

Study of Carbon Disclosure and Its Differences Between Different Countries Based on the Case of Energy Company Shell

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Abstract. Low carbon sustainable development is a popular issue in contemporary economic development, after the Kyoto agreement was signed, various countries around the world invested in the establishment of a carbon trading market and the system of carbon information disclosure system. For the research on carbon information disclosure, the current researchers focus more on accounting issues such as how to recognize and measure, however, there is a lack of uniform regulations on how to disclose carbon information for multinational enterprises. Therefore, this article takes Shell as an example to investigate the differences in carbon information disclosure standards between China and the UK by analyzing the differences between its carbon information disclosure in the UK and China. It is discovered that China is in the initial stage of establishing both the carbon market and carbon information disclosure, while the UK, as a developed country, has formed a relatively perfect carbon information disclosure system, in addition to the different attitudes of Chinese and foreign media. In order to establish a comprehensive carbon information disclosure standard in China, government policies, media support and corporate actions are needed to eliminate the inequality of carbon information disclosure among multinational companies.

Keywords: Carbon Accounting; Carbon Disclosure; Multinational Companies; Energy Industry.

1. Introduction

The constant pursuit of speedy economic development, globalization and ever-increasing energy demands has led to the production and release of a large number of pollutants, emissions and exhaust gases into the spaces where people live (Gulia et al., 2015, as cited in Gautam & B. Bolia, 2020), all of which are the invisible hands behind global climate change. Climate change is leading to an increase in the frequency of extreme weather events and the resulting increase in health problems such as death and disease, with 250,000 people expected to die each year from extreme weather events in the next two decades (WHO: Climate Change and Health, n.d.). As the impacts of climate change are significant and long-term, countries are adapting to low carbon and energy efficient solutions in their response to global climate change.

In order to address global warming, a series of international treaties were negotiated between countries, culminating in the adoption and signing of the Kyoto Protocol and the Paris Agreement, after which countries began to fulfill their low carbon emission commitments. The IPCC's goal that the world must limit temperature rise to 1.5°C is a call for the world to achieve net-zero emissions of carbon dioxide (CO₂) before 2050, a goal often referred to as "achieving carbon neutrality" (Wei et al., 2018). The carbon neutrality target has important implications for energy companies whose main business is oil and gas, requiring more and more detailed disclosure of relevant carbon information in each report.

The energy industry has always been the most important source of greenhouse gas emissions. In the period 2016 to 2018, the total CO₂ emissions from the oil extraction and refining sector rose slightly from 1200 million tons to 1250 million tons (Lei et al., 2021). Shell, which is one of the world's largest companies, is an oil and gas energy company involved in all supply chain verticals. According to Shell plc (Sustainability Report 2021, 2021), Shell's greenhouse gas emissions between 2016 and 2018 were 72 Mt, 73 Mt and 71 Mt respectively. To sum up, Shell's total greenhouse gas emissions account for between 5% and 6% of the industry as a whole. As a multinational energy

company with a global presence in over 70 countries, Shell's carbon emissions and disclosure of carbon information have come under scrutiny in the context of the implementation of the UN Paris Agreement.

With the continuous improvement and development of the carbon trading market, carbon accounting and carbon information disclosure have received attention from domestic and international researchers, but the current literature focuses on the recognition and measurement of carbon emission rights and other accounting treatments. There are no clear guidelines or regulations on carbon information disclosure internationally, and there are differences in the way and content of carbon information disclosure among countries, which leads to possible information asymmetry in the disclosure of carbon information by multinational enterprises. Based on the above considerations, this paper takes Shell as an example to explore the differences in carbon information disclosure among subsidiaries of multinational enterprises in various countries, and enhance the uniformity, standardization, reliability and relevance of carbon information disclosure of international companies, with a view to helping to establish a perfect and suitable carbon accounting disclosure system for multinational enterprises.

2. Literature review

2.1 Carbon emission trading

To deal with the threat of climate change, various measures to reduce global greenhouse gas emissions have been developed, including carbon emission trading (Bulkeley., 2014). However, the usefulness of carbon trading seems to be controversial at the moment. On the one hand, a strong economic argument indicates that carbon trading is an effective instrument for mitigating climate change (OECD, 2016). On the other hand, both in practice and in theory, there are still various problems with carbon trading mechanisms (Aldy & Stavins, 2012).

The effect and role of carbon trading mechanisms seem to be different in different national and regional carbon markets. A number of scholars have begun to investigate carbon trading systems in different regions. Pearse (2014) investigates Australia's carbon trading scheme and suggests that just carbon trading should reduce emissions and distribute the burden fairly, and that Australia's carbon trading scheme does not meet this criterion. In addition, carbon trading system is used as an alternative program in California, similarly, carbon trading programs in the EU cover only 45% of European greenhouse gas emissions (Bang et al., 2017). Nevertheless, the situation in China is different. Biedenkopf, Van & Walker (2017) indicate that China's carbon trading program is the most prominent case in the global carbon market, as China will begin to transform its seven carbon trading pilot programs into a national pilot program sometime in 2017, thus becoming the world's largest carbon market.

At present, the major global carbon emission trading systems are European Union Greenhouse Gas Emission Trading Scheme (EU ETS), China's Carbon Emission Trading System (CN ETS), California Cap-and-Trade Program (California CAT), and New Zealand Emissions Trading Scheme (NZ ETS). As strong links have been established between carbon markets in different countries or regions around the world (Flashland et al., 2009), different carbon emission trading systems are influenced by each other. Among them, the experience of the EU ETS has had a prominent impact on the practice of other countries. For instance, from a positive perspective, California has referenced various design attributes of the EU ETS and incorporated them into its own design (Biedenkopf et al., 2017). From a negative perspective, Australia has been auctioning off some of its emission rights since the beginning, recognizing its initial free allocation of permits was not beneficial to the EU (Biedenkopf et al., 2017). Furthermore, as mentioned above, with the development of China's ETS, many countries similar to China may emerge in Southeast Asia to learn from China and evolve a new blueprint (Lederer, 2014).

2.2 Accounting information disclosure

The strength of carbon emission regulation depends on the quality of accounting disclosure to a certain extent. Therefore, this article also reviews the literature related to accounting disclosure of different countries. The current literature mainly analyzes the accounting disclosure requirements in five countries - China, the United States, Japan, the United Kingdom and Canada.

From the perspective of accounting information disclosure regulations, only China and the U.S. have mandatory disclosure requirements among the five countries, while the other three countries mainly adopt voluntary disclosure. The U.S. mandated disclosure of environmental accounting information in the financial statements of public companies as early as 1973 and further refined it in 1993, requiring companies to disclose accounting information on environmental costs, environmental compensation and environmental liabilities, respectively (Shen & Chen, 2020). In China, the government is relatively strict about environmental accounting information disclosure, requiring polluting companies to disclose information, and for companies that exceed standards, the information disclosure requirements are even stricter (Shen & Chen, 2020). Different from China and U.S., Japan and the UK are relatively similar in their approach, in addition to issuing Environmental Reporting Guidelines and Environmental Accounting Guidelines, they have created national competitions and awards, thereby providing incentives for companies to voluntarily disclose high-quality environmental accounting information (Xu & Wu, 2012). Although Canada is also primarily based on voluntary disclosure, its approach differs from that of the UK and Japan. Canada advocates that companies choose different disclosure methods to provide environmental accounting information in response to the information needs of different stakeholders, thus making the reports more precise (Xu & Wu, 2012).

In terms of the way accounting information is disclosed, all five countries choose financial reports as the main disclosure method, while the content of the information disclosed differs among all five countries. In the UK, companies voluntarily disclose relevant accounting information, mainly in accordance with guidelines issued by the government, the quantitative part of which relates to environmental costs and liabilities (Lai, 2016). In U.S., in addition to disclosing environmental accounting information through financial reports, American companies also disclose accounting information through other means such as online media and press conferences, which are similar to those in the United Kingdom and Canada (Fu, 2018). Japanese companies are different from those in the first three countries as the government does not compel companies to disclose environmental reports, but due to a good incentive and institutional environment, the percentage of Japanese companies disclosing environmental reports is significantly high (Fu, 2018). In the reports of Japanese companies, a relatively detailed classification of accounting information is required, with many other sub-categories under the two main sections of environmental benefits and environmental costs (Lai, 2016). China is still significantly different from the other four countries, Chinese companies mainly disclose environmental accounting information in five ways: annual financial reports, sustainability reports, social responsibility reports, environmental, social and regulatory reports and environmental reports, among which, except financial reports, companies disclose environmental accounting information primarily in social responsibility reports (Shen & Chen, 2020). Moreover, Zhang (2018) indicates some problems with accounting disclosure in China by conducting a case study of Sinopec, such as the lack of voluntariness of disclosure by companies, and therefore tend not to disclose negative environmental accounting information timely and completely.

2.3 Carbon information disclosure

In order to deal with climate change, a non-profit organization called Carbon Disclosure Project (CDP), that tries to standardize environmental reporting and risk management, and promote disclosure, insight and action to achieve a sustainable economy, was established. In 2021, more than 14,000 organizations disclose their carbon information through CDP. The current literature analyzes the situation of carbon information disclosure of companies participating in CDP in different countries. Jiang et al. (2021) find that among companies participating in the CDP in China, Brazil,

the US, Russia and India, the higher the company value, the more carbon information is disclosed, and this positive relationship is stronger in developing countries. They also find that large emitters with full carbon information disclosure have smaller negative valuations compared to firms with insufficient carbon information disclosure. Similarly, Jaspreet, Annie & Raymond (2022) suggest that among the Global 500 listed companies, the higher the market value, the more likely they are to voluntarily disclose carbon information, although such voluntary disclosure is not standardized. In addition, Freedman & Jaggi (2011) investigate GHG reporting in Europe, the US, Canada, Japan and India, and indicate that companies located in the area that have ratified the protocol tend to disclose more carbon information, excluding Indian companies.

Specifically, Peng, Sun & Luo (2015) first analyzed the annual CSR reports of listed companies in China from 2008 to 2012, indicating that companies with high emissions and those with high sales rankings in their industries are more likely to disclose carbon information. Jaggi et al. (2018) then conducted a study on Italian listed companies and indicate that companies that voluntarily establish environmental committees (EC) are more inclined to disclose carbon information than companies that do not voluntarily establish EC. They also point out that board independence leads companies to disclose more carbon information. Datt, Luo & Tang (2019) analyzed 487 U.S. companies that voluntarily participated in a carbon disclosure program from 2011 to 2012, showing that better carbon performers tend to disclose more key carbon information items, such as external verification and carbon accounting, and services and goods that avoid GHG emissions, to show their authenticity.

2.4 Summary

The existed literature mainly analyzes and investigates the carbon emission trading, accounting disclosure and carbon information disclosure of enterprises or organizations in the EU, China, the US and other countries or regions. Specifically, the content and framework of the information disclosed by companies or organizations in these countries or regions and the factors that influence the scale of their disclosure are investigated and analyzed in the current literature. However, the differences in carbon information disclosure in different countries have not been specifically analyzed. Carbon emission trading tends to be globalized, the analysis of the differences of carbon information disclosure in different countries or regions can help promote the development of carbon emission trading and the further development and improvement of carbon market mechanism. Therefore, the rest of this article aims to analyze and describe the differences in carbon information disclosure between China and the UK and provide recommendations based on the findings of the study.

3. Case description

3.1 Company history and background

Royal Dutch Shell is an energy company with worldwide footprints as well as being an international company. Marcus Samuel built up the capital to become a world-class energy company in 1833 by adding the sale of Eastern shells to his original business of selling antiques (Company History | Shell Global, n.d.). After Marcus Samuel's death in 1870, his sons named the company Shell and switched the business to exporting oil. After decades of operation and development, the telegraphic announcement of the combination of Shell Transport and Trading with the Royal Dutch was finally made on 23 April 1907 (Brand History | Shell Global, n.d.). During First World War period, the British Army was mainly supplied with fuel from Shell. During the Second World War Shell joined the RAF war flag in 1939. With 185 years of history under its belt, Shell is now shifting its corporate focus to low-carbon energy systems (History of the Shell Brand | Shell UK, n.d.). Shell dominates the petroleum market. Goey (2002) claimed in his article that in 1940 Shell occupied 46% of the market, although it has declined, it still held 31% of the market in 1997. Meanwhile, Gaghman (2020) asserted that the company has established agencies in over 70 countries worldwide. The leading brand in the UK in 2021, as measured by the value of the brand, is Shell, worth £3.24 billion,

which is higher than second-placed BP by £1.598 billion (Statista: Top UK Brands 2021, 2022). As a result, Shell has a global footprint and is a giant international energy company.

3.2 Current carbon footprint

GHG includes carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (SF₆), sulphur hexafluoride (PFC) and nitrogen trifluoride (NF₃). Shell's greenhouse gas emissions for the last six years were collated by reviewing Shell's Sustainability Report from 2016 to 2021 (as shown in Table 1). Where specific local calculations were available, local calculations were used. If no specific calculation method is available locally, calculations are made using recognized industry standards under the GHG Protocol Corporate Accounting and Reporting Standard compiled by API in 2009. As a result, there may be an error value of around 4% in the data in this table. As shown in Table 1, Shell's total greenhouse gas emissions in 2021 will be 60 million tonnes, of which 58 million tonnes of CO₂ will be emitted. As shown in Table 1, Shell's total greenhouse gas emissions in 2021 and 2020 are 60 million tonnes and 63 million tonnes respectively, with 58 million tonnes and 61 million tonnes of CO₂ emissions respectively. In contrast, methane emissions in 2021 and 2020 are only 55 thousand tonnes and 67 thousand tonnes respectively. During the last six years, CO₂ emissions accounted for approximately 97% of total GHG emissions.

Table 1. Greenhouse Gas Emissions 2016 to 2021

	Unit	2021	2020	2019	2018	2017	2016
GHG emissions	million tonnes CO ₂ e	60	63	70	71	73	72
Carbon dioxide (CO ₂)	million tonnes	58	61	67	69	70	68
Methane (CH ₄)	thousand tonnes	55	67	91	92	123	138
Nitrous oxide (N ₂ O)	thousand tonnes	1	1	1	1	1	1
Hydrofluorocarbons (HFCs)	tonnes	25	30	29	31	22	22
Sulphur hexafluoride (SF ₆)	tonnes	0.01	0.01	0.01	0.03	0.01	2

According to Shell's business classification (What We Do | Shell Global, n.d.), Shell's upstream business mainly includes the exploration and development of crude oil and natural gas and their liquids, which also includes the sale and transportation of oil and gas; its integrated gas business mainly operates and trades in liquid natural gas, renewable energy and carbon credits; its downstream business sells and manages services including but not limited to refining and chemicals for various retail outlets and customers. Table 2 shows a summary of CO₂ emissions by business from 2017 to 2021 in Shell's scope 1, notably the downstream business will emit 32.6 million tonnes of CO₂ in 2021, followed by the integrated gases business with 15.5 million tonnes of CO₂. In contrast, the upstream business, which involves the exploration and extraction of crude oil, emits only 11.7 million tonnes of CO₂.

Table 2. Scope 1: CO₂ emissions by business

CO ₂ emission by business	Unit	2021	2020	2019	2018	2017
Upstream	million tonnes CO ₂ e	11.7	12.8	12.9	14.8	19.6
Integrated Gas	million tonnes CO ₂ e	15.5	14.1	16.3	13	12
Downstream	million tonnes CO ₂ e	32.6	35.8	40.2	42.7	41.1
Refining	million tonnes CO ₂ e	20.1	23.4	28	29.1	27.8
Chemicals	million tonnes CO ₂ e	11	10.8	10.5	11.6	11.4
Other Downstream	million tonnes CO ₂ e	1.4	1.6	1.8	2.1	2

As shown in Figure 2, refining in the downstream business generated 20.1 million tonnes of CO₂, followed by chemicals with 110,000 tonnes, accounting for 62% and 34% of total downstream business CO₂ emissions respectively.

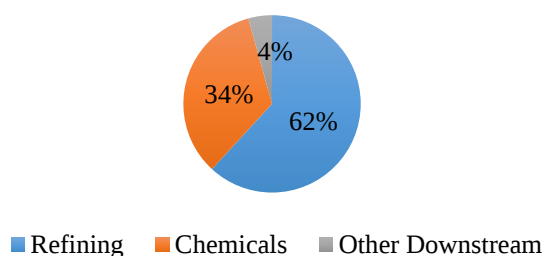


Figure 1. The proportion of CO2 emissions from different downstream business

3.3 Emission reduction

Shell has a commitment to achieving its goal of net zero emissions. Table 3 provides a table of the company's greenhouse gas and energy data for the last six years, based on a summary of the Shell Sustainability Report for the period 2016 to 2021. As can be seen in Table 3, while the net carbon footprint density has remained at 79 g CO₂/ MJ for the first three years, its carbon intensity starts to decrease slightly in 2019. The main factor considered is the inclusion of carbon credits from total GHG emissions from 2019 onwards. So the total greenhouse gas emissions in 2021 are 1,375 Mt CO₂ equivalent and the carbon intensity drops to 77 g CO₂/ MJ. Using 2016 as a foundation, Shell has reduced its carbon intensity by around 5% in 2020, although there is a small rebound in 2021, but it is still on track to meet its target of a 6% to 8% reduction in carbon intensity by 2023.

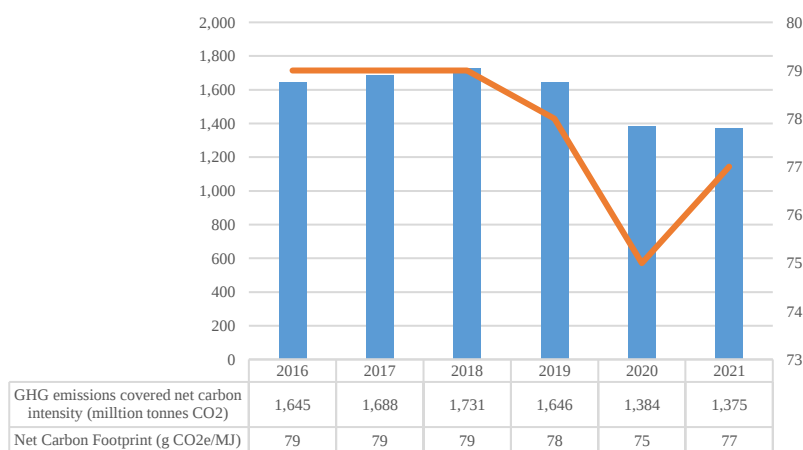


Figure 2. Shell's GHG emissions covered net carbon intensity and carbon intensity trends from 2016 to 2021

At the same time, Shell has set a new growth target for 2021 to achieve net zero emissions by reducing greenhouse gas emissions in scopes 1 and 2 by 50% compared to 2016 net levels in 2030. According to the Shell 2021 Annual Report, Shell is improving the company's footprint across the board, actively seeking additional sales opportunities for low-carbon products and services, including biofuels, solar, hydrogen, offshore wind and electric vehicle charging stations. Shell is actively working in strategic partnerships with customers, businesses, and governments to work together to decarbonize every sector, including carbon-emitting sectors such as aviation and shipping. In addition, Shell is supporting government intervention in decarbonization in the form of economic policies, such as direct government pricing of carbon credits in the carbon trading market.

4. Analysis of case's carbon information disclosure

As a world-leading energy company with 15 years of experience in global carbon trading, Shell (Global) has implemented transparency requirements for its corporate information disclosures, therefore it has a good status of environmental information disclosure. However, there is still value

in studying the status of its carbon information disclosure. For this reason, Shell can be studied and analyzed as a typical case of carbon disclosure by multinational enterprises and the energy industry. Through the analysis of its carbon disclosure situation, it not only can identify the common problems of carbon disclosure that may exist in Shell or most multinational companies at present, but also can serve as a basis for establishing a carbon disclosure system for multinational enterprises in the future.

4.1 Status of carbon disclosure

By reviewing and summarizing information from Shell (UK), Shell (China) and Shell (Global) annual reports, sustainability reports, annual environmental statements and ESG report for 2016-2021, Table 3 was derived. As shown in Table 3, while both Shell (UK) and Shell (Global) have disclosed their carbon information in their annual reports, sustainability reports and annual environmental statements during the six years, Shell (China) has not been represented in any of these reports.

Table 3. Carbon disclosure approach by Shell companies from 2016 to 2021

	2016	2017	2018	2019	2020	2021
Annual Report and Accounts						
UK	√	√	√	√	√	√
China	×	×	×	×	×	×
Annual environmental statement						
UK	√	√	√	√	√	√
China	×	×	×	×	×	×
Sustainability Report						
UK	√	√	√	√	√	√
China	×	×	×	×	×	×
ESG Report						
UK	×	×	×	√	√	√
China	×	×	×	×	×	×

The disclosure of carbon accounting information in the various reports over the years is mainly comprehensively and specifically summarized and disclosed by Shell UK. Shell (UK) has developed its carbon accounting disclosure system, which is discussed and analyzed in each of the company's reports for the last six years in the areas of overall company operations, company achievements for the year, future development plans and corporate social responsibility and environmental information. At the same time, detailed and specific disclosures are made in the annual environmental statement, including greenhouse gas emissions, energy transition and related company activities and policies. This indicated that Shell (UK) did not have a clear unit of disclosure for relevant carbon information in its annual report, but was more scattered among other items in the report.

More detailed disclosure of carbon information is provided in the Annual Environmental Statement, the Sustainability Report and the ESG Report, where there are detailed and clearly identified cells that make the information easier to find. For Shell (China), it is not explicitly listed in the various reports. However, Shell China's actions and policies to achieve its carbon neutrality targets are listed in the media on the Shell China website.

In terms of the form of disclosure of carbon accounting information for Shell (UK), the UK company has maintained relevant information in various reports, including current corporate efforts and achievements to reduce energy consumption and the targets it plans to achieve in the future. Although a combination of qualitative and quantitative disclosures are used in each report, there is a significant amount of duplication across reports, for example, corporate carbon emissions are disclosed in the company's annual report, annual environmental statement, sustainability report and corporate ESG report.

4.2 Contents of carbon disclosure analysis

Based on the 2022 climate change guidelines issued by the international non-profit organization CDP (Disclosure Insight Action) for the Energy Sector Carbon Disclosure Project, Shell's carbon

accounting disclosures are analyzed in detail. A review of Shell UK's reports for the last six years shows that Shell UK's disclosure of corporate carbon accounting information is fairly comprehensive, apart from information relating to audit assurance of carbon accounting information. With the exception of the annual report, which differs significantly from the CDP survey, the information disclosed in the other reports is as comprehensive as possible.

Table 4. Shell's Carbon Accounting Disclosure Fundamentals 2016-2022 (UK)

Disclosure of contents	Annual report and accounts	Sustainability report	Annual environmental statement	ESG report
Corporate Governance	√	√	√	√
Risks, opportunities and business strategies	√	√	√	√
Carbon reduction initiatives and performance	√	√	√	√
Emission Data and Breakdown	×	√	√	√
Carbon information audit assurance	×	×	×	×
Other carbon information	×	√	√	√

The corporate governance module required to be disclosed by the CDP indicates that the Board of Directors is required to assess, monitor and make decisions on climate change related issues. In any given year, the Chairman of the Board of Directors presents a report on the progress, achievements and plans of the company's energy transition and energy reduction. For example, in the 2020 Annual Report, the Chairman of the Board, CHAD HOLLIDAY, made it clear that Shell is aiming to reduce nitrogen dioxide emissions by providing more and more low-carbon energy and products and investing in low-carbon projects such as wind and hydrogen power generation. This demonstrates that Shell has maintained a proactive approach to corporate governance in achieving its carbon neutrality targets. At the corporate governance level regarding carbon disclosure, Shell has achieved full disclosure.

Risks, opportunities and corporate strategies related to carbon emissions, as well as carbon reductions and achievements, are clearly and thoroughly disclosed in each of Shell's reports. For carbon emissions and reductions, Shell UK has developed a relatively complete disclosure system in 2016, with individual emissions for each operation and carbon emissions by region presented in separate tables and appended to each corporate report, of which the annual environmental statement and ESG report are the most complete. The Annual Environmental Statement and ESG Report not only show the carbon emissions from individual operations but also compare them with emissions from previous years, giving users of the reports a clear picture of Shell's achievements in carbon reduction projects over recent years.

Overall, Shell has developed a relatively complete system of carbon information disclosure in the UK that meets market needs. Although carbon accounting information is not fully disclosed in the annual financial report, the other corporate reports can be said to complement the inadequate disclosure of carbon accounting information in the annual financial report almost perfectly. However, it is noteworthy that audit assurance on carbon information is not disclosed in any of the reports.

4.3 Analysis of the quality of carbon information disclosure

Based on the construction of the carbon information disclosure evaluation system published by Li et al. (2015), the quality of Shell's carbon information disclosure was scored, evaluated and analyzed for the five primary indicators and fourteen secondary indicators of carbon accounting information disclosure. The quality of Shell UK's carbon accounting disclosures is shown in Table 5, where two points are awarded when the company's disclosures are in line with the indicators and are accompanied by detailed data, one point is awarded when only relevant information is disclosed without detailed data and zero points are awarded when no relevant information is disclosed.

According to the aggregated scoring of Shell UK's reports, the quality of carbon accounting disclosures in Shell UK has generally shown an upward trend from 2016 and a relatively regular pattern of disclosure by 2020. Compared to 2016, Shell's carbon disclosure in 2017 is more specific about green technology investments, disclosing the amount of specific investments and expected benefits to be achieved, as well as accounting for carbon emissions for the first time. Starting in 2018, the company has added disclosure of the reporting capture process and low carbon development strategy information to its reports. It can be said that Shell has been improving its corporate carbon disclosure program since 2016 in order to improve the quality of its carbon disclosure. The quality of corporate carbon disclosure is maintained in 2020, with a score of 19 in both 2020 and 2021, while in 2020, Shell begins to have specific data to support its disclosure on emissions reduction risks. In general, Shell UK's carbon accounting disclosures have improved over the last six years, with the exception of the reliability of the disclosures, for which there is consistently no information disclosed on validation assurance.

Table 5. A quality rating scale for Shell UK's carbon accounting disclosures

Primary indicators	Secondary indicators	2016	2017	2018	2019	2020	2021
Timeliness	Report Disclosure Schedule	1	1	1	1	1	1
	Report Adoption Process	1	1	1	1	1	1
Reliability	Validation Assurance	0	0	0	0	0	0
	Images & Text Descriptions	2	2	2	2	2	2
Understandability	Technical Glossary	1	1	1	1	1	1
	Quantitative Standards	2	2	2	2	2	2
Comparability	Low Carbon Development Strategy	1	1	2	2	2	2
	Carbon Asset Management	0	0	0	0	0	0
	Emission reduction risks	1	1	1	1	2	2
	Government Subsidies	0	0	0	0	0	0
Completeness	Green Technology Investments	1	2	2	2	2	2
	Meeting Emission Reduction Targets	2	2	2	2	2	2
	Whether to account for emissions	0	1	1	2	2	2
	Whether carbon performance is calculated	1	2	2	2	2	2
Total		13	16	17	18	19	19

A horizontal comparison shows that the quality of carbon accounting disclosure by Shell UK is positive, particularly as Shell has improved the quality of carbon accounting disclosure by publishing an annual energy transition report since 2017. From a timeliness viewpoint, Shell UK's annual report has a clear disclosure schedule, whereas all other reports do not have a specific disclosure schedule and uniformly state the year on the cover of the report. In terms of reliability, Shell UK does not have a description of the process for capturing carbon accounting information in each of its insurance policies, although information on the methodology for calculating greenhouse gases is disclosed in the company's sustainability report and annual environmental statement. In addition, the lack of information on third-party assurance engagements for carbon accounting information in each of Shell's reports is a major reason for the low reliability of the company's carbon accounting information. From the point of view of comprehensibility, Shell UK has textual explanations, graphical interpretations and data support for carbon accounting information in the Corporate Sustainability Report, Annual Environmental Statement and ESG Report, particularly in the Corporate Energy Transition Report. Although a few technical terms are not explained in detail, they are easy enough

for information users to understand. In terms of comparability, the company's standards for accounting for carbon accounting information have been relatively uniform, with data presented in accordance with UK government guidance to facilitate comparisons with different companies in the same industry. At the integrity stage, Shell has disclosed its targets and plans for energy transition and zero carbon development in its corporate strategy development report, with clear annual emission reduction targets and low carbon development investments from 2018 on-wards, indicating that Shell's stated goal of achieving net zero emissions by 2050 has been concretely implemented and enforced. From the disclosure of corporate green technology investment, Shell disclosed clearly in the Energy Transition Report that the company has made a large investment in research and development and operations for the development of new and clean energy, while this investment is on a trend of increasing year on year. However, there is no clear indication of the industry subsidies granted by the government. Shell provides specific disclosures in its corporate annual reports, sustainability reports, particularly in its energy transition reports, on the specific reductions in carbon emissions that Shell achieves each year, as well as reporting on their associated economic benefits. However, the company does not disclose much information about the risks of emission reductions, but more about how much positive impact the reductions are expected to generate.

5. Differences in different countries' carbon disclosure

Although the Paris Agreement was adopted in December 2015 by 197 countries in an effort to combat climate change, the Climate Change Act was formally enacted in the UK even back in 2008. The UK was the first country in the world to officially legislate for a long-term carbon reduction target, achieving a local carbon peak in 1972 and formally setting a 'net zero' target by 2050 in 2019. By contrast, it was announced in September 2020 by President Xi Jinping that China was aiming to peak its CO₂ emissions by 2030 and become carbon neutral by 2060. From the beginning, China is not as sensitive to climate change and carbon reduction as Western countries, compared to the UK's forward-looking approach to carbon reduction. The main reason for these differences is that the two countries are at different stages of development. As is well known, Britain was the first country in the world to make the industrial revolution. As early as the 1860s, Britain had fully entered the industrial age, making the leap to machine industry instead of handicraft. This led to a very advanced level of productivity in Britain. In 1960, Britain's gross national product (GNP) reached US\$73.23 billion and its per capital GDP reached US\$1,400. China began the process of full-scale industrialization after reform and opening up. Although China's economy has been on a positive growth trend, as a developed country the UK is ahead of China as a world economic power and financial center. At the same time, the UK Commission expects that the UK can keep the cost of annual resource costs of greenhouse gas emissions reductions to just 1-2% of GDP. As a result, the UK had the time and economic basis to focus on climate change earlier than China, shifting the center of development from the economic center to sustainable development.

While the Chinese and foreign media are positive about voluntary carbon disclosure, companies in Europe place a high priority on corporate carbon disclosure because of the positive correlation between positive voluntary disclosure of carbon information and corporate financing and financial performance. According to Jin (2017), approximately 50% of companies in China do not pay adequate attention to the disclosure of carbon information, and there are significant differences in media coverage of different companies. The Chinese media have focused more on state-controlled enterprises. In addition, as the Chinese government is developing low-carbon projects and calling on enterprises to undertake low-carbon development, there is currently more positive coverage in the Chinese media of government subsidies for the development of low-carbon projects and the transition of state-owned enterprises to low-carbon projects. Conversely, there has been no more positive guidance or attention given to voluntary disclosure of carbon information by companies. On the other hand, when searching for carbon disclosure on the BBC's official website, most of the media do science and call to action related to carbon information in the UK. Although, there is no mature stage

for carbon disclosure reporting, stakeholders are still concerned about the disclosure of relevant information by companies. Stakeholders will be interested in whether the company is currently integrating climate change into its strategic direction to facilitate adjustments to corporate governance systems and corporate culture. Potential investors are more interested in whether the business can be sustainable in a global warming environment. As a result, there is a positive and consistent attitude throughout the UK media as they actively promote carbon information, while at the same time continuing to report on carbon disclosure by different companies in different sectors.

The guidelines for carbon information disclosure in China and the UK are different. China has implemented the "Administrative Measures for the Legal Disclosure of Corporate Environmental Information", which will be published in December 2021, while the UK has adopted the "Environmental Reporting Guidelines", which will be fully effective in April 2019. The differences between the Chinese and UK regulations on carbon information disclosure can be found between the two standards. Firstly, there are differences in the subjects of disclosure required by the two countries. China mandatory requires key emission units, units that have implemented the forced stop of cleaner production audits, listed companies and bond issuing companies that comply with the relevant regulations. The United Kingdom requires all UK-listed companies to disclose carbon information. In terms of subject matter, China is selective about who is required to disclose carbon information, with each province and municipality having the right to determine the list of companies that are required to disclose carbon information to the public in that year, whereas the UK has a uniform requirement for all UK-listed companies to make carbon disclosures. Secondly, the time frame for disclosure is not the same. China requires companies to disclose environmental information for the full year from 1 January to 31 December of the previous year by 15 March each year. In contrast, the UK has a 12-month reporting cycle that corresponds to the financial year and requires that most of the reporting year should fall within the financial year. At the same time, the principles applied in China and the UK are different. China requires companies to disclose carbon information in accordance with the law, timely, truthfully, accurately and completely, as well as requiring that the information disclosed be concise, clear and understandable, without false accounts, misleading statements or material omissions. The UK has added to these requirements relevance, quantification, consistency, comparability and transparency. Additionally, the most important difference is that the management approach applied in the UK is more focused on comparison with the previous year, whereas China is more oriented towards a presentation of the current situation. Among the eight categories of information included in China's required annual environmental information reporting requirements, more companies are required to disclose information on pollutant entanglement, treatment and emissions, as well as related emergency information and information on violations of the law. However, the carbon disclosure regulations in the UK require companies to set a base year, a target, which is intended to make it easier for companies and other stakeholders to understand the changes and achievements of the company in the current year more easily, allowing for stronger regulation and enforcement. The UK regulations also require companies to make disaggregated disclosures according to the scope of the type of business and to disclose the environmental risks to which they are exposed and the measures to address them.

6. Recommendations and conclusion

6.1 Recommendations

From the government's standpoint, the government should base on China's national conditions, improve the legal system related to carbon information disclosure and introduce relevant preferential policies. Accelerating the establishment of a comprehensive carbon information disclosure system in China is the crucial to ensure the steady development of the market economy and the healthy and sustainable development of all economic entities. Compared to the UK, China is still a developing country and the development of a carbon information related system is still in its infancy, so the relevant system still needs to be improved. Therefore, China can learn from the mature legal

system that has been well established and concretely implemented in developed European countries, further standardize corporate carbon accounting according to the actual situation in China, as well as continuously improve the standard of carbon information disclosure quality. Some examples include: learning from the UK's requirement for mandatory carbon disclosure for all listed companies and voluntary disclosure for others; comparison of base years for environmental reporting, not just statements of circumstances. In addition, the government also needs to provide preferential policies to encourage and support enterprises that have already voluntarily disclosed carbon information, in order to promote the implementation of China's carbon information disclosure system in a comprehensive manner.

From the perspective of the enterprise's own development, the current market advocates the low-carbon development of the general environment, enterprises should be top-down construction of low-carbon development of corporate culture, the implementation of corporate low-carbon development strategy into the enterprise specific projects. Companies need to train their staff on carbon information disclosure to ensure that the quality of carbon information disclosure is timely, truthful and complete. According to a study of UK companies, the financial indicators of companies are influenced by the quality of their carbon disclosure. Therefore, companies should proactively research the relationship between carbon information disclosure and corporate financial performance in order to gain more access to finance for market expansion.

For the media, they need to ensure their independence, the quantity and quality of their reporting, strict control over the accuracy and objectivity of their reporting. The media has a role to play in guiding the implementation of carbon information disclosure, as it should actively promote the knowledge and policies related to carbon information and focus on companies from all sectors, not just state-owned enterprises. Regulating the media will maximize the positive impact of the media on policy reporting and market trends. In addition, the media should raise the sensitivity of companies to low-carbon strategies and achievements. Timely and positive reporting of corporate behaviour not only enhances the reputation of the companies concerned, but also calls for a positive transformation of other companies in the social context of a low carbon economy.

6.2 Conclusion

This article is based on a comparison of Shell's carbon information disclosure in China and the UK, which reveals that multinational enterprises are subject to different economic and regulatory constraints, resulting in significant differences in the content, and quality of carbon information disclosure by enterprises in different countries. In the UK, the carbon disclosure management system has been updated and improved since June 2013, as well as the fact that Shell UK has been voluntarily disclosing carbon information for many years before the implementation of specific laws and regulations, so Shell UK has fifteen years of experience in carbon footprint management and carbon disclosure.

In contrast, China is still at the early stage of carbon information management, although relevant regulations have been issued and implemented, the list of companies that need to disclose carbon information is still selective, the content of the carbon information disclosure report is mainly about the current situation of carbon emissions rather than the specific amount of emission reductions, so the carbon information disclosure of Shell Chinese companies is still at the stage of strategic management and reaching strategic cooperation with other enterprises. Shell China's carbon information disclosure is still at the stage of strategic management and strategic cooperation with other enterprises and has not yet formed a substantial carbon information disclosure reporting system and system.

As a result, China can learn from the mature legal and regulatory system in the UK and develop a management approach that is suitable for China's actual situation. In conclusion, if China wants to improve its carbon information disclosure system and enhance the quality of carbon information disclosure as soon as possible, it needs the government to introduce relevant encouragement policies, the media to actively make relevant reports and enterprises to comply with the national call to comply

with the relevant regulations, and the three parties to make joint efforts to promote the establishment and improvement of China's carbon information disclosure system.

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