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November 2025

Establishing a Research Infrastructure for ESG Intelligence: A Multi-Stakeholder Perspective (RGC Ref. No.: UGC/IDS(R)14/21)

Final Outcome and Methodology Report

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Acknowledgement

We acknowledge the financial support from UGC under the Institutional Development Scheme (IDS) project "Establishing a Research Infrastructure for ESG Intelligence: A Multi-Stakeholder Perspective" (RGC Ref. No.: UGC/IDS(R)14/21) for conducting the research.

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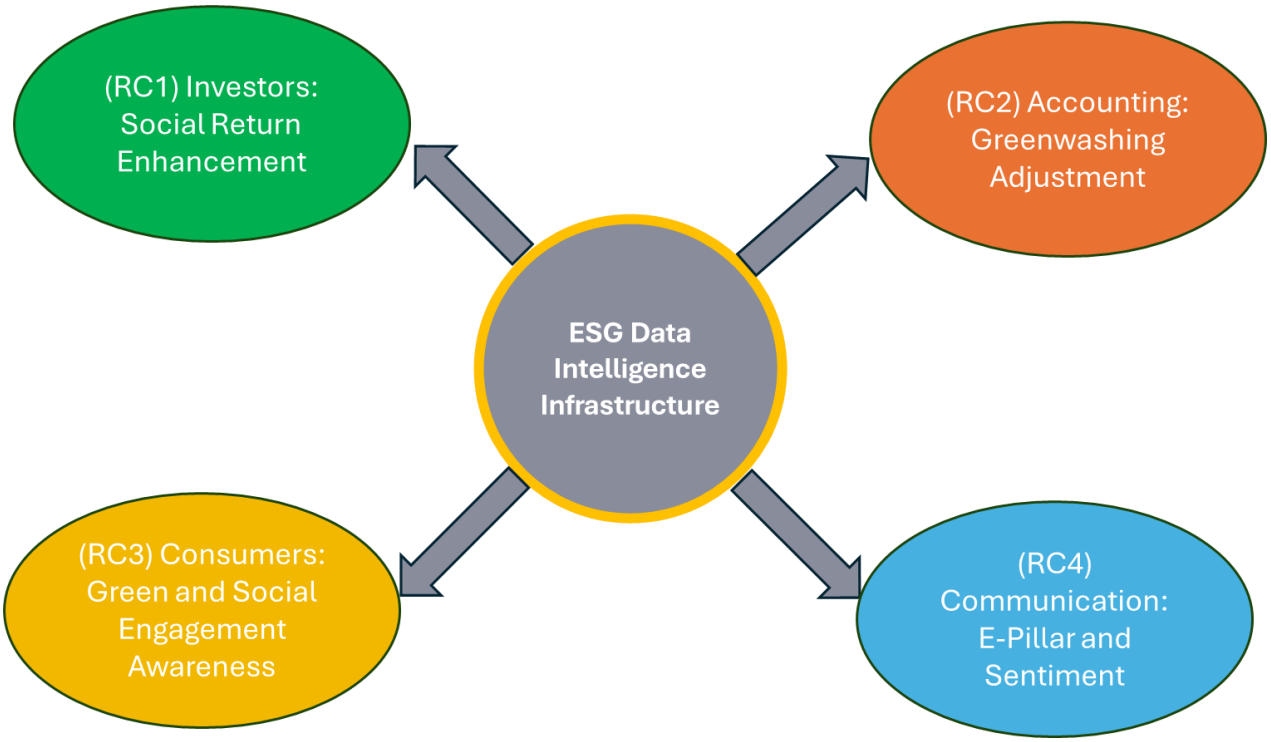

IDS Final Outcome and Methodology Report

1. Overview of Final Outcome

The Environmental, Social, and Governance (ESG) concept, developed in 2006 by UNPRI, has gained attention in finance and accounting. The objective of this report is to provide a clear road map (i.e., A scientific methodology with computational procedure) to demonstrate how the stakeholders of the 4 Research Components (RCs) can use a tailor-made ESG intelligence through our research findings from the IDS project. Our aim is to create such alternative data for listed firms to support smart and efficient business decisions for the stakeholders.

Based on the datasets purchased under the IDS grant, we obtained ESG performance data from MSCI and SynTao. Adding with the Asset4 subscribed by HSUHK, we construct the ESG i-score using a simple divergence adjustment mechanism derived by the implication from Berg et al. (2022)[1]. In addition, the sustainability sentiment score generated from RavenPack is employed to create an integrated measure called i-Composite. Our research outcomes for each RC are generated to add insight to create a unique approach tailor-made for the stakeholders of each RC. Specifically, for RC1, the stakeholder is the investor group. For RC2, the stakeholder is the accounting professional group. For RC3 and 4, the stakeholders are consumers and corporate communication professionals respectively. Following our initial IDS proposal, the ESG intelligence for each stakeholder group is guided by the research objective listed in the table below.

Table 1. Summary of the Key Findings

RC	Objective	Stakeholder	Key Findings
RC1	Integrating social returns into performance benchmarks related to ESG portfolios.	Investors	Comparing US with China, mainland investors are willing to pay more for good ESG performance stocks, indicating that they are willing to accept lower returns from better ESG performing stocks. Listed firms in Hong Kong/China can promote their ESG performance to these investors to raise capital.
RC2	Improve KPIs of ESG reporting for listed firms.	Accounting professionals	Greenwashing undermines the integrity of ESG reporting, as it poses significant risks to corporate credibility, investor trust, and global sustainability efforts. A systematic approach to detect and mitigate such practices by evaluating disclosure consistency is needed.
RC3	Measure consumer satisfaction on ESG performance.	Consumers	Employees' perceptions of their employers' CSR performance enhance their green purchase behaviors as consumers. Comparing the US and Hong Kong survey respondents, the employee-consumers in Hong Kong appear to have a stronger preference for green purchase behaviors than those in the US.
RC4	Enhance the effectiveness of strategic corporate communication on ESG efforts for listed firms.	Corporate communication professionals	Carbon and greenhouse gases are the most common topics related to IR job duties. Early-stage and mature firms face different situations when their IR teams handling ESG issues. There is still room for IR to incorporate ESG into its implementation to enhance value.

[1] Florian Berg, Julian F Kölbel, Roberto Rigobon, Aggregate Confusion: The Divergence of ESG Ratings, *Review of Finance*, Volume 26, Issue 6, November 2022, Pages 1315–1344, https://doi.org/10.1093/rof/rfac033

2. RC1: Social Return Enhancement

RC1 Objective:

The main objective of RC1 is to identify the role of social return in creating ESG intelligence to gauge the satisfaction of asset owners. We believe that an effective way to overcome this challenge is to better quantify the value (i.e., utility/satisfaction) of social returns to asset owners and buy-side professionals. Based on this goal, our investigation path takes the form of an online survey to understand the Environmental, Social, and Governance (ESG) integration in stock investments.

Investigation Path:

To achieve the aforementioned objective, we conducted online survey experiments in Mainland China and the US to investigate how investors make trade-offs between ESG considerations and investment returns when evaluating stocks and portfolios. Our study has two novel features. Firstly, it examines the willingness to invest in ESG stocks across various ESG dimensions, including carbon emissions, greenhouse gas emissions, solid waste, employee health and safety, product safety, and data security. This approach enables the investigation of potential differences in preferences for ESG stocks across these dimensions. Secondly, the study engages participants from both the US and Mainland China, facilitating a comparison of investor preferences for ESG stocks between these two countries. By considering perspectives from both countries, the research aims to provide insights into the divergences or similarities in ESG investment preferences among investors in the US and Mainland China.

291 US investors and 300 Mainland Chinese investors participated in the survey. The survey focused on their willingness to pay for high ESG stocks, aversion to low ESG stocks, and risk tolerance related to ESG investments.

The study employed several tasks to measure ESG investment preferences, including a task to elicit ESG premium, an incentivized bidding task, a task to elicit expected annual return, a task to elicit expected range of return, and a task to elicit willingness to invest in stock. These tasks assessed investors' willingness to invest in high and low ESG stocks under varying conditions of return and risk.

Key Findings:

Basic findings:

1) ESG affects investors' valuation of stocks.
2) Investors bid higher for good ESG performance stocks, indicating that they are willing to accept lower returns from high ESG stocks relative to low ESG stocks.

Country-specific findings:

1) Mainland China investors care more about ESG measured by differential returns between high and low ESG stocks in the areas of data security (4.02%), greenhouse gas emissions (3.82%), and employee health and safety (3.80%).
2) For the US, the investors care more about carbon emission (1.90% differential return), and data security (4.02% differential return).
3) In short, investors from the two countries are willing to sacrifice returns in pursuing stronger performance in different ESG aspects.

Comparing the US and Mainland China:

Mainland China investors are willing to sacrifice more return than the US investors. Among all the ESG issues, Mainland China investors care the most about product safety and data security. They sacrifice the highest return in these two categories compared with the US investors.

Formation of ESG Intelligence Infrastructure for RC1 Stakeholders:

Based on the Investor Survey, Mainland China firms and Hong Kong firms can receive better support to pursue ESG performance as Mainland Chinese investors are more willing to sacrifice a larger return to support firm-level ESG effort. Therefore, researchers should consider some overall ESG measures that control divergence (i.e., i-score) and sentiment effects (i.e., i-Composite).

Limitation and Future Direction:

For RC1, we follow our IDS proposal and empirically tested the social return level of Mainland Chinese and US investors for comparison. We do not focus on Hong Kong investors because the academic contribution to understanding Mainland Chinese investors relative to US is bigger than using Hong Kong for comparison. The implication is clear and useful for future research and listed firms. The willingness to sacrifice more financial return to support ESG effort by the Mainland investors is significantly greater than that of the US investors. Therefore, listed firms can take advantage of this information and deploy their ESG commitments accordingly, especially when it is appropriate to expand their shareholder base in Mainland. Academic researchers can also use this information to control their research design when their studies explore stock market reactions to ESG related issues.

3. RC2: Greenwashing Adjustment

RC2 Objective:

RC2 takes on a wider scope with different research issues related to ESG disclosure, ratings, and their effects on firm-level performance. The research outputs are listed below:

1) Kong, P., **Cheng, L. T. W.**, Pan, L., Shen, J., and Yu, Q. Non-financial information uncertainty, firm growth, and market value during crisis: Evidence from China, *Pacific-Basin Finance Journal*, *Volume 91*, June 2025, 102748 https://doi.org/10.1016/j.pacfin.2025.102748 (Note: also presented at the 2nd Asia Sustainability and ESG Summit, Bali, Dec 2024) *

2) MA, L., LI, J., **Cheng, L. T. W.**, and CAO, J., The Role of Independent Directors in Mitigating Corporate Greenwashing: Evidence from Board Voting in China, *European Journal of Finance*, 1-21 https://doi.org/10.1080/1351847X.2025.2481957 *

3) **Cheng, L. T. W.**, Cheong, T. S., Wojewodzki, M., and Chui, D., The Effect of ESG Divergence on The Financial Performance of Hong Kong-Listed Firms: An Artificial Neural Network Approach, *Research in International Business and Finance*, *Volume 73*, Part A, January 2025, 102616. https://doi.org/10.1016/j.ribaf.2024.102616

4) **Cheng, L. T. W.**, Tsang, C. K., and Lee, S. K., Comparing the Financial Performance Effect of International and Local ESG Ratings: A Two-stage DEA Approach. *Annals of Financial Economics*, *19*(4), 1–21. https://doi.org/10.1142/S2010495225500010 *

5) Fan, K.Y., Shen, J., Hui, E.C., and **Cheng, L.T.W.**, ESG Components and Equity Returns: Evidence from Real Estate Investment Trusts, *International Review of Financial Analysis Volume 96*, Part B, November 2024, 103716. https://doi.org/10.1016/j.irfa.2024.103716 *

6) **Cheng, L.T.W.**, Lee, S.K., and Tsang, C.K., Understanding resource deployment efficiency for ESG and financial performance: A DEA approach. *Research in International Business and Finance*, *65*, Article 101941. https://doi.org/10.1016/j.ribaf.2023.101941 *

7) Wojewodzki, M., Cheong, T.S., Shen, J., and **Cheng, L.T.W.**, Does corporate carbon performance converge in the global market? Evidence from a distribution dynamic approach, *Journal of Environmental Management*, *342*, Article 118355. https://doi.org/10.1016/j.jenvman.2023.118355 *

8) Zeng, J. Z., Yu, I.Y., Tso, S.H., and **Yang, M.X.**, "Employees' geographic social identity and group pro-environmental behaviors: Cross-cultural evidence from 45 countries. *Business Strategy and the Environment*, *32*(6), 3848–3860. https://doi.org/10.1002/bse.3341 *

9) **Cheng, L. T. W.**, Shen, J., and Wojewodzki, M., A cross-country analysis of corporate carbon performance: An international investment perspective, *Research in International Business and Finance*, *64*, Article 101888. https://doi.org/10.1016/j.ribaf.2023.101888 *

Summary of Findings and Investigation Path:

Greenwashing (or ESG washing) refers to the practice of misrepresenting sustainability-related disclosures, information, or practices in ESG reporting, with the intent of artificially inflating the ESG ratings of listed firms. This can manifest in multiple ways, from selective disclosure to outright exaggeration of ESG performance. For instance, companies may emphasise less costly social and governance initiatives while underinvesting in more resource-intensive environmental policies. Another tactic involves mischaracterising ESG disclosures by using vague or inflated language to overstate sustainability achievements. Furthermore, firms may downplay or omit green-related risks to present a more favourable sustainability image. Such practices not only mislead investors

and stakeholders, but also undermine the credibility of ESG metrics, raising concerns about transparency and accountability in corporate sustainability reporting.

Therefore, our investigation path begins with different research issues above and lead to the conclusion that greenwashing is a more prominent topic that can be singled out as the ESG intelligence for the RC2 stakeholders. Therefore, we will develop a research methodology for readers to apply their research on greenwashing, which will be reported in detail in Section 6.

4. RC3: Green and Social Engagement Awareness

RC3 Objective:

The key objective of RC3 is to measure consumer satisfaction on ESG performance. RC3 examines the effectiveness of ESG efforts of corporations from the perspective of retail clients and consumers. Using survey and experimental design in the field of consumer psychology, RC#3 will evaluate the role of ESG efforts of listed firms in creating ESG intelligence from the consumers' perspective. Previous research has indicated that consumers and retail clients place high importance to the environmental and social aspects of products in terms of their materials, ingredients, and production process. We believe that additional brand value and trust from consumers are generated by the ESG performance of firms.

Investigation Path:

The survey was developed based on academic research. All the items were measured using a seven-point scale, with 1 denoting "strongly disagree/never true", and 7 denoting "strongly agree/always true".

The Research Centre for ESG engaged Dynata, a global market research firm, to conduct the survey in the US and Hong Kong SAR respectively in October 2023. There are 72 questions in the survey excluding the demographic questions. The survey was conducted in English in the US and traditional Chinese in Hong Kong SAR. Dynata received 321 responses from each location or a total of 642 for the sample. After the data cleaning procedure, the sample sizes for the US is 315, and 317 for Hong Kong SAR. Our current report employs the final sample of 632 to conduct the analysis.

Key Findings:

The survey revealed the following results:

1) Employees' perceptions of their companies' CSR performance would eventually enhance their green purchase behaviors as individual customers.

2) Comparing the US and Hong Kong SAR samples, the employee-consumers in Hong Kong SAR appear to have a stronger preference for green purchase behaviors than those in the US.

3) Based on additional research analysis not reported here, we conclude that the positive relationship is stronger between companies' CSR performance and green purchase behaviors of their employee-consumers if the corporate value is more synchronized with the individual life value of the employee.

Formation of ESG Intelligence Infrastructure for RC3 Stakeholders:

Our survey findings give confidence to Hong Kong firms to strengthen Green and Social Pillar strategies as they have a strong positive influence on their employees compared to the US. The researchers and senior executives should employ E and S Pillars i-score to strengthen the ESG performance of the firms to provide a stronger influence on the employees in pursuing green behaviors.

5. RC4: Additional E-Pillar Indicator

RC4 Objective:

The key objective of R4 is to enhancing effectiveness of strategic corporate communication on ESG efforts for Listed firms. Effective corporate communication is the key to success to disseminate quality ESG information to the market, especially to the related institutional investors efficiently. Nowadays, finance and accounting professionals face difficulties in communicating ESG information to stakeholders. This research will identify the role of communications in creating ESG intelligence.

Investigation Path:

We are fortunate that the Hong Kong Investor Relation Association (HKIRA) has pledged its support to enhance our research process through participation of surveys and focus groups from their members and we aim at generating corporate communication solutions supported by our academic research.

In order to support the RC4, this survey explores 1) whether there are particular issues of the certain E, S, G pillars bringing the most challenges for the IR/CC units to handle; 2) the operation differences between early-stage firms and mature firms in handling ESG issues.

A total of 19 participants have filled out a simple questionnaire, and 7 of them have engaged in an in-depth group interview (focus group) on their views on how they perceived the relevance of ESG (Environmental, Social, and Governance) to their IR /CCjob functions. We targeted major stakeholders from Real Estate, Banking, Insurance or Financial Services, Consumer products and services, Technology, Media, and Telecom, and Healthcare industries.

We conducted a focus group to reach out to the IR/CC professionals:

Date	Supporting Organization/ Host (number of Participants)
September 25, 2023	Hong Kong Investor Relations Association, Hang Seng University of Hong Kong (n=7)

We drafted a questionnaire consisting of two sections. Section one asks for certain personal information for our demographic segmentation as well as to have a basic knowledge of the respondents' ESG professional team. Section two requires the respondents to answer a total of 5 questions to evaluate the difficulty of communicating ESG with stakeholders or corresponding parties. After the meeting, we refine the questionnaire draft by combining the comments and suggestions from the focus group participants and finalize it for the use of the online survey.

A total of 12 participants filled out the questionnaire on how they (IR/CC professionals) perceived their ESG-related job functions through a commercial online platform.

Key Findings:

The survey revealed the following results:

1) Early-stage and mature firms face different situations when their IR teams handling ESG issues.
   The major function of IR is to produce the maximum possible relevant information to major stakeholders (e.g., shareholders, buy-side, clients, investors in general, and the society) so that stock price fully reflects intrinsic value. Meanwhile, for ESG, the current development in Hong Kong is at the transitional (early) stage. ESG does not enhance profitability in a direct manner. Consequently, there is still room for IR to incorporate ESG into its implementation to enhance value, which is very difficult to do at this stage. Under these circumstances, early-stage and mature firms encounter different challenges and demonstrate different responses.

For the early-stage firms, the main barrier for IR teams lies in the lack of experience and the ability to acquire enough information from the supply chain for disclosure. As was mentioned above, ESG does not enhance profitability in a direct manner, which means ESG benefits would not straightforwardly turn into financial or branding benefits, it is quite challenging to persuade stakeholders such as the lend sides to support.

The mature firms, compared with the early-stage firms, their IR teams are able to acquire the ESG intelligence to support their job and they have developed a stable work scope and clear workflow. There are three communication situations of the mature firms' IR teams. One of them is that when questioned by the stakeholders about ESG issues, they would ask the ESG professionals for explanations and convey the answers to the stakeholders. Also, in order to improve efficiency, there are IR teams that tend to collect and publish common-concerned questions and answers on a website instead of directly answering the stakeholders one by one. In addition, IR teams of mature firms usually have multiple channels of communicating ESG issues except for the websites: physical meeting, phone/ conference call, online meeting, press release for mainstream media and social media.
However, the huge size of the mature companies has led to IR teams' work difficulty of keeping an eye on every incident and details of the whole group. Especially, ESG has been attached more importance than before, an occasional or individual incident (e.g., employee's long-time working overtime) turns into a Social issue that probably causes a decline in ESG rating. The IR teams need to seek a way out of the problem.

2) There appears differentiation in ESG materiality challenges and solutions for E and S pillars in a different manner.
The survey results present differences in ESG materiality in the E and S pillars. For the Real Estate sector, commonly recognized standards and organizations have been set up to regulate and assess the sustainability of buildings. Therefore, most of the firms in the Real Estate sector have employed ESG or sustainability experts to monitor the prevent potential environmental problems during operation. However, in industries like bank, insurance, and technology, due to the lower frequency and lower severity of Environmental issues, they are less likely to have a separate ESG team to support IR/CC department.
As for the Social issues, as mentioned above, owing to the large company scale of technology and financial service firms, IR teams may not respond to or be involved in occasional or individual incidents timely. Yet, Social issues like human rights and employee health and safety have received growing concerns from the public, IR professionals from these sectors need to figure out a proper pattern or establish new regulations to deal with similar Social issues.

Formation of ESG Intelligence Infrastructure for RC4 Stakeholders:

Our survey findings imply that carbon and greenhouse gases are the most common topics related to IR job duties. In addition, today's strong influence from public media may obviously affect companies' image. IR and corporate communication professionals should consider applying E-Pillar of i-score and ESG sentiment indicators to closely monitor the environmental performance and the public perceptions of the ESG issues.

Future Direction:

The findings of this online survey and focus group have implication to our IDS ESG intelligence dataset design on the purpose of investor relations (IR) as a stakeholder. Based on the replies for Question 9, which states that carbon and greenhouse gases are the most common topics related to IR job duties. Therefore, it is recommended that environmental (E Pillar) i-score should be considered for the IR community.

6. ESG Data Intelligence Infrastructure and Methodology

In RC2, we take on a wider scope in research. Therefore, our investigation path begins with different research issues related to ESG disclosure, ratings, and their effects on firm-level performance. However, among these different related research issues under RC2, we find that greenwashing is a more prominent topic that can be singled out as the ESG intelligence for the RC2 stakeholders. Therefore, we will develop a research methodology for readers to apply their research on greenwashing, which is reported here. This Section begins with a literature review. Then we proceed to design a methodology for quantifying potential greenwashing in ESG reports, as well as a system for adjusting ESG ratings based on severity of greenwashing.

Literature Review

ESG Performance Using Artificial Neural Network (ANN)
Based on a published paper by the research team (Cheng et al. 2025)[2], the Artificial Neural Network (ANN) is used to both linear and nonlinear effects between firm-level characteristics and ESG performance of all firms listed on the Hong Kong Stock Exchange (HKEX) with ESG scores during 2019–2021. The paper uses a novel iScore based on divergence-adjusted ESG measure to demonstrate the nonlinear effects of the relationships, showing the superiority of the self-organising map (SOM) ANN framework in explaining the impact of firm-level factors on ESG performance.

Greenwashing Impact on Individual Companies
According to Ma et al., (2025) and Shen (2024), greenwashing strategies may be linked to both positive and negative ramifications for involved companies. In the short term, greenwashing can lead to higher market valuations, higher gross profit margins, as well as enhanced public image and stock price inflation. However, these benefits disappear over the long term, with companies that have engaged in greenwashing suffering from increased financial and regulatory risks, greater market volatility, as well as erosion of consumer and investor confidence.

Furthermore, there are also regional disparities regarding the impact of greenwashing. Yang et al., (2024) explained that real estate investment trusts (REITs) implementing greenwashing practices in the United States experienced higher market valuation and profitability, whereas REITs that engage in such practices in Europe would experience lower market valuation and reduced profitability. While in Asia, greenwashing strategies are found to have a mixed impact, with REITS enjoying improved corporate fundamentals such as higher gross profit margins, but at the same time also lead to worse market valuation.

This discrepancy has been attributed to both institutional and societal factors. From an institutional perspective, regions with more stringent environmental regulations, such as Europe or certain Asian countries like Japan, not only discourage greenwashing through rigorous compliance requirements, but also impose heavier penalties when such practices are uncovered. These penalties may include fines, mandatory corrective actions, or even sanctions that can significantly impact a company's business competitiveness. In contrast, the United States maintains relatively lax environmental policies and enforcement mechanisms, thereby creating a regulatory environment where companies may more easily engage in greenwashing without facing severe legal consequences or financial repercussions (Yang et al., 2024). From a societal perspective, regions with stronger environmental consciousness, such as many European countries, tend to have a public that prioritises sustainability, which leads investors and consumers to value genuine environmental protection efforts. In these markets, any detected instances of greenwashing would trigger scrutiny, resulting in reputational damage for the company and a loss of stakeholder trust, which can ultimately lead to financial implications. On the other hand, the market-driven culture of the United States tends to frame environmental actions in terms of individual or corporate benefit rather than collective responsibility. This mindset reduces the immediate backlash from

[2] Cheng, L. T. W., Cheong, T. S., Wojewodzki, M., and Chui, D., The Effect of ESG Divergence on The Financial Performance of Hong Kong-Listed Firms: An Artificial Neural Network Approach, *Research in International Business and Finance*, *Volume 73*, Part A, January 2025, 102616. https://doi.org/10.1016/j.ribaf.2024.102616

investors when companies engage in greenwashing, as financial performance and shareholder returns are more likely to take priority over sustainability claims (Yang et al., 2024).

Spillover Effects of Greenwashing Impact

However, while companies that engage in greenwashing may reap either positive or negative results, research has shown that greenwashing practices generally lead to widespread negative consequences that go beyond said companies. One of the most apparent harms is the inflicted damage to the environment and hindrance towards global sustainability goals, as greenwashing allow companies to either focus on superficial ESG measures or disclose misleading ESG figures while continuing environmentally harmful practices, thus delaying actual environmental improvements or achieving environmental goals (Ma et al., 2025; Shen, 2024; and Yu et al., 2020). In addition, whistleblowing of greenwashing practices has also been found to undermine genuine sustainability efforts and ESG investing, since investors would become sceptical and lose trust in ESG scores and ratings, thus discouraging investors from supporting authentic ESG and sustainability initiatives (Yang et al., 2024). On a similar note, greenwashing practices would also lead to credibility loss for overall ESG regulations and ESG reporting, and lack of accountability in ESG reporting would ultimately impede further ESG regulatory progress (Cheng et al., 2023).

Methodology for Future Research in ESG

Methodology Background

Given these findings, ESG consultants should endeavour to eliminate greenwashing from ESG report writing, as such practices would eventually lead to negative repercussions for both the company in question and the ESG reporting industry as a whole. However, identifying these types of misleading statements remains challenging, primarily because the defining characteristics of greenwashing have not yet been officially standardised or clearly defined by regulatory bodies. To address this critical gap, and in consultation with accounting professionals from Ascent Partners Advisory Service Limited, this paper shall aim to design and propose a systematic methodology for identifying greenwashing in ESG reports (hereinafter referred to as the APE Greenwashing Identification Methodology). The development of this methodology is driven by the ultimate goal to detect and punish problematic reporting practices, as well as to address and improve key performance indicators (KPIs) in the preparation of disclosure-based ESG reporting by ESG consultants, thereby enhancing the overall transparency and reliability of sustainability disclosures.

As mentioned above, to design the APE Greenwashing Identification Methodology, this paper shall incorporate elements of disclosure-based ESG reporting. Under disclosure-based ESG reporting regulations, ESG reports have a defined framework in which ESG data and information is expected to be laid out. This standardised framework creates a transparent system where all disclosures can be systematically evaluated for accuracy and completeness, where any instances of non-compliance or misleading statements, which would suggest possible greenwashing in the ESG report, may be pinpointed and quantified. Referring to the APE Score Methodology by the Hang Seng University of Hong Kong [HSUHK] (2024), a proprietary scoring system designed to evaluate ESG reporting disclosure KPIs, the methodology was able to identify inadequacies in ESG reports of HKEx listed firms under the HKEx ESG framework.

APE Washing Score Methodology

As such, for the first step in the APE Greenwashing Identification Methodology, this paper has adapted and combined the APE Score methodology (HSUHK, 2024), which as mentioned above evaluates ESG reporting disclosures, with the ESG Washing Score methodology (Yang et al., 2024), which assigns a score to ESG reports based on their prioritisation for each ESG pillar. With reference to the APE Score methodology and the ESG Washing Score methodology, [Formula 1] for identifying potential greenwashing based on ESG reporting disclosure KPIs has been designed.

The point allocation system for social and environmental aspects and KPIs maintains consistency with the original APE methodology, though several key modifications have been implemented specifically to detect potential instances of greenwashing. In divergence from the original methodology for the APE Score, points are no longer awarded even when explanations for non-compliance are given within the ESG Report. Research from Yang et al., (2024) has shown that mandatory ESG regulations discourages greenwashing practices, while "Comply or Explain" is a form of voluntary compliance where issuers may explain why certain disclosures have not been complied with. Thus, to account for the relation between voluntary disclosure and greenwashing, the APE Washing Score no longer considers full nor partial explanations of non-compliance to be eligible for points in its scoring system. Additionally, the updated approach eliminates industry weighting for social and environmental aspects, as greenwashing behaviours are not inherently linked to or justified by sector-specific characteristics. The APE Washing Score works on a similar basis as the ESG Washing Score designed by Yang et al., (2024), where elevated scores indicate disproportionate emphasis on social initiatives compared to environmental policies, a reporting imbalance that frequently signals potential greenwashing behaviour in corporate sustainability disclosures.

APE Consistency Score Methodology

Once an ESG report with potential greenwashing has been identified, the next step in the APE Greenwashing Identification Methodology involves determining discrepancies in ESG performance and ESG disclosure, which may be easily quantified under disclosure-based ESG reporting framework. By modifying the APE Score methodology (HSUHK, 2024), [Formula 2] for discrepancy quantification has been designed.

Based on this formula, an ESG report may receive a maximum and minimum APE Consistency Score of 1 and 0 respectively; a lower score indicates higher amounts of discrepancy between ESG performance and ESG disclosure in the company's reporting, while a higher score shows that the ESG report has been consistent in presenting the company's ESG performance and ESG disclosures. These inconsistencies suggest the presence of misleading statements in the ESG report, which may constitute as greenwashing. Under the APE Greenwashing Identification Methodology, ESG reports with a high APE Washing Score and a low APE Consistency Score have a high likelihood of engaging in greenwashing and should be analysed in further detail to determine whether such practices has actually occurred in its ESG reporting.

Applications for APE Washing Score and APE Consistency Score

Through applying the APE Greenwashing Identification Methodology, ESG consultants may follow a guideline to maintain integrity and avoid the pitfalls of greenwashing when conducting ESG reporting for listed companies, which may be achieved by aiming for a low APE Washing Score and high APE Consistency Score in their ESG report. A low APE Washing Score indicates that an ESG Report has equal focus on environmental and social pillars, meaning that ESG consultants should aim to balance the content of their ESG reporting, providing full disclosure for both environmental and social aspects and KPIs; whereas a high APE Consistency Score indicates that an ESG Report has little to no explanation for lack of environmental and social disclosures in its reporting, meaning that ESG consultants should provide comprehensive disclosure of all ESG aspects and KPIs as defined by their local stock exchange.

Application of Methodology to Other Local Stock Exchange and/or Regulator ESG Frameworks

On a related note, it should be noted that [Formula 1] and [Formula 2] have been designed with the HKEx ESG Framework in mind and thus should only be applied to ESG reports of HKEx listed firms. When applying the APE Greenwashing Identification Methodology to ESG reports under other local stock exchange or regulator frameworks, [Formula 1] and [Formula 2] should be replaced with [Formula 3] and [Formula 4], and point allocation for ESG disclosures should follow the criteria laid out in [Formula 5]. The application of [Formula 3], [Formula 4], and [Formula 5] allows the APE Greenwashing Identification Methodology to account for ESG disclosure ratings from other local stock exchanges or regulator frameworks, thus allowing for more widespread application of the methodology.

APE Rating Adjustment Methodology

As demonstrated through this paper's analysis, greenwashing presents a substantial and growing challenge that undermines the effectiveness and reliability of ESG reporting frameworks. The implications extend beyond mere reporting inaccuracies: when greenwashing effects remain unaccounted for in evaluation systems, this not only distorts individual company assessments, but also jeopardises the broader credibility of ESG ratings as a whole. Such systemic distortions could subsequently cast doubt on the validity of academic research findings derived from potentially compromised ESG data. To address these concerns, this paper proposes implementing the APE Greenwashing Identification Methodology as the foundation for developing a comprehensive adjustment mechanism, the APE Rating Adjustment Methodology. Within this system, ESG ratings assigned to reports exhibiting suspected greenwashing practices would be systematically penalised through a graduated scale that reflects both the severity and frequency of identified discrepancies, thereby creating meaningful accountability while preserving rating integrity. With this goal in mind, the APE Rating Adjustment Methodology has been designed with the proposed adjustment formula, [Formula 6].

Using [Formula 6], ESG reports that achieve balance between environmental and social disclosures (as indicated by an APE Washing Score of 0), as well as demonstrate comprehensive transparency (as indicated by an APE Consistency Score of 1) would maintain their original ESG Rating without any adjustments. Such ESG reports would represent the ideal standard in ESG reporting, as they show equitable attention to all sustainability aspects and provide complete disclosure of all KPIs, thereby exhibiting minimal risk of greenwashing practices. Conversely, ESG reports that display imbalances in their ESG focus (which would receive higher APE Washing Scores), gaps between claimed and actual performance (which would receive lower APE Consistency Scores), or both at the same time would receive progressively worse rating penalties. This adjustment system serves multiple functions: it creates meaningful disincentives for misleading reporting practices, provides investors and stakeholders with more accurate assessments of corporate sustainability performance, and enables researchers to control for greenwashing effects in academic studies. The formula's design ensures that the magnitude of ESG ratings deductions corresponds directly to the severity of potential greenwashing, thereby encouraging companies to improve their reporting practices through maintaining the integrity of their sustainability metrics. Furthermore, this approach helps standardise ESG evaluations across different industries and regions, as it accounts for both the relative emphasis on different sustainability pillars and the completeness of disclosure in a quantifiable manner.

The Model

[Formula 1]

$$APE\ Washing\ Score = \frac{SOC_c/_{21.1} - ENV_c/_{17.8}}{SOC_c/_{21.1} + ENV_c/_{17.8}}$$

Where:

SOC_c $= Sub\text{-}Total\ of\ Soc.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ with\ within\ the\ ESG\ Report$

ENV_c $= Sub\text{-}Total\ of\ Env.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ with\ within\ the\ ESG\ Report$

[Formula 2]

$$APE\ Consistency\ Score = \frac{SOC_c/_{21.1} + ENV_c/_{17.8}}{SOC/_{21.1} + ENV/_{17.8}}$$

Where:

SOC_c
$= Sub\text{-}Total\ of\ Soc.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ with\ within\ the\ ESG\ Report$
ENV_c
$= Sub\text{-}Total\ of\ Env.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ with\ within\ the\ ESG\ Report$
SOC
$= Sub\text{-}Total\ of\ Soc.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ or\ explained\ within\ the\ ESG\ Report$
ENV
$= Sub\text{-}Total\ of\ Env.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ or\ explained\ within\ the\ ESG\ Report$

[Formula 3]

$$APE\ Washing\ Score = \frac{SOC_c / SOC_{complete} - ENV_c / ENV_{complete}}{SOC_c / SOC_{complete} + ENV_c / ENV_{complete}}$$

Where:
SOC_c
$= Sub\text{-}Total\ of\ Soc.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ with\ within\ the\ ESG\ Report$
ENV_c
$= Sub\text{-}Total\ of\ Env.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ with\ within\ the\ ESG\ Report$
$SOC_{complete} = Sub\text{-}Total\ of\ Soc.KPIs\ and\ Aspects\ as\ per\ local\ stock\ exchange\ ESG\ framework$
$ENV_{complete} = Sub\text{-}Total\ of\ Env.KPIs\ and\ Aspectsas\ per\ local\ stock\ exchange\ ESG\ framework$

[Formula 4]

$$APE\ Consistency\ Score = \frac{SOC_c / SOC_{complete} + ENV_c / ENV_{complete}}{SOC / SOC_{complete} + ENV / ENV_{complete}}$$

Where:
SOC_c
$= Sub\text{-}Total\ of\ Soc.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ with\ within\ the\ ESG\ Report$
ENV_c
$= Sub\text{-}Total\ of\ Env.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ with\ within\ the\ ESG\ Report$
SOC
$= Sub\text{-}Total\ of\ Soc.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ or\ explained\ within\ the\ ESG\ Report$
ENV
$= Sub\text{-}Total\ of\ Env.KPIs\ and\ Aspects\ fully\ or\ partially\ complied\ or\ explained\ within\ the\ ESG\ Report$
$SOC_{complete} = Sub\text{-}Total\ of\ Soc.KPIs\ and\ Aspectsas\ per\ local\ stock\ exchange\ ESG\ framework$
$ENV_{complete} = Sub\text{-}Total\ of\ Env.KPIs\ and\ Aspectsas\ per\ local\ stock\ exchange\ ESG\ framework$

[Formula 5]

- Fully complied or explained
    - Aspects: 1.2 pts
    - Environmental KPI: 1 pt
    - Social KPI: 0.5 pt
- Partially complied or explained (e.g. lack of description, laws and regulations not provided, breakdown categories not fully followed, etc.)
    - Aspects: 0.6 pt

    - Environmental KPI: 0.5 pt
    - Social KPI: 0.25 pt
- Not complied nor explained
    - Aspects, KPI: 0 pts

[Formula 6]

$$ESG\ Rating_{APE} = ESG\ Rating \times (1 - APE\ Washing\ Score) \times APE\ Consistency\ Score$$

i-Score Computation

Step 1: Obtain ESG score of each stock
- Evaluate different ratings/scores from a third-party data provider.
- Make sure that the ESG ratings used are based on performance but not risk- or disclosure-based.

Step 2: Generate the divergence factor
- The "Aggregate Confusion Hypothesis" suggests that the rating divergence comes from 3 aspects: Scope, Rater, and Weighting differences. We argue that ESG analysts employed by different ESG data providers are subjected to regional and corporate culture influence in rating companies, leaving to the divergence.
- For each stock, we compute a divergence factor based on various ESG ratings of each firm from providers of different regions to capture the divergence effect.

Step 3: Compute the i-Score
- We compute the i-Score for each firm by scaling the ESG rating by the divergence factor generated in step 2.

ESG Data Intelligence for Future Research:

Our research suggests that listed firms' ESG reporting should adjust for greenwashing issue. Severe greenwashing will have strong negative consequences on stock valuation. As greenwashing is related to environmental measures, researchers and industry professionals should pay attention to the E-Pillar of i-score to examine the greenwashing issues.

Important Reminder: The following ESG scorecards are constructed based on a research methodology developed under the IDS Grant and documented in the "IDS Final Outcome and Methodology Report". The i-Composite measure reflects an ESG performance indicator based on inputs from various commercial ratings and sustainability sentiment scores. Owing to licensing restrictions of the databases, we are not able to show the actual raw data. As the i-Composite ratings are time-sensitive, the list serves as a demonstration of how ESG performance can be measured in a scientific manner in the past but should not be used as a tool to predict future valuation.

ESG Intelligence: i-Composite Scorecard:

We promote big data analytics through a technology-driven ESG sentiment indicator by adopting social listening measures for listed companies. The goal of the i-Composite Scorecard is designed to demonstrate the importance of a more dynamic ESG performance measure at firm level. The i-Composite Score consists of the i-Score and the Composite Sentiment Score.

The i-Score serves as a divergence-adjusted rating system regarding an investment portfolio, covering approximately the top 500 listed firms. By generating a unique and proprietary rating beyond a single number, we evaluate the overall ESG performance of a given portfolio in a fair and comprehensive manner using a peer-based approach for each composite stock. The Composite Sentiment Score is made up of RavenPack sentiment score (RP Senti) and YoujiVest sentiment score (YJV Senti).

i-Composite development process

The methodology for computing the i-Composite Score is demonstrated as follows.

a. Top100 i-Composite Scorecard v1.0

1. Compute i-Score (2022) for all HK listed firms with matching RavenPack sentiment score (RP Senti) and Youjivest sentiment score (YJV Senti), resulting in 498 firms as the i-Composite universe.

2. The data used for ESG ratings is as of December 2022, which reflect the latest ESG performance of the firms reported by the data providers. For the sentiment data, we employ a 15-month rolling period up to March 2023. Both sentiment data providers use a proprietary weighting scheme to reflect the relative importance of recent media coverage.

3. Based on the i-Composite universe, we perform simulations for various weightings among i-Score and the two sentiment scores to determine optimal weights to form the composite indicator. Our optimisation KPI is based on subjective sensitivity analysis of how the various weightings may affect the ranking of the top 100.

4. Our simulation result concludes that the optimal weighting scheme should follow a range of 70-80% for the i-Score, and the remaining 20-30% to be allocated to the sentiment components. Our current weighting scheme follows this guideline.

5. Then we compute the top 100 list based on the i-Composite indicator (theoretical range is -3 to 10). This is our *Top100* i-Composite Scorecard v1.0.

b. i-Composite Scorecard v2.0.

The Scorecard v2.0 employs a different ranking mechanism by integrating peer benchmarking into the methodology. We believe that this is an improvement from v1.0 as it is based on absolute i-Composite score, and therefore, subject to potential industry bias. The peer benchmarking procedure ensures each industry sector (GICS 1) would have a fair representation in the ranking construction process. In addition, we have two more enhancements in our data. First, we expand the news sources (both mainstream news and social media) for YoujiVest. Second, we expand the time period for both sentiment data which now covers the period of January 2022 – March 2023. The v2.0 system also compares the *Top100* (v2.0) with the *Bottom100*(v2.0) in the scorecard. Eventually, we aim to release the complete list of the Top500.

c. i-Composite Scorecard v3.0.

Enhancement in data timeliness and refresh for the new year

Entering 2024, the i-Composite Scorecard v3.0 has fully refreshed the raw data used for both the ESG and sentiment components. The ESG ratings now reflect the latest reported performance as of December 2023, while sentiment indicators are generated from a complete 12-month period covering January to December 2023. This significantly improves the timeliness and transparency of the underlying data compared to previous versions.

Continuation of peer benchmarking mechanism

The Scorecard v3.0 retains the same robust ranking mechanism introduced in v2.0, which integrates peer benchmarking within each industry sector. This consistent methodology ensures fair representation across industries and enables meaningful year-on-year comparisons of the characteristics of both the Top100 and Bottom100 firms between v2.0 and v3.0.

Expansion to full Top500 disclosure

In addition to enhanced data freshness and methodological continuity, the Scorecard v3.0 now provides greater transparency by releasing the complete ranked list of the Top500 firms in the i-Composite universe for the first time, allowing stakeholders to conduct more comprehensive analysis across the entire coverage scope. The actual firm level i-composite scorecard v3.0 is listed in the Appendix.

Appendix 1: Top 10 firms ranked by i-Composite v3.0

Stock Code	Name	GICS1	Market Cap	iScore (% sector rank)	RP Net Senti (% sector rank)	YJV Net Senti (% sector rank)	i-Composite (rank by sector)	Overall Ranking
00002.HK	CLP HOLDINGS LIMITED	Utilities	Large	6.30 (100%)	4.2 (92%)	1.7 (73%)	5.29 (1)	1
02359.HK	WUXI APPTEC CO., LTD.	Health Care	Large	7.65 (100%)	-0.1 (11%)	-0.4 (28%)	5.28 (1)	2
01928.HK	SANDS CHINA LTD	Consumer Discretionary	Large	6.39 (99%)	4.6 (94%)	0.1 (48%)	5.18 (1)	3
00175.HK	GEELY AUTOMOBILE HOLDINGS LIMITED	Consumer Discretionary	Mid	6.63 (100%)	2.0 (82%)	0.6 (83%)	5.03 (2)	4
00005.HK	HSBC HOLDINGS PLC	Financials	Large	7.06 (100%)	0.4 (53%)	-0.5 (32%)	4.93 (1)	5
02319.HK	CHINA MENGNIU DAIRY COMPANY LIMITED	Consumer Staples	Mid	6.65 (100%)	1.4 (58%)	0.2 (69%)	4.90 (1)	6
00956.HK	CHINA SUNTIEN GREEN ENERGY CORP LTD	Energy	Mid	6.55 (100%)	2.0 (67%)	0.1 (33%)	4.90 (1)	7
00011.HK	HANG SENG BANK LIMITED	Financials	Large	5.45 (97%)	4.6 (89%)	0.9 (92%)	4.64 (2)	8
00548.HK	SHENZHEN EXPRESSWAY CORP LTD	Industrials	Mid	6.39 (100%)	0.0 (27%)	0.1 (38%)	4.51 (1)	9
01299.HK	AIA GROUP LIMITED	Financials	Large	5.34 (95%)	4.4 (88%)	0.3 (83%)	4.44 (3)	10

To see the complete list of Top 500 firms ranked by i-Composite v3.0, please click here.

~End of Report~