, is not yet a common practice in Chinese businesses. For example, when participants were asked about their perceptions on water information disclosure, their responses often focused on compliance with regulatory requirements rather than information transparency and the practice of voluntary disclosures. Some participants did not seem to be aware that water information disclosure was voluntary. Even after explaining the concept of voluntary disclosures, they still emphasised that the company's disclosures/reporting should align with the government requirements (for reporting for operational purposes). This suggests that Chinese businesses tend to adopt a passive approach, prioritising operational

[29] Results from the t-test (Table 6.2) demonstrated that companies using established reporting frameworks consistently achieved higher disclosure scores compared to those without such frameworks or guidelines.

reporting (to the government) over information transparency or voluntary disclosure to external stakeholders. Improving water information transparency in China is feasible, but it would require regulatory intervention. Specifically, establishing and enforcing disclosure guidelines could foster a culture of accountability and transparency. Reflecting on these findings, the research underscores the importance of regulatory leadership in promoting corporate water accountability. Without mandatory requirements and specific water disclosure standards, the shift from (operational) compliance-driven reporting to proactive disclosure may remain limited.

When participants were asked whether the current water information disclosed by companies met their expectations, responses varied significantly. Regulators and policymakers generally indicated that the disclosed information met their expectations. Conversely, participants from academia and the media identified a gap between the current disclosures and their expectations. This divergence is particularly noteworthy given the influential role regulatory bodies play in shaping mandatory requirements and corporate practices. If regulators and policymakers believe current disclosures are adequate, it suggests a potential disconnect between their perceptions and the broader societal demand for information transparency. This is concerning because participants expressing dissatisfaction represent the perspectives of diverse social stakeholders. These stakeholders typically advocate for greater transparency and accountability in corporate water reporting. Reflecting on this finding, this research highlights the importance of bridging this gap. Regulators and policymakers must recognise and take societal expectations for information transparency into consideration when setting the relevant rules. This is especially important because companies in China predominantly rely on regulatory guidance to frame their reporting practices. Therefore, regulatory frameworks could evolve to address not only legal compliance but also the growing societal demand for meaningful and comprehensive water information disclosures.

The challenges for corporate water accountability in China stem primarily from the absence of a standardised reporting framework to guide companies in disclosing water-related information. This issue was identified as a central theme in participants' responses. However, another significant challenge highlighted by participants relates to the costs associated with collecting, preparing, and disclosing water-related information. Specifically, corporate managers noted that gathering data, such as wastewater treatment metrics or water reuse and recycling figures, requires specialised equipment and the associated maintenance cost. The procurement of such equipment involves considerable expense, and additional costs arise from the need to hire experts with specialised knowledge of water management and professional skills in disclosure preparation. Collectively, these factors pose financial burdens, leading managers to face uncertainties about whether investments in water reporting will yield economic returns or

enhance corporate reputation. As a result, persuading shareholders to allocate funds for such initiatives becomes a significant hurdle.

Another noteworthy finding was some participants' surprise upon learning that this research (on water issues) is conducted within the accounting discipline. In most cases, participants reported that water-related or even broader environmental disclosures are typically handled by their company's environmental protection and safety department or the general administration office. This indicates a lack of recognition of the potential role accountants can play in advancing disclosure and reporting practices. This conceptual barrier reflects a gap between the practitioners and the specialised knowledge held by academic professionals.

These findings provide valuable insights for standard setters and policymakers. First, there is a clear need for financial incentives or support mechanisms to encourage companies to engage in water-related disclosures. Second, there is a conceptual disconnect between accounting and environmental reporting practices, pointing to an opportunity to promote the contributions of accounting expertise in fostering information transparency and corporate accountability. Additionally, the findings suggest that standard setters might benefit from involving accounting professionals in policy development, as their expertise could significantly inform and enhance the design of disclosure standards and regulatory frameworks. This research, therefore, emphasises the broader potential for accounting knowledge to bridge gaps in environmental reporting practices and contribute meaningfully to accountability initiatives.

Overall, while there is evidence of strong community engagement and awareness on the part of Chinses companies in relation to water management, the general low disclosure scores point to the need for a more structured, systematic and adoptable reporting framework. Such a framework could help companies disclose detailed and comprehensive information, enhancing transparency and meeting the expectations of stakeholders and the public.

9.3 Contributions

This research makes significant contributions to both academic discourse and practical applications, offering valuable insights for a diverse group of stakeholders. Its contributions are particularly relevant to practitioners, such as corporate managers responsible for preparing and disclosing water-related information, as well as regulators, standard-setting bodies, academics specialising in corporate water disclosure and accountability research, and broader social stakeholders, including the media and environmental NGOs.

9.3.1 Academic contributions

This research makes several key contributions to the field of water accounting and accountability research. Foremost among these is the development of a comprehensive water disclosure index, which builds upon existing reporting frameworks and literature on corporate water disclosures. The creation of this index was further enriched through consultations with scholars globally, whose research focuses on corporate water information disclosure and accountability. The index developed and revised in this study represents a significant advancement, as it synthesises diverse perspectives and integrates best practices from the academic and professional fields.

Secondly, the scoring system developed in this research to measure the comprehensiveness of water information disclosure represents a significant academic contribution. This approach provides a robust framework that can be referenced and utilised in future studies seeking to conduct more detailed analyses of water disclosure practices. Additionally, the scoring system offers the flexibility to adapt the index for testing corporate water disclosure comprehensiveness in different contexts or regions.

Thirdly, much of the existing literature on corporate water information disclosure has been conducted in Western contexts, with limited attention to Chinese businesses. Additionally, few, if any, studies have systematically examined all industrial sectors across both of China's domestic stock exchanges – the SSE and SZSE – regarding water-related information disclosures among listed companies. This lack of comprehensive research created a gap in our understanding the water disclosure practices in China's diverse business landscape. This research addresses this gap by providing an overarching examination of companies across all sectors listed on both Chinese stock exchanges. By doing so, it offers a holistic perspective on the current state of water information disclosure in the Chinese business context. This comprehensive analysis not only broadens the scope of the existing academic literature but also contributes significantly to understanding regional practices, challenges, and opportunities in corporate water accountability within a rapidly developing economy.

Fourthly, this research conducted a total of 54 interviews with stakeholders identified as influential in shaping corporate water disclosure practices in China. This extensive and inclusive approach represents a significant advancement over prior studies, which have seldom incorporated such a broad spectrum of perspectives. By engaging directly with stakeholders, the research not only gathered firsthand information but also provided in-depth insights into their perceptions and expectations regarding water information disclosures. This dimension enabled a nuanced exploration of stakeholder perspectives on water information disclosure, shedding light on the multifaceted nature of water accountability and information transparency in the corporate

context. The findings from the interviews offer valuable recommendations for improving water disclosure practices, aligning corporate efforts with stakeholder expectations, and informing future policy and guideline development.

Fifthly, this research contributes to the theoretical understanding of corporate water disclosure within the Chinese context. While the primary contribution of this study lies in its practical application rather than the development of new theoretical frameworks, this does not diminish the significance of theoretical engagement. On the contrary, the application of stakeholder theory and accountability theory has provided a valuable lens through which to examine why Chinese companies are expected to disclose water-related information.

Overall, the findings reveal that the government remains the most influential stakeholder in promoting corporate water disclosure in China. Although this influence is primarily exerted through operational and regulatory compliance rather than voluntary reporting initiatives, the increasing stringency of environmental laws and regulations has encouraged companies to adopt more sustainable practices. In an environment where there is no mandatory requirement to publicly disclose water-related information, corporate decisions to engage in such disclosure are often shaped by the expectations of a broader range of stakeholders, including employees, customers, and members of civil society, such as media representatives and environmental NGOs (see Section 7.9). For example, interviews with managers and shareholders (see Sections 7.3.3, 7.4.1, and 7.6.3) highlighted that overseas customers expressed strong interest in corporate water-related practices. Additionally, media and NGO stakeholders were also identified as key actors showing concern for water-related disclosures (see Chapter 2 for a detailed discussion on the roles that media and NGOs play in influencing corporate practices within the Chinese context). These findings suggest a shift from a government-centric stakeholder model to a broader stakeholder focus, wherein influence over corporate disclosure practices extends to various non-state actors.

The content analysis further supports this perspective, indicating that Chinese companies frequently disclose information related to environmental initiatives and community-based stakeholder engagement. This may point to an alternative approach to discharging corporate water accountability through actions rather than reporting. For instance, many companies participated in community projects aimed at constructing or restoring water infrastructure. This action-based accountability may reflect a culturally embedded or context-specific strategy for demonstrating corporate responsibility. As such, it represents an important avenue for future research into alternative mechanisms for discharging water accountability in the Chinese business context.

Corporate water disclosure is an emerging topic not only in China but also globally. Prior studies in this field have predominantly employed content analysis to examine the extent of disclosure or to develop and test hypotheses regarding the factors influencing corporate water disclosure. However, no previous research has also applied an interview-based approach to engage directly with diverse stakeholders, thereby exploring both the motivations from managers' perspectives and the expectations from the perspective of different stakeholders. Consequently, this study makes a modest but valuable methodological contribution by adopting semi-structured interviews to gain firsthand insights from a variety of stakeholders regarding their perceptions of current corporate water disclosure practices in China.

The semi-structured interview method enabled the collection of rich qualitative data, but it also presented several challenges that required solutions. First, a low initial response rate posed a significant barrier at the beginning of the process. To address this, the researcher sent follow-up invitations in multiple rounds and discovered that direct phone calls were often more effective than email for establishing initial contact and building rapport with potential participants. Secondly, the researcher found that directly requesting participation in an interview often led to rejections. Considering the introverted and implicit nature of Chinese business culture, it became apparent that establishing a good relationship before requesting an interview was crucial. Providing potential participants with a detailed participant information sheet outlining the background and purpose of the study proved helpful in building trust and encouraging participation. Once participants had a clear understanding of the research objectives and process, they were more comfortable accepting the invitation and contributing their insights.

Moreover, the study proved that a snowball sampling approach was particularly effective in the Chinese context. Once a strong relationship – or *guanxi*, a concept deeply embedded in Chinese social and business culture – had been established, participants were more likely to recommend and introduce additional potential interviewees. Overall, this study contributes to research methodology by offering practical strategies for overcoming challenges associated with conducting interview-based research in the Chinese context. These methodological insights may serve as a valuable reference for future studies seeking to employ the interview research method in similar cultural settings.

9.3.2 Practical contributions

This research offers several practical contributions, particularly in addressing the challenges of corporate water information disclosure. First, the revised water disclosure index presented in Chapter 8 serves as a practical and actionable framework tailored for Chinese companies to enhance their water-related reporting practices. It addresses the pressing need for an immediate standardised water disclosure tool, which is crucial for improving both the scope and quality of

current disclosures. By implementing the revised index, companies can achieve greater consistency and reliability in their water information disclosures. This, in turn, supports better communication with stakeholders, strengthens corporate accountability, and aligns with global trends towards transparency and sustainability in environmental reporting.

Secondly, this research provides valuable insights for regulators and standard setters to further develop regulations and reporting policies that guide Chinese companies in effectively disclosing water-related information. Water-related information disclosure is currently voluntary in China, and no legal requirements exist to regulate companies in this regard. By proposing a structured water disclosure index, this study offers actionable recommendations for regulators and standard setters to establish clear, consistent, and enforceable standards. Such efforts can enable companies to improve the comprehensiveness and transparency of their disclosures, ultimately fostering better environmental accountability and aligning with global best practices.

Thirdly, the revised water disclosure index serves as a valuable resource for the media and environmental NGOs by providing a comprehensive reporting framework for evaluating Chinese companies' water information disclosure practices. This index can be seen as a good guideline for water disclosure and offers these stakeholders a practical tool for assessing corporate water activities and performance in the future. By utilising the revised index, media organisations can enhance the accuracy and depth of their news dissemination on corporate water activities, while NGOs can refer to the index in their reports to better advocate for improved transparency and environmental stewardship.

Fourthly, feedback collected from the interviews suggests that the development of a disclosure index is necessary for improving corporate water-related information disclosure. In particular, there is a need for an index that is both adaptable and applicable across a wide range of Chinese companies. This was mentioned by participants because the researcher provided the disclosure index used for content analysis to participants in advance of the interview, along with the participant information sheet. Participants commented that the index was sufficiently comprehensive. However, they suggested that the index could be improved by revising it to make it more suitable for practical application by companies in China. Corporate managers acknowledged that water-related information disclosure remains voluntary in China, and that companies vary significantly in both the quantity and quality of their disclosures. Although several existing reporting frameworks such as the GRI and environmental, social and governance (ESG) guidelines include water-related content, the scope and focus of water disclosures differ across these standards. As a result, companies that adopt different frameworks may produce inconsistent disclosure outcomes. For this reason, interview participants noted that the index could help address this issue by offering a more unified and structured approach to

water-related disclosure. They further suggested that adopting such an index could enhance the consistency and comparability of corporate water disclosures across companies. At the same time, social stakeholders viewed the index as a practical checklist that could be used by external parties such as the media, employees, and NGOs to assess and monitor a company's water-related information disclosure practices.

Against this background, a revised index was developed and presented in Chapter 8 to respond to the current needs of the Chinese business context. In addition, the researcher plans to promote the index through established connections with several managers who expressed interest in applying the index in practice once the research project is completed. One government official also indicated a willingness to consider incorporating the index into future disclosure policy and standard-setting processes. Therefore, the researcher will promote the index through active communication and participation with government departments responsible for setting the rules for corporate disclosure and reporting. Furthermore, the project has attracted interest from academics in China. Two academic participants from this research have expressed an interest to meet with the researcher to explore the potential application of the index in practice. This represents an opportunity for further impact and engagement given the close collaboration between academia and industry in China, where companies often invite academics and specialists to participate in business meetings and employee trainings. For these reasons, the researcher intends to engage in further discussions with more academics and explore opportunities to incorporate the water disclosure index into university teaching materials and relevant textbooks.

9.4 Research limitations and future research opportunities

The limitations of this research open several promising avenues for future exploration. First, this study analysed corporate water-related information disclosure for a single year (year-end 2019). Future research could adopt a longitudinal approach to examine trends over an extended period. Such an approach would provide insights into year-on-year changes in water disclosure practices and how companies progressively discharge their water accountability.

Secondly, this research adopted suggestions from stakeholder theory and accountability theory, which provide reasons to expect that companies will use water-related information disclosure as a way of discharging their corporate water accountability. Future studies could apply alternative theoretical perspectives to explore other dimensions of water accountability in China, potentially uncovering diverse motivations and practices.

Thirdly, the content analysis was based on a sample comprising the largest 10 companies from all sectors. Expanding the sample size in future studies could enhance the generalisability of

findings. Additionally, industry-specific studies could offer a more granular understanding by focusing on disclosure trends and performance within particular sectors, providing nuanced insights into sectoral variations.

Fourthly, this research focused exclusively on Chinese listed companies, offering findings relevant to emerging economies. Future research could apply the same water disclosure index to companies in different contexts. Such comparative studies would facilitate a broader understanding of corporate water accountability and allow for cross-cultural or cross-market comparisons.

Lastly, due to restrictions imposed by the COVID-19 pandemic, the interviews in this study were conducted online. Face-to-face interviews, particularly in the Chinese cultural context, are often considered more appropriate and conducive to fostering open dialogue. Future research could prioritise in-person interviews with key stakeholders to deepen the understanding of corporate water accountability and uncover richer qualitative insights into the Chinese business environment.

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Appendix A – Sample of companies selected for content analysis

Companies from the Shanghai Stock Exchange (SSE)

Company distribution by sector		
Sector	**Code**	**Listing date**
Energy		
PetroChina Company Limited	601857	05/11/2007
China Petroleum & Chemical Corporation	600028	08/08/2001
China Shenhua Energy Company Limited	601088	09/10/2007
Shaanxi Coal Industry Company Limited	601225	28/01/2014
China Coal Energy Company Limited	601898	01/02/2008
China Oilfield Services Limited	601808	28/09/2007
Yanzhou Coal Mining Company Limited	600188	01/07/1998
Sinopec Oilfield Service Corporation	600871	11/04/1995
CNOOC Energy Technology & Services Limited	600968	26/06/2019
Sinopec Shanghai Petrochemical Co., Ltd.	600688	08/11/1993
Materials		
Anhui Conch Cement Company Limited	600585	02/07/2002
Wanhua Chemical Group Co., Ltd.	600309	01/05/2001
Zijin Mining Group Company Limited	601899	25/04/2008
Hengli Petrochemical Co., Ltd.	600346	20/08/2001
Baoshan Iron & Steel Co., Ltd.	600019	12/12/2000
Shandong Gold Mining Co., Ltd.	600547	28/08/2003
Ningxia Baofeng Energy Group Co., Ltd.	600989	16/05/2019
China Molybdenum Co., Ltd.	603993	09/10/2012
Inner Mongolia Junzheng Energy & Chemical Group Co., Ltd.	601216	22/02/2011
Inner Mongolia BaoTou Steel Union Co., Ltd.	600010	09/03/2001
Industrials		
Beijing-Shanghai High Speed Railway Co., Ltd.	601816	16/01/2020
Longi Green Energy Technology Co., Ltd.	601012	11/04/2012
China State Construction Engineering Corporation Limited	601668	29/07/2009
Sany Heavy Industry Co., Ltd.	600031	03/07/2003
Shanghai International Airport Co., Ltd.	600009	18/02/1998

CRRC Corporation Limited	601766	18/08/2008
China Railway Group Limited	601390	03/12/2007
China Shipbuilding Industry Company Limited	601989	16/12/2009
Shanghai International Port (Group) Co., Ltd.	600018	19/07/2000
China Railway Construction Corporation Limited	601186	10/03/2008
Consumer Discretionary		
China Tourism Group Duty Free Corporation Limited	601888	15/10/2009
SAIC Motor Corporation Limited	600104	25/11/1997
Haier Smart Home Co., Ltd.	600690	19/11/1993
Great Wall Motor Company Limited	601633	28/09/2011
Huayu Automotive Systems Company Limited	600741	26/08/1996
Guangzhou Automobile Group Co., Ltd.	601238	29/03/2012
Fuyao Glass Industry Group Co., Ltd.	600660	10/06/1993
Oppein Home Group Inc.	603833	28/03/2017
Changzhou Xingyu Automotive Lighting Systems Co., Ltd.	601799	01/02/2011
Ningbo Tuopu Group Co., Ltd.	601689	19/03/2015
Consumer Staples		
Kweichow Moutai Co., Ltd.	600519	27/08/2001
Foshan Haitian Flavouring & Food Company Ltd.	603288	11/02/2014
Inner Mongolia Yili Industrial Group Co., Ltd.	600887	12/03/1996
Shanxi Xinghuacun Fen Wine Factory Co., Ltd.	600809	06/01/1994
Tongwei Co., Ltd.	600438	02/03/2004
Yonghui Superstores Co., Ltd.	601933	15/12/2010
Jiangsu King's Luck Brewery Joint – Stock Co., Ltd.	603369	03/07/2014
Tsingtao Brewery Company Limited	600600	27/08/1993
Jonjee Hi-Tech Industrial & Commercial Holding Co., Ltd.	600872	24/01/1995
Chong Qing Brewery Co., Ltd.	600132	30/10/1997
Healthcare		
Jiangsu Hengrui Medicine Co., Ltd.	600276	18/10/2000
WuXi AppTec Co., Ltd.	603259	08/05/2018
Zhangzhou Pientzehuang Pharmaceutical Co., Ltd.	600436	16/06/2003

Shanghai Fosun Pharmaceutical (Group) Co., Ltd.	600196	07/08/1998
Autobio Diagnostics Co., Ltd.	603658	01/9/2016
Topchoice Medical Co., Inc.	600763	30/10/1996
DaShenLin Pharmaceutical Group Co., Ltd.	603233	31/07/2017
Zhejiang Huahai Pharmaceutical Co., Ltd.	600521	04/03/2003
Yifeng Pharmacy Chain Co., Ltd.	603939	17/02/2015
Beijing Tiantan Biological Products Corporation Limited	600161	16/06/1998
Information Technology		
Will Semiconductor Co., Ltd. Shanghai	603501	04/05/2017
Yonyou Network Technology Co., Ltd.	600588	18/05/2001
San'an Optoelectronics Co., Ltd.	600703	28/05/1996
360 Security Technology Inc.	601360	16/01/2012
Gigadevice Semiconductor (Beijing) Inc.	603986	18/08/2016
Shenzhen Goodix Technology Co., Ltd.	603160	17/10/2016
Shanghai Baosight Software Co., Ltd.	600845	15/03/1994
JCET Group Co., Ltd.	600584	03/06/2003
Shengyi Technology Co., Ltd.	600183	28/10/1998
Dawning Information Industry Co., Ltd.	603019	06/11/2014
Telecommunication Services		
Foxconn Industrial Internet Co., Ltd.	601138	08/06/2018
China United Network Communications Limited	600050	09/10/2002
Wingtech Technology Co., Ltd.	600745	28/08/1996
China Satellite Communications Co., Ltd.	601698	28/06/2019
Tianjin 712 Communication & Broadcasting Co., Ltd.	603712	26/02/2018
Jiangsu Zhongtian Technology Co., Ltd.	600522	24/10/2002
Hengtong Optic-Electric Co., Ltd.	600487	22/08/2003
Fiberhome Telecommunication Technologies Co., Ltd.	600498	23/08/2001
Quectel Wireless Solutions Co., Ltd.	603236	16/07/2019
Yangtze Optical Fibre & Cable Joint Stock Limited Company	601869	20/07/2018
Utilities		

China Yangtze Power Co., Ltd.	600900	18/11/2003
Huaneng Lancang River Hydropower Inc.	600025	15/12/2017
China National Nuclear Power Co., Ltd.	601985	10/06/2015
SDIC Power Holdings Co., Ltd.	600886	18/01/1996
Huaneng Power International, Inc.	600011	06/12/2001
Zhejiang Zheneng Electric Power Co., Ltd.	600023	19/12/2013
Sichuan Chuantou Energy Co., Ltd.	600674	24/09/1993
Gd Power Development Co., Ltd.	600795	18/03/1997
Huadian Power International Corporation Limited	600027	03/02/2005
Datang International Power Generation Co., Ltd.	601991	20/12/2006
Financials		
Industrial & Commercial Bank of China Limited	601398	27/10/2006
Agricultural Bank of China Limited	601288	15/07/2010
China Life Insurance Company Limited	601628	09/01/2007
Ping An Insurance (Group) Company of China, Ltd.	601318	01/03/2007
China Merchants Bank Co., Limited	600036	09/04/2002

Companies from the Shenzhen Stock Exchange (SZSE)

Company distribution by sector		
Sector	**Code**	**Listing date**
Energy		
North Huajin Chemical Industries Co., Ltd.	000059	23/01/1997
Gansu Jingyuan Coal Industry & Electricity Power Co., Ltd.	000552	28/12/1996
Shanxi Meijin Energy Co., Ltd.	000723	08/01/1997
Inner Mongolia PingZhuang Energy Resources Co., Ltd.	000780	11/06/1993
COFCO Biotechnology Co., Ltd.	000930	28/08/1998
Jizhong Energy Resources Co., Ltd	000937	26/08/1999
Shanxi Xishan Coal & Electricity Power Co., Ltd.	000983	26/04/1999
Huolinhe Opencut Coal Industry Corporation Limited of Inner Mongolia	002128	18/12/2001
ShaanXi Provincial Natural Gas Co., Ltd.	002267	20/01/1995
China Oil HBP Science & Technology., Ltd.	002554	07/10/1998
Materials		

HBIS Company Limited	000709	18/01/1997
Tongling Nonferrous Metals Group Co., Ltd.	000630	12/11/1996
Pangang Group Vanadium Titanium & Resources Co., Ltd.	000629	27/03/1993
Angang Steel Company Limited	000898	14/09/1998
Rongsheng Petro Chemical Co., Ltd.	002493	15/09/1995
Shanxi Taigang Stainless Steel Co., Ltd.	000825	11/06/1998
Beijing Shougang Co., Ltd.	000959	15/10/1999
Hunan Valin Steel Co., Ltd.	000932	29/04/1999
GEM Co., Ltd.	002340	28/12/2001
Jiangsu Eastern Shenghong Co., Ltd.	000301	16/07/1998
Industrials		
XCMG Construction Machinery Co., Ltd.	000425	15/12/1993
Zoomlion Heavy Industry Science & Technology Co., Ltd.	000157	31/08/1999
China Merchants Expressway Network Technology Holdings Co., Ltd.	001965	18/12/1993
Weichai Power Co., Ltd.	000338	23/12/2002
S.F. Holding Co., Ltd.	002352	22/05/2003
AVIC Electromechanical System Co., Ltd.	002013	05/12/2000
Xinjiang Goldwind Science And Technology Co., Ltd.	002202	26/03/2001
Qingdao Hanhe Cable Co., Ltd.	002498	08/11/1989
Tongyu Heavy Industry Co., Ltd.	300185	25/05/2002
Transfar Zhilian Co., Ltd.	002010	06/07/2001
Consumer Discretionary		
Focus Media Information Technology Co., Ltd.	002027	26/08/1997
TCL Corporation	000100	19/04/2002
Suning. Com CO., Ltd.	002024	15/05/1996
Shenzhen Overseas Chinese Town Co., Ltd.	000069	02/09/1997
Midea Group Co., Ltd.	000333	07/04/2000
Leo Group Co., Ltd.	002131	21/05/2001
Offcn Education Technology Co., Ltd.	002607	25/08/1999
Gree Electric Appliances, Inc. of Zhuhai	000651	13/12/1989
Ccoop Group Co., Ltd.	000564	05/12/1996

Shenzhen MTC Co., Ltd.	002429	04/04/2005
Consumer Staples		
Wens Foodstuff Group Co., Ltd.	300498	26/07/1993
Beijing Dabeinong Technology Group Co., Ltd.	002385	18/10/1994
New Hope Liuhe Co., Ltd.	000876	04/03/1998
Wuliangye Yibin Co., Ltd.	000858	21/04/1998
Henan Shuanghui Investment & Development Co., Ltd.	000895	15/10/1998
Beijing Yanjing Brewery Co., Ltd.	000729	08/07/1997
Jiangxi Zhengbang Technology Co., Ltd.	002157	26/09/1996
Guangzhou Zhujiang Brewery Co., Ltd.	002461	25/12/2002
Muyuan Foods Co., Ltd.	002714	13/07/2000
By-health Co., Ltd.	300146	01/04/2005
Healthcare		
Shanghai RAAS Blood Products Co., Ltd.	002252	23/06/2008
Aier Eye Hospital Group Co., Ltd.	300015	30/10/2009
Meinian Onehealth Healthcare Holdings Co., Ltd.	002044	18/05/2005
Tianjin Chase Sun Pharmaceutical Co., Ltd.	300026	30/10/2009
Zhejiang NHU Company Ltd.	002001	25/06/2004
Hualan Biological Engineering, Inc.	002007	25/06/2004
Lepu Medical Technology (Beijing) Co., Ltd.	300003	30/10/2009
Huadong Medicine Co., Ltd.	000963	27/01/2000
Chongqing Zhifei Biological Products Co., Ltd.	300122	28/09/2010
Walvax Biotechnology Co., Ltd.	300142	12/11/2010
Information Technology		
BOE Technology Group Co., Ltd.	000725	12/01/2001
TCL Communication Technology Holdings Ltd.	000100	30/01/2004
Hangzhou Hikvision Digital Technology Co., Ltd.	002415	28/05/2010
Zhejiang Century Huatong Group Co., Ltd.	002602	28/07/2011
LINGYI Guangdong Co., Ltd.	002600	15/07/2011
Luxshare Precision Industry Co., Ltd.	002475	15/09/2010
Shanghai 2345 Network Holding Group Co., Ltd.	002195	12/12/2007
Tunghsu Optoelectronic Technology Co., Ltd.	000413	25/09/1996
GCL System Integration Technology Co., Ltd.	002506	18/11/2010

Lens Technology Co., Ltd.	300433	18/03/2015
Telecommunication Services		
ZTE Corporation	000063	18/11/1997
Guangzhou Haige Communications Group Incorporated Company	002465	31/08/2010
Hytera Communications Corporation Limited	002583	27/05/2011
Gosuncn Technology Group Co., Ltd.	300098	28/07/2010
Sumavision Technologies Co., Ltd.	300079	30/04/2010
Net263 Ltd.	002467	08/09/2010
Tongding Interconnection Information Co., Ltd	002491	21/10/2010
Guomai Technologies, Inc.	002093	15/12/2006
Shenzhen Sunway Communication Co., Ltd	300136	05/11/2010
Yealink Network Technology Co., Ltd.	300628	17/03/2017
Utilities		
Hubei Energy Group Co., Ltd.	000883	09/03/1993
Guangdong Electric Power Development Co., Ltd.	000539	05/02/1996
Shenzhen Energy Group Co., Ltd.	000027	21/08/1993
Jiangsu Guoxin Corp. Ltd.	002608	16/06/2003
Cecep Solar Energy Co., Ltd.	000591	12/04/1993
Chengdu Xingrong Environment Co., Ltd.	000598	26/05/1996
An Hui Wenergy Company Limited	000543	13/12/1993
Guangdong Baolihua New Energy Stock Co., Ltd	000690	20/01/1997
Jilin Electric Power Co., Ltd.	000875	20/11/1997
Jointo Energy Investment Co., Ltd. Hebei.	000600	18/01/1994
Financials		
Shenwan Hongyuan Group Co., Ltd.	000166	26/01/2015
PingAn Bank Co., Ltd.	000001	03/04/1991
CNPC Capital Company Limited	000617	22/10/1996
Guosen Securities Co., Ltd.	002736	29/12/2014
East Money Information Co., Ltd.	300059	19/03/2010

Appendix B – Academics who commented on the index

Academic	Title	Name of the university/research institution	Consultation method
A	Professor	Durham University, UK	Written comment
B	Professor	University of Sheffield, UK	Written comment
C	Professor	School of Business and Management, Royal Holloway University of London, UK	Written comment
D	Professor	Institute of Physical geography, Goethe University Frankfurt, Germany	Online meeting
E	Professor	Department of Management, Economics and Quantitative Methods, University of Bergamo, Italy	Written comment
F	Professor	Faculty of Engineering Technology. University of Twente, Netherlands.	Online meeting
G	Professor	Department of Accounting and Corporate Governance, Macquarie University, Sydney, Australia	Online meeting
H	Professor	University of Nebraska, Lincoln, USA	Written comment
I	Doctor	University of South Australia Business School, Adelaide, Australia	Written comment
J	Doctor	Fenner School of Environmental and Society, College of Science, Australian National University, Canberra, Australia	Written comment
K	Doctor	Management School, University of Sheffield, UK	Written comment
L	Doctor	Director of the Pacific Institute for Studies in Development, Environment, and Security, Oakland, California, USA	Written comment
M	Doctor	Water and Development Research Group, Aalto University, Finland	Written comment
N	Doctor	University of Sydney Business School, Sydney, Australia	Online meeting
O	Doctor	Department of Urban Studies and Plaining, University of Sheffield, UK	Written comment

P	Doctor	Direct General, International Centre for Integrated Mountain Development (ICIMOD)	Written comment
Q	Doctor	Center for Energy, Environment and Sustainability, Wake Forest University, Charlotte, North Carolina, USA	Written comment
R	Doctor	Twente Water Centre, University of Twente, Enschede, Netherlands	Online meeting

Appendix C – Invitation letter in both English and Chinese

Interview invitation letter to participate in the research titled:
"Corporate accounting and accountability for water in a Chinese context"

Dear Sir/Madam,

My name is Justin Zhu, and I am a PhD student studying at the Auckland University of Technology, New Zealand (AUT). AUT is one of New Zealand's highly ranked universities, and it has been rated a 5–star university by the world rankings organisation QS and ranked in the Top 1% of universities worldwide in the Times Higher Education World University Ranking 2022. The Accounting department of the AUT Business School is ranked among the top 150 in the world. Our department conducts world-class research on accounting and accountability for social and environmental impact. My supervisor, Professor Chris van Staden, is one of the leading scholars in the field of corporate social and environmental disclosures. He has published scholarly articles and research papers in internationally renowned accounting and management journals.

My doctorial research aims to investigate corporate water accounting and accountability among Chinese publicly traded companies. To achieve this objective, I would appreciate your thoughts on stakeholder expectations and perceptions regarding the disclosure of water-related information disclosure by Chinese companies. More specifically, I would like to request your participation in an online interview as part of my PhD research. As an influential stakeholder, you are in an ideal position to provide valuable first-hand information from your own perspective.

The interview will be conducted online by any means convenient to you. The interview takes approximately 45 minutes and is informal. I will merely attempt try to capture your thoughts and perspectives on Chinese companies' water-related information disclosure. Your responses to the questions will be kept confidential. Your participation will be a valuable addition to my research, and the findings could lead to a greater understanding of corporate water accounting and accountability in a Chinese context. Your participation will also have important benefits for

business leaders, practitioners, and regulators, as it will reveal the difficulties and challengers for companies to be accountable to a range of stakeholders. This knowledge could assist Chinese companies in measuring and reporting their water-related impacts transparently. I am willing to share a summary of my findings with you.

Thank you for taking your time to read this letter. I understand that you are a busy person, and if you are willing to participate, please suggest a day and time that suits you and I will do my best to accommodate you. If you will be taking part, I will send you the participant information as required by the ethics consent for this research. If you have any questions, please do not hesitate to ask. My contact details can be found at the end of this letter. I look forward to hearing from you.

Yours faithfully,

Justin Zhu
(0064) 21 369 787
Justin.zhu@aut.ac.nz

参加研究的面试邀请函标题为：

“中国背景下的企业会计与水资责问制”

尊敬的先生/女士，

我叫朱弘，是新西兰奥克兰理工大学的博士生。我博士学位研究的目的是探索中国上市公司的企业水资源会计和问责制。为实现这一目标，我想请您谈谈利益相关者对中国企业涉及到水资源相关信息披露的期望和看法。 更具体地说，我想请问您是否可以参加一个面试，这将作为我博士研究的一部分。作为（利益相关者），从您所处的位置提供的第一手信息将会非常具有价值。

面试讲通过您方便的任何方式在线上经行。这是一次非正式的面试，时长约为 45–90 分钟。此次面试主要是想知道您对中国企业涉及水资源相关信息披露的想法和观点。您的回答将被保密。在分析和撰写调查结果期间，您的个人信息将会使用数字或字母代码来代替以确保您的个人信息不会泄露。如果您想了解这次会谈的详细内容，请阅读附在电子邮件中的《参与者信息表》。

参与这项研究有没有任何报酬。但是，您的参与将对我的研究和研究成果提供宝贵意见， 也可能会帮助全球对中国背景下的企业涉及水资源相关信息的披露和问责制有更多的了解。

感谢您花时间阅读这封信。我明白您的时间非常的宝贵，如果您愿意参加这个研究项目，请告诉我适合您的日期和时间，我会尽我所能安排是时间与您会谈。如果您有任何问题，请随时问我。 我的联系方式可以在这封信的末尾找到。

祝您工作愉快。

朱弘

(0064) 21 269 787

Justin.zhu@aut.ac.nz

Appendix D – Participant information sheet

Date Information Sheet Produced:

01/03/2022

Project Title

Corporate accounting and accountability for water in a Chinese context

An Invitation

My name is Justin Zhu, and I am a PhD student studying at the Auckland University of Technology (AUT), New Zealand. Auckland University of Technology is one of the best universities in New Zealand.

The objective of my PhD research is to explore corporate water accounting and accountability by Chinese listed companies. To achieve this aim, I would like your opinion on stakeholder expectations and perceptions about water-related information disclosure in Chinese companies. More specifically, I would like to ask if you could participate in an online interview, as part of my PhD research.

What is the purpose of this research?

The aim of this research is to explore corporate water reporting and water accountability in major listed Chinese companies. The research has two specific goals. Firstly, this research aims to explore the current status of corporate water disclosure in terms of content and quality, along with the motivations behind corporate water disclosure. Secondly, this research will explore stakeholder expectations and perceptions over water-related information disclosure in Chinese companies.

The findings of this research may be used for academic publications and presentations.

How was I identified and why am I being invited to participate in this research?

Identify participants in each stakeholder group:

Managers: senior-level managers responsible for corporate water disclosure or who are responsible for making the water-related targets and goals of companies listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange.

Government: managers from the administration department with the authority to influence and enforce the environmental regulations.

Stock exchange: managers from the regulatory commission responsible for setting out the environmental disclosure rules for listed companies.

Shareholders: managers from representative shareholder associations in China, such as the China Association for Public Companies and the Asset Management Association of China.
Employees: individuals from appropriate union and associations representing the workers from listed companies.
Academia: Academic researchers from China's top universities focusing on accounting research about corporate sustainability development and corporate environmental disclosures.
Media: journalists and chief editors working in business and financial media to report business information disclosures and corporate impact on the environment.
NGOs: managers from Chinese local environmental NGOs focusing on the corporate impact on the local environment and managers from international brand environmental NGOs operating in China.

Each respondent type will just get one of these below.

Managers: you are part of this research project because you have been considered as a report preparer that has an impact on the company's water-related information disclosure and corporate water accountability.

Government: you are part of this research project because you have been considered as an environmental regulator that has the authority to promulgate water-related laws and to impact the corporate water-related information disclosure.

Stock exchanges/standard setters: you are part of this research project because you have been considered as a standard setter that has an impact on setting standards for listed companies to disclose water-related information and corporate water accountability.

Shareholders: you are part of this research project because you have been considered as an important stakeholder represent the shareholders from listed companies. Your role can influence companies' water-related information disclosure and corporate water accountability.

Union: you are part of this research project because you have been considered as an important stakeholder represent employees from listed companies. Employees has an impact on companies' water-related information disclosure and corporate water accountability.

Academia: you are part of this research project because you have been considered as an important stakeholder represent the academia in corporate environmental disclosure and sustainable development research. Your role can influence companies' water-related information disclosure and corporate water accountability.

Media: you are part of this research project because you have been considered an important stakeholder represent the public. Your role can influence companies' water-related information disclosure and corporate water accountability.

NGOs: you are part of this research project because you have been considered an influential stakeholder represent the society. Your role can influence companies' water-related information disclosure and corporate water accountability.

How do I agree to participate in this research?

You need to let me know by accepting the invitation and send your response back to me. Next, a consent form will be sent to you through email, and you need to complete and return it to me before the interview. In addition, you can verbally give your consent and it will be recorded during our conversation before the interview start.

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

What will happen in this research?

This research project involves a semi-structured interview. You will answer questions during the interview. The interview will be conducted online by any means convenient to you. The interview takes approximately 45–90 minutes and is very informal. I am simply trying to capture your thoughts and perceptions on Chinese companies' water-related information disclosure. Your responses to the questions will be kept confidential.

What are the discomforts and risks?

All interview questions are predesigned. The purpose of the questions is to explore your thoughts and opinions on water-related information disclosure and corporate water accountability. Providing answers to the questions should not cause any discomforts and risks. Your identity and that of your organisation will always be kept confidential throughout the whole process of this research. Your answers will only be used to answer my research questions and will be aggregated with other responses in the analysis, therefore your responses cannot be identified at any level.

What are the benefits?

This interview is an important part of my PhD research project, your participation will be a valuable addition to my research. Also, the findings of this research could extent the current knowledge and global understanding of corporate water accounting and water accountability in the Chinese business context. You can also get a summary of the findings for you information.

How will my privacy be protected?

Full confidentiality will be given. Your personal details will be kept confidential. Interview information will be assigned a number/letter code to help ensure that your personal information is not revealed during the analysis and write up findings.

What are the costs of participating in this research?

Only a bit of your time. The interview will take approximately 45–90 minutes to complete.

What opportunity do I have to consider this invitation?

You will have two weeks to consider this invitation.

Will I receive feedback on the results of this research?

If you would like to receive feedback on the results of this research, please tick the appropriate box in the consent form, and I will send a one or two page summary of the findings to you on request.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor,

Professor Chris van Staden, Chris.vanstaden@aut.ac.nz, (+649) 921 9999 ext. 6524

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, *ethics@aut.ac.nz* , (+649) 921 9999 ext 6038.

Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference.

You are also able to contact the research team as follows:

Researcher Contact Details: justin.zhu@aut.ac.nz

Project Supervisors Contact Details: chris.vanstaden@aut.ac.nz***;*** mahmood.momin@aut.ac.nz

Approved by the Auckland University of Technology Ethics Committee on *5 July 2022*, AUTEC Reference number *22/65*.

Appendix E – Consent form in both English and Chinese

For use when interviews are involved.

Project title: ***Corporate accounting and accountability for water in a Chinese context***

Project Supervisor: ***Professor Chris van Staden***

Researcher: ***Justin Zhu***

- ○ I have read and understood the information provided about this research project in the Information Sheet dated 7 September 2023.
- ○ I have had an opportunity to ask questions and to have them answered.
- ○ I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- ○ I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.
- ○ I understand that if I withdraw from the study then I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.
- ○ I agree to take part in this research.
- ○ I wish to receive a summary of the research findings (please tick one): Yes○ No○

Participant's signature: .....

Participant's name: .....

Participant's Contact Details (if appropriate):

.....

.....

.....

.....

Date: ***Approved by the Auckland University of Technology Ethics Committee on 5 July 2022 AUTEC Reference number 22/65***

Note: The Participant should retain a copy of this form.

同意书

项目名称: ***中国背景下的企业会计与水资源问责制***

项目主管: ***Professor Chris van Staden***

研究员: ***Justin Zhu***

- O 我已阅读并且理解在日期为年 9 月 7 日 2023 的信息表中提供的关于该研究项目的信息。
- O 我有机会提出问题并且得到回应。
- O 本人理解在访问期间将做笔记，并且录音和转录这些笔记。
- O 我明白参加这项研究是自愿的（本人的选择），我可以在任何时候退出这项研究而不会在任何方面处于不利地位。
- O 我明白，如果我退出研究，那么我将会获得选择，是删除属于我的任何可识别数据，还是允许其继续被使用。然而，一旦研究结果产生，那么删除我的数据可能是不行的。
- O 我同意参加这项研究。
- O 我希望收到研究结果的概要 (请选择一个): 是O 否O

参与者的签名： .....

参与者的姓名： .....

参与者具体的联系方式 （如果有的话）：

.....

.....

.....

.....

日期：

Approved by the Auckland University of Technology Ethics Committee on 5 July 2022 AUTEC Reference number 22/65

注：参与者须保留一份此表格。

Oral Consent Protocol

For use when interviews are being conducted by videoconference.

Project title: ***Corporate accounting and accountability for water in a Chinese context***

Project Supervisor: ***Professor Chris van Staden***

Researcher: ***Justin Zhu***

The participant joins the videoconference

- ○ Do you agree to my recording your consent to participate?

If they agree, then the record function will be activated and they will be asked the following:

- ○ Have you read and understood the information provided about this research project in the Information Sheet dated 7 September 2023?
- ○ Do you have any questions about the research?
- ○ Do you understand that notes will be taken during the interviews and that the interview will also be audio-recorded and transcribed?
- ○ Do you understand that taking part in this study is voluntary (your choice) and that you may withdraw from the study at any time without being disadvantaged in any way.?
- ○ Do you understand that if you withdraw from the study then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used? However, once the findings have been produced, removal of your data may not be possible.
- ○ Do you agree to take part in this research?
- ○ Do you wish to receive a summary of the research findings? (please tick one): Yes○ No○
- ○ Do you want me to send you a copy of the audio recording for this consent? Yes○ No○
- ○ Please confirm you name and contact details

Participant's name: ……

Participant's Contact Details (if appropriate):

……

……

……

……

I will now turn off the recording of the Consent and then will start a separate recording for the interview.

Approved by the Auckland University of Technology Ethics Committee on 5 July 2022 AUTEC Reference number 22/65

Note: The Participant should retain a copy of this form.

口头同意协议

项目名称: **中国背景下的企业会计与水资源问责制**

项目主管: **Professor Chris van Staden**

Dr Mahmood Ahmed Momin

研究员: Justin Zhu

与会者加入视频会议

- 你同意我对以下内容进行录音吗?
- *如果他们同意，便会启动录音功能，并询问他们以下问题:*
- 您是否已阅读并理解日期为 2023 年 9 月 7 日的信息表中关于该研究项目的信息?
- 你对这项研究有什么问题吗?
- 你是否了解在面试过程中会做笔记，面试也会进行录音和转录?
- 您是否理解参加本次研究是自愿的(您的选择)，您可以在任何时候退出研究而不会在任何方面处于不利地位。?
- 您是否理解，如果您退出研究，那么您将被提供一个选择，是删除属于您的任何可识别数据，还是允许其继续使用?然而，一旦研究结果产生，删除您的数据将会是不可能的。
- 你同意参加这项研究吗?
- 你希望收到研究结果的摘要吗?(请选一个): 是〇　　否〇
- 你想让我寄给你一份录音的副本作为同意吗? 是〇　　否〇
- 请确认您的姓名和联系方式

参与者的名字：.....

参加者联络资料(如适用):

.....

.....

.....

.....

现在我将关闭同意书的录音，然后开始为采访进行单独的录音。

由奥克兰科技大学伦理委员会批准，2022 年 7 月 5 日参考编号类型为 22/65

注:参赛者须保留一份此表格

Appendix F – Information on interviewees

Participant group	Code	Work position	Interview date	Interview time (in minutes)
Information providers and preparers	M1	Senior manager	03/08/2022	26:21
	M2	Senior manager	18/11/2022	34:01
	M3	Senior manager	18/11/2022	20:53
	M4	Senior manager	18/11/2022	23:15
	M5	Senior manager	18/11/2022	13:46
	M6	Senior manager	18/11/2022	14:06
	M7	Senior manager	25/11/2022	21:03
	M8	Senior manager	08/12/2022	23:39
	M9	Senior manager	14/12/2022	12:04
	M10	Senior manager	17/12/2022	19:25
	M11	Senior manager	22/12/2022	23:24
	M12	Senior manager	22/12/2022	17:34
	M13	Senior manager	14/02/2023	28:31
	M14	Senior manager	16/02/2023	18:23
	M15	Senior manager	16/02/2023	10:04
	M16	Senior manager	06/03/2023	15:41
	M17	Senior manager	06/03/2023	12:45
	M18	Senior manager	07/03/2023	27:53
	M19	Senior manager	07/03/2023	14:53
	M20	Senior manager	07/03/2023	17:04
	M21	Senior manager	08/03/2023	18:26
Regulators (government officials)	G1	Government official	15/11/2022	18:34
	G2	Government official	14/12/2022	32:16
	G3	Government official	16/02/2023	26:06
	G4	Government official	17/02/2023	17:54
	G5	Government official	20/02/2023	17:32
Shareholders and stock exchange managers	SH1	Shareholder	03/08/2022	32:40
	SH2	Shareholder	18/11/2022	16:64
	SH3	Shareholder	18/11/2022	30:01
	SH4	Shareholder	22/11/2022	42:10
	SH5	Shareholder	23/11/2022	18:15
	SH6	Shareholder	29/03/2023	31:32

	SE1	Stock exchange manager	01/03/2023	22:52
	SE2	Stock exchange manager	06/05/2023	47:46
Other stakeholders	E1	Employee union manager	21/12/2022	24:39
	E2	Employee union manager	21/12/2022	17:04
	E3	Employee union manager	21/12/2022	8:42
	E4	Employee union manager	21/12/2022	23:41
	E5	Employee union manager	05/01/2023	17:52
	E6	Employee union manager	05/01/2023	20:17
	E7	Employee union manager	06/03/2023	20:06
	E8	Employee union manager	07/03/2023	27:53
	A1	Academia	16/09/2022	23:04
	A2	Academia	16/09/2022	52.16
	A3	Academia	17/12/2022	20:34
	A4	Academia	18/12/2022	18:55
	A5	Academia	19/12/2022	46:21
	MEDIA1	Journalist & Editor	06/12/2022	27:51
	MEDIA2	Journalist & Editor	22/12/2022	17:53
	MEDIA3	Journalist & Editor	13/01/2023	38:08
	MEDIA4	Journalist & Editor	14/01/2023	18:02
	MEDIA5	Journalist & Editor	14/01/2023	30:43
	MEDIA7	Journalist & Editor	19/02/2023	30:08
	NGO1	NGO manager	14/12/2022	30:30

Appendix G1 – Reporting Frameworks adopted by companies listed on the Shanghai Stock Exchange (SSE)

Appendix G1

Reporting Frameworks adopted by companies listed on the Shanghai Stock Exchange (SSE)

	International				Domestic				
Sectors	GRI	ISO 26000	Ten Principles of the UNGC	UN SDGS	ESG	CASS-CSR3.0/4.0*	GB/T 36001: Guidance for CSR Reporting	Guidelines on Environmental Information Disclosure	Guidelines for preparing CSR report
Energy (E)	E1, E2, E4, E5, E6, E7, E9	E7, E10	E2, E6, E9		E1, E2, E3, E5, E6, E7, E8, E10	E5, E4*, E6*	E4	E2, E3, E4, E6, E7, E8, E9	E1, E3,
Materials (M)	M2, M3, M5, M6, M7, M8	M7	M7	M2	M1, M3, M6, M8	M1*, M3*, M5, M6*, M7*	M3, M6	M2, M3, M5, M6, M8, M10	M1, M5, M6
Industrials (I)	I2, I3, I5, I6, I7, I8, I9, I10	I3, I5, I6, I8, I10	I7	I8	I2, I6, I7, I10	I3*, I5, I6*, I8*, I10*	I3, I5, I7	I2, I6, I7	I4, I5, I8, I9, I10
Consumer Discretionary (CD)	CD3, CD6, CD7	CD6, CD7			CD3, CD4, CD6, CD7	CD2*, CD3*	CD6, CD7	CD2, CD3, CD4, CD5, CD6	CD2
Consumer Staples (CS)	CS3, CS8	CS3, CS6	CS3		CS6, CS8	CS3*, CS6	CS3	CS3, CS8	CS6, CS8, CS9
HealthCare (H)	H2, H3, H4				H2, H3, H4	H3*, H4*, H8*	H3, H4	H3, H6, H8	H6
IT (IT)	IT2			IT2		IT4, IT10		IT4	
Telecommunication Services (TS)	TS1, TS2, TS6, TS8				TS2, TS10	TS2*, TS8	TS6	TS1, TS6, TS8, TS10	TS1, TS2
Utilities (U)	U1, U2, U3, U4, U5, U10	U1, U2	U4		U5, U9, U10	U1*, U2, U3*, U7, U8*	U1, U2	U3, U4, U7, U8, U10	U2, U7, U9
Financials (F)	F1, F2, F4, F5	F1, F2, F3	F1		F1, F2, F3, F4, F5	F3	F3	F1, F2	F1, F2

Appendix G2 – Reporting frameworks adopted by companies listed on the Shenzhen Stock Exchange (SZSE)

Appendix G2

Reporting Frameworks adopted by companies listed on the Shenzhen Stock Exchange (SZSE)

	International				Domestic				
Sectors	GRI	ISO 26000	Ten Principles of the UNGC	UN SDGS	ESG	CASS-CSR3.0/4.0 *	GB/T 36001: Guidance for CSR Reporting	CSR Disclosure Requirements/Instructions issued by the SZSE	Guidelines for Standardized Operation of Listed Companies on the Main board of SZSE
Energy (E)	E6				E7				E6, E7
Materials (M)	M3, M5, M6, M10	M3, M6			M4, M9	M3*, M5*, M6*, M9*	M3, M4, M5, M6, M9	M5	M4, M9
Industrials (I)	I4, I5, I7	I4, I5, I7	I5	I5	I4, I7	I4, I5*	I5, I7	I2, I5, I7	I4, I5
Consumer Discretionary (CD)	CD2, CD3, CD4, CD5, CD7	CD2, CD3	CD2, CD7	CD2	CD2	CD2*, CD3, CD4, CD5*, CD7*	CD3, CD4, CD7	CD2, CD3, CD8	CD1, CD5, CD7, CD8
Consumer Staples (CS)	CS1, CS3. CS4	CS3, CS4	CS4		CS4, CS5	CS1*, CS4*, CS5*	CS4	CS5	CS2, CS4, CS6
HealthCare (H)	H2, H3, H8, H10	H2	H2			H2, H3*, H10	H2, H3, H9	H3, H8, H10	H1, H2, H6, H9
IT (IT)	IT1, IT3, IT6, IT8	IT6, IT10	IT6			IT8, IT10*	IT10, IT10*	IT3, IT6, IT10	IT1, IT8
Telecommunication Services (TS)	TS1	TS1		TS3	TS1, TS3			TS2, TS3, TS9	TS2, TS8, TS9
Utilities (U)	U2, U6	U6				U2	U6	U2, U6	U8
Financials (F)	F2	F2			F1	F2	F2	F1, F2	

Appendix H – The revised corporate water disclosure index

Disclosure categories and definition	Disclosure items	Scoring approach
A. Water policy Corporate water policy refers to mechanisms that allow companies to integrate decisions about water use and discharge into their core management processes and business planning. Many companies disclose water policy that support corporate water-related decision making and enhance accountability.	A1. The company disclose information on their corporate water policy/statement relating to water consumption, discharge, wastewater treatment, pollution, and wastewater recycling and reuse. The policy includes information on water-related targets and goals and water-related strategy.	A 4-point scale (0–3) will be used for measuring the disclosure comprehensiveness: 0 = no information disclosed. 1 = briefly mentioned about water policy (i.e., the company has an existing water policy in place, but no detail about the policy). 2 = detail water policy (i.e., water policy was clearly described in the corporate reports, with any water-related targets, goals and strategies (including both qualitative and quantitative information)). 3 = excellent (i.e., the company has an extended water statement/policy, with the detail of water-related targets, goals and water-related strategies (including both qualitative and quantitative information), and the design of water policies complies with local or international regulatory requirements.
B. Water consumption Water consumption is an essential element in corporate water disclosures because it reflects a company's overall water	B1. Description of water consumption including water quality and the total volume of water consumption (in megalitres or cubic metres). B2. Water consumption per unit of product, wate consumption per dollar	A 5-point scale (0–4) will be used for measuring the comprehensiveness of the disclosures: 0 = no information disclosed. 1 = an information item disclosed with minimum coverage and discussion about the issue. Information disclosed only in general terms (i.e., narrative only).

Disclosure categories and definition	Disclosure items	Scoring approach
usage during production and operation.	of revenue, or another operational measure to reflect water intensity. B3. Change in water consumption (in monetary terms or physical quantities). B4. Total cost of water consumed or used (in monetary terms). B5. Water withdrawal by source type (municipal water supply/private water supply/recycling/natural environment sources (including rainwater, river water, lake water, oceanwater or underground water)) and location.	2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but there is no explanation putting the issue in perspective. 3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets). 4 = truly extraordinary, benchmarking against best practice (i.e., GRI or other standards/guidelines, industry averages, regulatory requirements/guidelines).
C. Wastewater generated and discharged Discharge refers to a company's water release (output). In most cases, when water has been used, and there is no further need for it, it is treated and discharged as wastewater.	C1. Description of wastewater generated and discharged (i.e., how wastewater is produced and discharged) and the total volume of wastewater generated and discharged (in megalitres or cubic metres). C2. Wastewater discharged by destination (i.e., municipal sewage treatment facilities/independent sewage	A 5-point scale (0–4) will be used for measuring the comprehensiveness of the disclosures: 0 = no information disclosed. 1 = an information item disclosed with minimum coverage and discussion about the issue. Information disclosed only in general terms (i.e., narrative only). 2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but there is no explanation putting the issue in perspective.

Disclosure categories and definition	Disclosure items	Scoring approach
If wastewater is not treated it may then cause pollution.	treatment/self-treatment facilities/natural water body) and location. C3. Change in the cost of water discharged (in monetary terms) or in physical quantities of wastewater discharged. C4. Description of contaminants contained in wastewater (i.e., COD, BOD, HOD, physical pollutants, nitrogen and phosphorus compounds).	3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets). 4 = truly extraordinary, benchmarking against best practice (i.e., GRI or other standards/guidelines, industry averages, regulatory requirements/guidelines).
<u>D. Wastewater treatment</u> Wastewater treatment is used to deal with wastewater of reduced quality. Understanding a company's treatment of wastewater reveals its approach to avoid potential damage to the environment.	D1. Description of wastewater treatment (i.e., describe the process of wastewater treatment) and the total volume of wastewater treatment (in megalitres or cubic metres) and any changes in wastewater treatment (in physical quantities). D2. Total cost invested in wastewater treatment (in monetary terms).	A 5-point scale (0–4) will be used for measuring the comprehensiveness of the disclosures: 0 = no information disclosed. 1 = an information item disclosed with minimum coverage and discussion about the issue. Information disclosed only in general terms (i.e., narrative only). 2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but there is no explanation putting the issue in perspective.

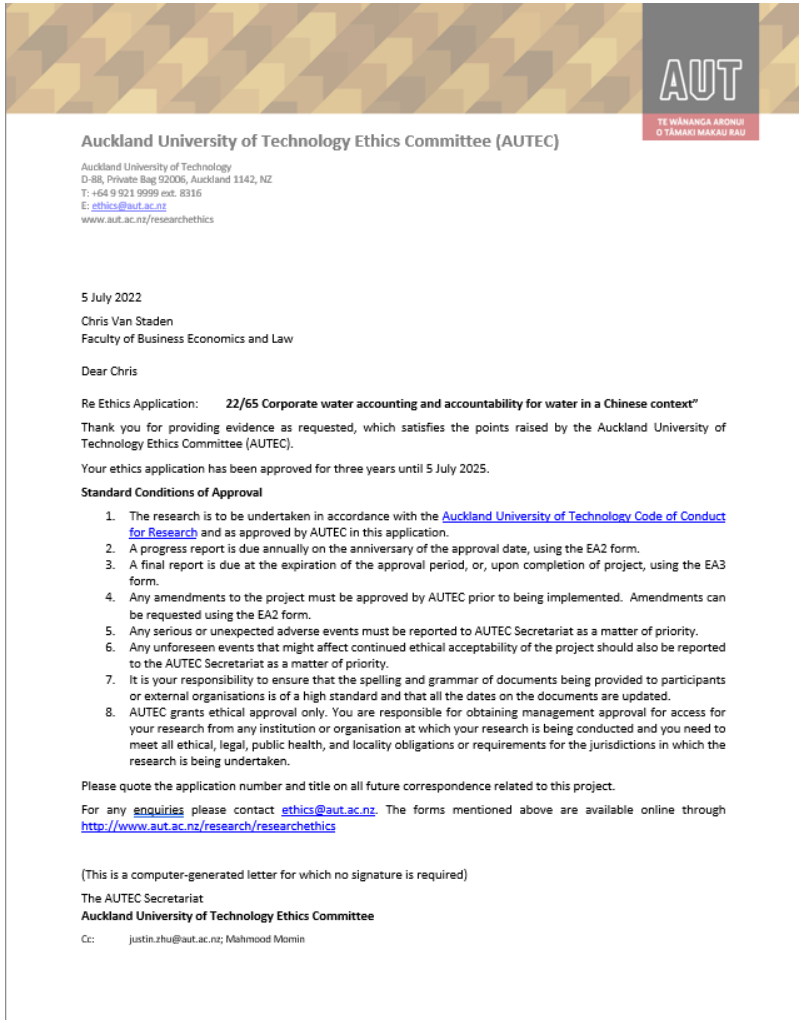
Disclosure categories and definition	Disclosure items	Scoring approach
		3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets). 4 = truly extraordinary, benchmarking against best practice (i.e., GRI or other standards/guidelines, industry averages, regulatory requirements/guidelines).
E. Water reuse Water d reused indicate a company's reuse of water resources.	E1. Description of water reused (i.e., method and total volume of water reused). E2. Total volume of water reused as a percentage of the total water consumption. E3. Change in the cost of water reused (in monetary terms) and in the physical quantities of water reused, or in a percentage increase/decrease. E4. Total cost invested in water reuse activities (in monetary terms).	A 5-point scale (0–4) will be used for measuring the comprehensiveness of the disclosures: 0 = no information disclosed. 1 = an information item disclosed with minimum coverage and discussion about the issue. Information disclosed only in general terms (i.e., narrative only). 2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but there is no explanation putting the issue in perspective. 3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets). 4 = truly extraordinary, benchmarking against best practice (i.e., GRI or other standards/guidelines, industry averages, regulatory requirements/guidelines).
F. Information assurance Information assurance is the practice of assuring the	F1. Assurance provider (external/internal assurance, and the name of the assurance provider).	A 3-point scale (0–2) is designed for measuring the index item F1 under the disclosure category of information assurance (F). 0 = no information on assurance.

Disclosure categories and definition	Disclosure items	Scoring approach
quality (i.e., overall integrity and credibility) of water-related information contained in the corporate reports.	F2. Assurance scope (identifying if water disclosure is included in the assurance scope). F3. Assurance opinion (the assurance opinion in the assurance report. For example, limited/reasonable assurance opinion). F4. Assurance standards (whether the assurance process/standard is disclosed in the assurance report).	1 = internal assurance: information assured by the company itself through its internal process. 2 = external assurance: information assured by a domestic accounting firm, domestic consultant group or NGOs. 2 = information assured by the Big 4 accounting firms, international consulting firms or international NGOs. A 2-point scale (0–1) is designed for measuring the index item F2 under the disclosure category of information assurance (F). 0 = no indication of the assurance scope or assurance does not include water information. 1 = assurance include water information. A 3-point scale (0–2) is designed for measuring the index item F3 under the disclosure category of information assurance (F). 0 = no opinion specified. 1 = limited assurance opinion (moderate). 2 = reasonable assurance opinion (high). A 2-point scale (0–1) is designed for measuring the index item F4 under the disclosure category of information assurance (F). 0 = no indication of the assurance process and standard.

Disclosure categories and definition	Disclosure items	Scoring approach
		1 = assurance standards were disclosed in the report.
G. Water risks Water risks deal with company's exposure to water risk factors, including water scarcity.	G1. Description on water-related risks (i.e., physical water risks in quantity and quality, reputational, regulatory and regional risks).	A 4-point scale (0–3) is designed for measuring the index items G1–G5 under the disclosure category of water risk (G). 0 = no information disclosed. 1 = an information item disclosed with minimum coverage and discussion about the issue. Information disclosed only in general terms (i.e., narrative only). 2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but there is no explanation putting the issue in perspective. 3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets).
H. Other water disclosures This category is designed to capture other possible water-related issues which could be find during the analysis of reporting.	H1. Information on stakeholder engagement with regard to water issues. H2. Water information on community projects and environmental initiatives (i.e., helping consumers to improve their water usage, repairing and restoring community water,	A 4-point scale (0–3) will be used for measuring the comprehensiveness of the disclosures: 0 = no information disclosed. 1 = an information item disclosed with minimum coverage and discussion about the issue. Information disclosed only in general terms (i.e., narrative only).

Disclosure categories and definition	Disclosure items	Scoring approach
	responding to accidents and spills or investing and building community water infrastructure and facilities).	2 = an information item disclosed in quantitative terms (i.e., in monetary terms or physical quantities), but there is no explanation putting the issue in perspective. 3 = the impacts of the item were clearly defined in quantitative terms complemented with explanations and other information putting the item in perspective (i.e., comparative information, tracking against aims and budgets).

Appendix I – AUTEC Approval Letter



Auckland University of Technology Ethics Committee (AUTEC)

Auckland University of Technology
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T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

5 July 2022

Chris Van Staden
Faculty of Business Economics and Law

Dear Chris

Re Ethics Application: **22/65 Corporate water accounting and accountability for water in a Chinese context"**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 5 July 2025.

Standard Conditions of Approval

1. The research is to be undertaken in accordance with the Auckland University of Technology Code of Conduct for Research and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard and that all the dates on the documents are updated.
8. AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted and you need to meet all ethical, legal, public health, and locality obligations or requirements for the jurisdictions in which the research is being undertaken.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact ethics@aut.ac.nz. The forms mentioned above are available online through http://www.aut.ac.nz/research/researchethics

(This is a computer-generated letter for which no signature is required)

The AUTEC Secretariat
Auckland University of Technology Ethics Committee

Cc: justin.zhu@aut.ac.nz; Mahmood Momin