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Life Cycle Management Laboratory

Project Report

Incorporating environmental, social, and governance (ESG) criteria into investment decision-making: Advancing the normalization of ESG performance characterization

Prepared for

Environmentally Sustainable and Socially Accountable Finance (ESSAFIN) Logic

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Executive Summary

The global ESG (environmental, social, and governance) movement has recently gained traction. The driving force behind this movement is a growing demand by investors to participate in responsible financing. This has led organizations and companies to develop ESG pillars, performance standards, principles, and metrics to ensure that business decision-making achieves the desired outcomes. In short, ESG investing considers financial viability while incorporating environmental and social impact factors. Despite obvious benefits, incorporating ESG values into investments can be problematic. The existing ESG assessment frameworks and performance evaluation tools lack standardization. In addition, there is an over-reliance on self-reported data, which may be prone to preferential manipulation or omission. The variability of approaches to ESG evaluation, combined with less than reliable data, creates a scenario where bluewashing and greenwashing have become pervasive in the market. To address the challenges of embedding ESG into financing, Environmentally Sustainable and Socially Accountable Finance (ESSAFIN) has developed a risk assessment tool that predicts and projects ESG performance of investments based on subject matter expertise and internationally accepted principles and standards. The ESSAFIN Logic ESG risk analysis tool, developed by scientists and assessment specialists, allows decision-makers to detect and mitigate risks to ESG values early in the investment process. In order to independently evaluate the quality of the ESG risk analysis tool and identify opportunities for enhancements, ESSAFIN commissioned the Life Cycle Management Laboratory (LCML) at the Okanagan Campus of the University of British Columbia (UBC) to provide a rigorous review. As such, the UBC LCML developed a three-phased approach to evaluate the ESSAFIN Logic risk analysis tool. Phase 1 included a comprehensive literature review and subject matter analysis of ESG pillars, criteria, standards, principles, and metrics. Phase 2 involved a comparative analysis of ESSAFIN's algorithm and decision tree matrix in relation to the existing body of knowledge. Finally, in Phase 3, an ESG expert panel scrutinized assumptions, weightings, and priorities incorporated in the ESSAFIN Logic risk analysis tool. The evaluation showed that the ESSAFIN Logic ESG risk analysis tool strongly aligns with globally accepted ESG policies, practices, and expert opinions. The LCML further recommended that probabilistic sensitivity analysis could be incorporated into the tool to account for uncertainty in risk predictions.

Keywords: Risk Analysis; ESG; Environmental, Social, and Governance; Sustainable Investing; Social Impact Investing

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Abbreviations

AUM	Asset under management
CLT	Central limit theorem
EPs	Equator principles
ESG	Environmental, social, and governance
ESSAFIN	Environmentally Sustainable and Socially Accountable Finance
EU	European Union
GRI	Global Reporting Initiative
IFC	International Finance Corporation
LCML	Life cycle management laboratory
MCDM	Multicritiera decision-making
PRI	Principle of Responsible Investment
SASB	Sustainability Accounting Standards Board
TCFD	Task Force on Climate-related Financial Disclosure
UBCO	University of British Columbia-Okanagan
UN	United Nations
WEF	World Economic Forum
WSM	Weighted sum method

1 Background

Environmentally Sustainable and Socially Accountable Finance (ESSAFIN) Logic provides environmental, social, and governance (ESG) analysis services through a proprietary software program that assesses and categorizes risks associated with investments or projects. The software incorporates globally acceptable ESG pillars, criteria, and indicators and generates a report with an ESG mitigation and monitoring strategy. The software program also provides decision-makers with measures to mitigate EGS risk in early phases before a project moves to the operational phase.

The algorithm of ESSAFIN's software incorporates the Equator Principles (EPs) and the International Finance Corporation (IFC) principles of life cycle thinking and waste hierarchy into the decision tree. The report generated from the analysis details the project's risk level and formulates an ESG mitigation and monitoring strategy. The report then forms the ESG analysis portion of the due diligence a financial firm would complete in their day-to-day business operations. The algorithm and weighting scheme behind the ESSAFIN software program was designed by scientists with decades of academic and real-world experience in analyzing ESG risks.

In order to scientifically validate the risk analysis tool, ESSAFIN commissioned the Life Cycle Management Laboratory (LCML) at the University of British Columbia Okanagan (UBCO) to independently evaluate its decision tree, methodology, and weighting scheme. LCML conducted a comprehensive literature review, a forensic review of the algorithm, and a research survey to validate the critical ESG criteria and metrics identified. The results found that ESSAFIN's algorithm was generally validated in its current state.

1.1 Life Cycle Management Laboratory (UBCO)

LCML, located in UBCO, is the only research facility in Western Canada that provides multidimensional assessments of the built environment and novel solutions to current and future decision-makers. Established in 2011, the LCML research team has expertise in urban development, water-energy nexus, waste management, life cycle assessments, construction and asset management, water systems and industrial products and processes, and solid waste management. The LCML resources include >30 state-of-the-art software and databases to facilitate comprehensive assessment for reliable decision-making. The LCML's research team comprises 30+ highly qualified personnel, experts in conducting detailed content analysis, extracting state-of-the-art information, conducting the expert survey, analyzing the data, and designing and modelling systems by considering multidimensional factors related to the environment, energy, social impact, and governance. LCML has a unique record of working with government and private organizations on numerous projects, enabling them to have a sound knowledge of industrial and research practices. They are also experts in creating and developing systems or assessments by considering the scientific lens and market perspectives. Over the years, the research team at LCML has been recognized with several Researchers of the Year, Applied Science Rising Stars, and Distinguished Scholar awards, reflecting their quality and commitment to the field of science.

LCML conducted a comprehensive literature review and content analysis of ESG pillars, criteria, and metrics by extracting information from over 40 peer-reviewed articles, reports, and relevant finance, accounting, and ESG association web pages to establish a knowledge base on indicators and parameters related to ESG. Following the literature review, a forensic review and analysis of ESSAFIN's algorithm and decision tree matrix was conducted in light of the existing body of knowledge. Then survey research was conducted involving experts from industry and academia from Canada, the United States, Asia, and

Europe to validate the critical ESG criteria and metrics identified in the literature review and forensic review phase.

2 History, practices, and tactics to evaluate ESG: A literature review

2.1 History of ESG

ESG is a term used to describe a set of factors that companies and investors consider when making decisions on operations and investments concerning risks, impacts, and opportunities. The IFC defines ESG as including three components: Environmental, Social, and Governance. The environmental component looks at business operations' impact on the natural environment, including climate change, biodiversity loss, carbon management, water pollution and consumption, waste management, energy, and land use. The social component considers how the company treats its employees, its relations with stakeholders, and the impact its products, services, and operating activities may have on society. The governance component examines the company's management, transparency, and ethical practices. ESG performance can be evaluated and incorporated by various stakeholders, including investors, lenders, government agencies, communities, customers, and employees. Investors and lenders use ESG data to evaluate the firm's risk based on ESG ratings and financial performance, while communities and customers may want to know about a company's environmental and social practices to inform their advocacy and purchasing decisions (Gorley, 2022; IFC, 2005).

Financial institutions play a crucial role in project funding as they influence the lending criteria for proponents. These criteria assess the proponents' ability to repay the loan and are accompanied by terms to support project completion and investment repayment. The importance of ESG risks in the project and corporate investments grew in the early 2000s due to increased awareness of climate change and social inequality, particularly in emerging economies. This led to the emergence of ESG investment strategies and an entirely new sector of thematic and social impact investment firms. ESG has now become an industry in itself, with various associations and standards used by governments, finance firms, and corporations to demonstrate their contributions to ESG goals. Pension, mutual, index, and hedge funds have adopted ESG strategies to varying degrees, reflecting the recognition of ESG's importance in managing risk and promoting long-term returns. Financial institutions readily adopted ESG after corporate scandals such as Enron, WorldCom, and the Exxon Valdez oil spill. However, the challenge is to standardize ESG metrics to evaluate and measure the impact of decisions made through ESG analysis (KPMG, 2021; UN, 2004).

The importance of ESG in investment decisions was first recognized by the United Nations (UN) in their Principles for Responsible Investment (PRI) report, which introduced the concept of "Who Cares Wins" in 2004. The framework aimed to promote ESG strategies and encourage greater disclosure from companies (UN, 2004). However, it wasn't until after the 2008 financial crisis that the adoption of ESG criteria into investment strategies began to grow exponentially. As of May 2021, over 2500 signatories representing more than $80 trillion in assets under management (AUM) have signed up to ESG criteria. The widespread adoption of ESG metrics has made it increasingly ubiquitous in the corporate landscape, with almost 20% of earnings calls mentioning ESG criteria. This shift is primarily driven by investor demand, with negative screening (avoiding sectors such as tobacco, oil & gas) and positive screening (focusing on clean energy or sustainable construction) becoming increasingly popular among investors who seek to promote positive social and environmental change through their investments (Atkins, 2020). It is evident that ESG has become an integral part of investment decision-making, and companies that fail to adopt ESG principles may be at risk of losing potential investors who are more socially and environmentally conscious.

In 2008, the World Bank launched the first green bond, introducing a new financial instrument designed to provide fixed-income securities for projects with specific environmental benefits. Green bonds offer investors an ethical and stable investment opportunity, as they are sourced from companies that adhere to high corporate governance and sustainability standards (World Bank, 2022). This financial innovation has since grown in popularity, with the global green bond market reaching over $1.6 trillion in 2021. Green bond use has expanded to 80 countries and includes various sectors, such as renewable energy, sustainable agriculture, and clean transportation. By providing access to capital for environmentally friendly projects, green bonds contribute to the global effort to mitigate the effects of climate change and promote sustainable development (Harrison et al., 2022).

The signing of the Paris Agreement in 2015-2016 was a historic milestone in the global fight against climate change, with signatories committing to limiting global warming to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase even further to 1.5°C. As a result of this agreement, there has been an increased global focus on climate change and sustainability, with investors and companies placing a greater emphasis on ESG issues (Paris Agreement, 2015). In fact, according to a recent report, sustainable investing assets grew by 15% between 2018 and 2020, reaching $35.3 trillion in AUM (Global Sustainable Investment Alliance, 2021). This demonstrates the increasing importance of ESG factors in the investment decision-making process.

In response to the growing demand for ESG data and disclosure, a number of organizations have developed standards and frameworks to help companies assess and report on their ESG performance. The Global Reporting Initiative (GRI) and Sustainability Accounting Standards Board (SASB) are two such organizations that have developed widely accepted standards for reporting on ESG factors. By using these frameworks, companies can more effectively communicate their ESG performance to investors and other stakeholders (Nordea, 2021). Furthermore, governments around the world are introducing measures to adopt ESG frameworks due to the rising demand for responsible investments. For example, the European Union's (EU's) Sustainable Finance Disclosure Regulation requires financial market participants to disclose information about how they integrate ESG factors into their investment decisions (BlackRock, 2021).

The UK Corporate Governance Code, published in 2018, requires companies to establish a minimum standard of ESG, reflecting the growing importance of ESG issues in corporate decision-making. This move aligned with a broader trend of regulators and policymakers recognizing ESG as a crucial factor in managing risk and promoting sustainable growth (airmic, 2018; FRC, 2018). The Code is intended to promote transparency and accountability and encourage companies to take a more holistic view of their impact on society and the environment by considering board composition, stakeholder engagement, and climate-related risks (FRC, 2018).

Moreover, the rise of green bonds has provided an additional avenue for investors to support ethical and sustainable business practices. Green bonds are fixed-income securities to raise funds for environmentally sustainable projects (Harrison et al., 2022). The issuance of green bonds has grown significantly in recent years, with the global market for these bonds reaching a record high of $470 billion in 2022 (Sugrue & Popoola, 2023). Green bonds provide investors with a unique opportunity to invest in projects supporting environmental sustainability while encouraging companies to adopt sustainable business practices.

In recent years, the insurance industry has increasingly recognized the importance of ESG factors in its investment strategies. This is because ESG issues can significantly impact long-term financial performance and risk management. In response, many insurance companies have adopted ESG guidelines and criteria to promote sustainable investments, such as investments in renewable energy or green bonds (Insurance

Europe, 2022). For example, insurance and reinsurance companies are now prioritizing their investments towards companies that are better managed and positioned to mitigate potential ESG risks.

In addition, companies are now required to report on their process for identifying and assessing adverse impacts of risks that could impact their entire value chain. This ensures companies consider ESG factors in decision-making (Insurance Europe, 2022). By adopting ESG investing strategies, insurance companies can also help build customer trust and create a better public image by gathering and sharing ESG performance data to generate evidence on various ESG outcomes, such as carbon reduction targets and physical climate risk factors (McLennan, 2021).

Betsy DeVos, a prominent supporter of ESG investing, made a case in 2020 for including ESG considerations in any investor's portfolio. She highlighted the potential for both long-term financial returns and positive societal impact. DeVos argued that ESG investing could benefit policyholders and encourage greater transparency from companies while addressing critical issues such as climate change and social inequality. She emphasized the need for increased transparency in ESG investing, responsible investing, and the availability of easily accessible ESG data.

A report by Morgan Stanley found that sustainable funds outperformed traditional funds during the coronavirus pandemic. According to the report, the funds that invested based on ESG principles demonstrated greater resilience in the face of market volatility, resulting in a significant outperformance compared to traditional funds. This further supports the importance of ESG investing in current global settings (Morgan Stanley, 2019).

2.2 Environmental, Social, and Governance Trends and Influences

Companies and investors are under increasing pressure to adopt sustainable practices and meet ESG requirements. However, this has led to some corporations overselling their ESG initiatives to gain stakeholder favour, a practice known as ESG washing. ESG washing can take many forms, including green, social, blue, and whitewashing (Seidler, 2022). Greenwashing occurs when companies mislead stakeholders about their environmental impact, while social washing is when companies market themselves as socially conscious when they are not. Blue washing is used in two ESG contexts; the first is related to marine development initiatives that deliver little to no sustainable benefits and may cause harm to aquatic environments. The other context concerns businesses registered as part of the UN Global Compact that fail to follow its ten corporate ethics and sustainability principles. Whitewashing occurs when companies attempt to cover up scandals with biased data or minimal investigations (ABT, 2022; Seidler, 2022).

To combat ESG washing, standards and tools have been developed to facilitate companies in managing and disclosing ESG practices and evaluating their performance (Huber et al., 2018). However, the ESG aspect is still evolving, and companies and stakeholders must make their operations more sustainable (Gorley, 2022). In the coming years, ESG integration into mainstream finance is expected to increase, and regulators and legislative bodies will implement frameworks and incentivize companies to take ESG into account. New financial instruments will also emerge to bridge the gap between traditional return-seeking investors and sustainability-focused investors (PRI, 2022).

It's important to note that the standardization of ESG analysis remains a challenge due to the varied nature of ESG factors across industries and regions. It isn't easy to set a uniform standard that applies to all companies across all sectors, especially without universally accepted ESG criteria. Nevertheless, standardizing ESG analysis would provide clarity and transparency to stakeholders and investors, reduce the risks of ESG washing, and promote sustainable investments. Several initiatives and organizations have

been working towards creating standardized ESG frameworks and metrics. These include the GRI, SASB, and the Task Force on Climate-related Financial Disclosures (TCFD).

2.3 ESG Standards, Frameworks, and Metrics

The section highlights various ESG standards, frameworks, principles, and metrics that companies can adopt to better understand and manage ESG risks and evaluate their investments' potential impacts. One such standard is the Performance Standards developed by the IFC, which outlines the environmental and social expectations that the organization has for its clients. The Performance Standards cover pollution prevention, community health and safety, labour and working conditions, involuntary resettlement and Indigenous peoples, cultural heritage, biodiversity, risk management, and community (IFC, 2012).

The IFC's corporate governance framework provides a holistic approach that considers technology, strategy, organization, and culture to strengthen the board structure, improve transparency and accountability, develop strategies and policies, and strengthen risk management and compliance efforts. Adopting IFC standards and corporate governance framework can help companies increase their disclosures to investors and analysts through its Disclosure Toolbox (IFC, 2012).

Another risk management framework is the EPs that financial institutions can adopt for determining, assessing, and managing environmental and social risk in project financing. The EPs provide a benchmark for determining whether a project is financially and socially sustainable and help ensure that projects adhere to applicable laws, regulatory requirements, and industry best practices. The EPs cover stakeholder engagement and consultation, assessment of potential project impacts, environmental and social management plans, and monitoring and reporting (Equator Principles, 2020).

The World Economic Forum (WEF) has also created a diverse set of ESG metrics to support investors in better analyzing, measuring, and understanding the impact of their investments. The ESG metrics cover climate change, environmental performance, social inclusion, diversity, and governance. The metrics address issues such as pollution and hazardous waste management, biodiversity preservation, respect for labour laws, and responsible supply chain management, among other topics. The WEF metrics are used to compare the ESG performance of companies and help investors better assess their risk profile (WEF, 2020).

Similarly, the PRI is an international network that supports investors in understanding and better managing environmental, social, and governance risks. PRI focuses on integrating ESG factors into the decision-making and analysis of investments to enhance long-term value (PRI, 2006).

The EU taxonomy is an environmental taxonomy developed by the European Commission to provide a set of criteria to distinguish environmentally sustainable investments. The investments are categorized based on six overarching environmental objectives: climate change mitigation, adaptation, preservation of water and marine resources, circular economy, pollution prevention, and protection of biodiversity and ecosystem. The taxonomy also outlines technical screening criteria that need to be met to ensure that investments are labelled "green" and meet the requirements for public and private funding (European Commission, 2023).

Adopting these standards, principles, and metrics provides guidelines for better understanding and managing ESG risks and evaluating investments' potential impacts. An assessment tool incorporating the lenses of IFCs, EPs, WEF, PRI, and EU taxonomy can facilitate evaluating and conforming to the applicable ESG criteria and metrics and ensuring the delivery of long-term benefits to society. Additionally, the EPs play a particularly crucial role in providing a risk management framework for financial institutions, and the

EU taxonomy is critical in developing and evaluating ESG investments, helping investors prioritize investments within a framework of sustainable development criteria, and tracking progress towards sustainability goals.

2.4 Challenges in implementing ESG reporting

Organizations have become increasingly aware of the importance of sustainable practices and social responsibility, so the demand for comprehensive ESG reporting has grown. Initiatives such as GRI, SASB, and UN Sustainable Development Goals have been developed to encourage organizations to become more transparent in their reporting. However, the effective implementation of these reporting requirements can be impacted by several factors (Cort & Esty, 2020; Jacobs & Levy, 2022).

- Firstly, variations in reporting standards across different regions and jurisdictions make it difficult to apply a generalized reporting system that ensures compliance with all applicable regulations and standards. This challenge is compounded by the significant resources required to conduct a complete ESG reporting project, including investment in specialized resources, software tools and services, and subject matter experts.
- Secondly, ESG data limitations and complexities can be challenging, as data is currently underdeveloped and may be scattered due to different reporting standards. Additionally, self-reported data from companies can be incomplete or inaccurate, not reflecting a company's true ESG performance or reporting.
- Thirdly, data collecting and reporting can be time-consuming and require a certain skill set to ensure accuracy and quality. Finally, the complex requirements of stakeholders, including competing interests and different expectations, can make it challenging to conduct a robust ESG assessment and implement a generalized reporting system.

Therefore, expert surveys can be useful for eliciting opinions from knowledgeable individuals on specific topics, highlighting critical factors and areas of greatest importance. Integrating expert opinions into existing ESG criteria can develop a more generalized and comprehensive knowledge base, guiding decision-makers in selecting relevant ESG metrics and their weights to measure progress, ensure compliance with relevant regulations, and establish standardized best practices. Ultimately, these efforts can help organizations implement more effective ESG reporting, promoting sustainable practices and social responsibility.

2.5 Survey Research

Questionnaires and surveys are useful for integrating large populations or experts' opinions into decision-making. In survey research, it will always be tempting to take a non-specific approach and ask as many questions as possible; however, this approach does not work as asking too many irrelevant or incoherent questions reduces the response rate (Story & Tait, 2019). Therefore, it is important to carefully identify the required critical information and the right personnel to question to extract the meaning of full results. Surveys can gather large amounts of information and have that validated with the available models. The survey distribution and response should be significant to draw reliable conclusions. Therefore, it should follow the central limit theorem (CLT) guidelines.

The CLT states that the distribution of a sample variable approximates a normal distribution as the sample size becomes larger, assuming that all samples are identical in size and regardless of the population's actual distribution shape. The CLT is useful when analyzing large data sets because it allows one to assume that the sampling distribution of the mean will be normally distributed in most cases. This allows an easier

statistical analysis and inference. Generally, a sample size of 30 is reasonable, as it will increase the confidence interval of the data set to support the findings and arguments. Nonetheless, the information extracted from the survey needs to be integrated using decision-making techniques to draw simple and interpretable outcomes (Ganti, 2022).

2.6 Decision-making

Decision-making is a cognitive problem-solving process that ends when a satisfactory solution is reached. For selecting or prioritizing alternatives, the decision-makers often encounter tangible and intangible conflicting criteria (i.e., environmental, social, and governance) due to real-world complexities (Mian et al., 2023). Therefore, multicriteria decision-making (MCDM) techniques have been widely used to evaluate different factors or criteria. In most MCDM techniques, a numerical value is assigned to highlight the importance. The analysis of weight and interpretation of results depends on the selected technique type, as the method used in each technique has a different basis and assumptions. The utility-based methods, i.e., analytical hierarchy process, multi-attribute utility theory, and weighted sum method (WSM), give a single score for each alternative, requiring all the alternatives to be directly comparable. Among these utility-based methods, the WSM is preferred over other methods as it is simple and less severe than the weighted multiplicative (Bazgan et al., 2022).

The model for the WSM is provided in Eq.1

$$WS = \sum_{i=1}^{N} W_i S_i \qquad \text{Eq.1}$$

Where; WS = weighted score; N = number of indicators to be aggregated; S_i = category value i; W_i = weight allocated for the indicator i. The weighted sum method was applied to interpret the results by combining the weights (response from experts) and importance categories (defined linguistic scale) mentioned in Table 1 to evaluate various ESG indicators and criteria.

3 Methodology

LCML adopted a three-phased methodology to evaluate the ESG criteria and indicators.

In phase 1: A comprehensive literature review and content analysis on global ESG pillars, criteria, standards, principles, and metrics were conducted. In addition, several performance standards and governance frameworks developed by different organizations were reviewed to establish up-to-date knowledge based on ESG practices and reporting. Similarly, the data on the relative importance of each ESG criterion was collected to identify the critical factors used to evaluate ESG performance.

In phase 2: A forensic review of ESSAFIN's algorithm and decision tree was conducted and compared to establish a knowledge base on indicators and parameters (up-to-date literature) from phase 1. All critical ESG pillars, criteria, and metrics developed by ESSAFIN were identified, and their applicability in diverse organizational and background settings was assessed. Some critical ESG pillars, criteria, and their respective weights were taken to the next phase for expert validation via a research survey.

In phase 3: A questionnaire was developed based on an assessment tool review and content analysis of the literature. The questionnaire was designed based on existing literature and trends of ESG as well as modules of existing risk assessment tools, i.e., life cycle thinking, climate effects and natural hazards, risk characterization, regulatory settings, primary assessment, and community engagement. The questions were

mapped in both generalized and specific contexts to extract information from the experts working in different sectors (engineering, finance, health, social, etc.) from both academia and industry. After developing the questionnaire, approval from the research ethics committee was taken to protect the research participants' dignity, rights, and welfare. The survey was distributed to >60 industry experts. Participants were contacted via email or a Qualtrics survey tool and given the option to have a telephonic, one-on-one interview. The questionnaire was designed to take 10-12 minutes to complete. In total, 16 questions were mapped to evaluate different pillars, criteria, and parameters of ESG. A questionnaire sample is provided in Appendix A1. A linguistic scale was also established for the respondents to rank their opinion on questions evaluating ESG pillars, criteria, and parameters, as shown in Table 1.

Table 1 Linguistic scale

Scale	Score	Description
Very Low	1	Considered factor has a very low impact on overall ESG risk
Moderate	3	Considered factor has a moderate impact on overall ESG risk
High	5	Considered factor has a high impact on overall ESG risk
Very High	7	Considered factor has a very high impact on overall ESG

In total, ≈40 respondents provided feedback, showing that the results are statistically significant (>30). Furthermore, the response rate was ≈ 50%, reflecting high-quality, reliable, and accurate data collected to draw meaningful conclusions. Among the respondents, 40% were from engineering and environmental backgrounds, 26% were from financial backgrounds, 18% belonged to social sectors, and 16% were from academia. The individual results were collected, analyzed, and the responses for each question were mapped using 100% stacked bar graphs, provided in Appendix A2. In this report's results section, the WSM was applied to the responses compiled in Appendix A2 by considering two scenarios. In scenario 1, all rank categories and their respective response percentage were collectively analyzed, whereas, in scenario 2, only *high* and *very high* categories were analyzed. The results from both scenarios were combined, and a probabilistic assessment was conducted to establish a range (minimum to maximum) of the relative importance of ESG criteria instead of a single value. The 10^{th} and 90^{th} percentiles of probabilistic assessment were taken as the minimum and maximum values of the range. The detailed results of the survey are provided in the following section.

4 Results and discussion

4.1 Phase 1

In Phase 1, the knowledge base on different ESG pillars, criteria, and their relative importance developed by various organizations was summarised. EFFAS (2009) identified 25 key performance indicators for ESG performance evaluation. The indicators are split into five categories: economic, environmental, social, corporate governance, and stakeholder relations. The indicators measure corporate activities or policies in these categories ranging from employee satisfaction to energy efficiency and waste management. Similarly, Thomson Reuters (2017) comprehensively developed key performance indicators for ESG using 400 data points and several ESG measures. The critical ESG criteria were further grouped into 10 categories: 3 categories of environmental components, 4 of social components, and 3 of governance components. In

environmental components, the categories and their respective percentage weights are resource use (11%), emission (12%), and innovation (11%). In the social component, the categories and their respective percentage weights are workforces (16%), human rights (4.5%), community (8%), and product responsibility (7%). Under the governance component, the categories and their respective percentage weights are management (19%), shareholders (7%), and Corporate Social Responsibility strategy (4.5%). In 2018, the quantum advisors weighted ESG metrics such as governance (50%), environmental (25%), and social (25%). Similarly, global and domestic systemically important banks in North America, Europe, and Asia have weighted governance (60%) as relatively higher than the social (25%) and environmental (15%) components (Orsagh et al., 2018). For these systemically important banks, the environmental element is defined in terms of sustainable lending impacts, environmental and sustainability plans, and green bond insurance. The social components include regulatory requirements, product safety, customer privacy, and data security. The governance aspect includes culture, risk management, accounting quality, board quality, and human capital (Orsagh et al., 2018).

DFIN (2019) incorporates the ESG criteria by considering 10 themes and 37 ESG issues. Among established themes and issues, the critical ones, along with their weighted percentage (%), include environmental impact (26%), political contribution (23%), greenhouse gas emissions (23%), diversity (22%), and sustainability (21%). Similarly, the Alternative Capital Partners (2019) defined the ESG performance by considering 7 components and their weighted percentage (%), i.e., management (10%), policy & disclosure (11%), risk & opportunity (30%), monitoring (14%), stakeholder engagement (4%), performance indicators (28%), and certificates and rewards (3%). Recently, Mirova (2021) developed a framework that takes a multidimensional approach to evaluate the ESG performance of investments. The framework evaluates investments from a risks-based, life-cycle view and considers both listed and unlisted investments. It also categorizes investments based on multiple indicators such as climate change, ecosystem services, employment, gender/ethnicity inclusion, and more. This approach provides a more holistic assessment of investments and allows investors to better understand the potential ESG performance and outcomes associated with their investments. The knowledge base on ESG and the accompanying literature provides important insights into global trends and practices. This information can guide investors in understanding the potential outcomes associated with investments for informed decision-making and ensure that investments meet specific sustainability goals.

4.2 Phase 2

The ESSAFIN assessment tool covers the components of ten EPs, IFC performance standards, and corporate governance frameworks to highlight various environmental and social challenges and ensure good governance and transparency to the public and shareholders. In addition, the assessment tool mirrors the criteria of UN sustainable development goals, WEF metrics, and PRI to provide institutions with guidelines for managing environmental and social risk, comparing the ESG performance of companies to assess their risk profile and encourage investors to manage the consequences of the investments actively. More specifically, the decision tree includes the modules of life cycle thinking, the impact of climate effect and natural hazards, risk characterization during the planning and operational phase, regulatory settings, primary assessment and impact of different activities, and stakeholder engagement. The tool can conduct a risk analysis for a project (i.e., new development), process (i.e., enhancement), and investment (i.e., stocks and bonds etc.). In addition, it can evaluate all sector levels, such as primary (i.e., raw material extraction), secondary (i.e., manufacturing), territory (i.e., financial services), and quaternary (i.e., research and

development). It can therefore provide a robust risk assessment to agriculture, food, manufacturing, infrastructure, public service and utilities, energy, private services, and education sectors.

4.3 Phase 3

This section further assesses critical ESG pillars, criteria, and indicators identified in ESSAFIN's algorithm and decision tree through the expert lens using a search survey. The following discussion compares different ESG pillars, criteria, and indicators based on the recorded responses. Details of responses are provided in Appendix A2, as mentioned.

1. *Importance of Environment, Social, and Governance criteria in selecting an investment:*

83% of respondents ranked environment as *high* to *very high*, 77% ranked social as *high* to *very high*, and 71% ranked governance aspects as *high* to *very high*. The environment component was weighted slighter higher, followed by social and governance components. Based on WSM and probabilistic analysis, scenario 1 weights the social and governance criteria 5% lower than the environment. In scenario 2, the social and governance components are 10% and 13%, respectively less important than the environment. Table 2 provides the overall comparison of ESG criteria.

Table 2 Importance of ESG criteria based on responses

Environment	Social	Governance
Maximum	↓ 5-10%	↓ 5-13%

2. *Importance of the proponent's ESG framework in determining risk to environmental and social factors:*

77% of respondents ranked environmental factors as *high* to *very high*, and 74% ranked social factors as *high* to *very high*. Similarly, 19% and 16% of respondents ranked environmental and social factors as *moderate*, respectively. The WSM and probabilistic assessment showed that social factors have a 1% relative low weight compared to the environment, as indicated in Table 3.

Table 3 Importance of existing ESG framework

Environment	Social
Maximum	↓ 1%

3. *Importance of life cycle stages in evaluating the overall risk to ESG values:*

87% of respondents ranked the design aspect as *high* to *very high* to evaluate the ESG risk, 84% of respondents ranked operational life and material sourcing as *high* to *very high*, and 68% of respondents ranked project type as *high* to *very high*. Considering these top three life cycle stages, i.e., operational life, material sourcing, and design, 52% of respondents ranked operational life as *very high* only, whereas 39% ranked design and material sourcing as *very high*. Table 4 compares each life cycle stage using the WSM followed by a probabilistic assessment.

Table 4 Importance of life cycle stages

Operational life	Material Sourcing	Design	Project type
Maximum	↓ 3-5%	↓ 2%	↓ 18-27%

The operational life stage is the most critical, followed by the design and material sourcing phase. Furthermore, it was identified that project type is weighted 18-27% lower than operational life when making investment decisions.

4. *Importance of different frequencies of expected hazard occurrence to evaluate the project risk:*

>90% of respondents ranked the frequency of occurrence within 1 and 3 years as *high* and *very high*, 80% of respondents ranked the frequency within 5 years as *high* to *very high*, and <70% of respondents rank occurrences within 7 and 10 years as *high* to *very high*. The WSM followed by probabilistic assessment results is given in Table 5.

Table 5 Expected hazard Occurrence frequency

Within 1 yr.	Within 3 yr.	Within 5 yr.	Within 7 yr.	Within 10 yr.
Maximum	↓ 2-3%	↓ 8-14%	↓ 10-13%	↓ 5-12%

It was observed occurrence frequency of 1 yr. is most important, followed by 3 yr. for a project investment or selection. The occurrence frequency of 5, 7, and 10 years was ranked relatively lower, i.e., 8-13%.

5. *Effectiveness of available control technology able to mitigate the impact:*

The results showed that ≈45% of respondents believe mitigation technology effectively (*high to very high*) mitigates the impacts, whereas ≈45% of respondents believe that control technologies *moderately* mitigate the impacts. Around 10% of respondents believe that control technology would have a *low* effect in mitigating the impacts.

6. *Importance of the following:*
   - *Surface contamination*
   - *Terrestrial habitat*
   - *Aquatic habitat*
   - *Sensitive species impact*

According to the survey, >90% of respondents ranked sensitive species as *high* to *very high*, whereas the aquatic and terrestrial habitats were ranked *high* to *very high* by 87% and 83%, respectively. Furthermore, around 77% of respondents ranked surface contamination as *high* to *very high*. The comparison of considered aspects using WSM and probabilistic assessment is given in Table 6.

Table 6 Relative importance of risk characterization factors

Sensitive species	Aquatic habitat	Terrestrial habitat	Surface contamination
Maximum	3-5%	2%	18-27%

The impact on sensitive species is most important, followed by aquatic habitat impacts (lower by 3-5% compared to sensitive species impact). The terrestrial habitat and surface contamination impacts have a relatively low importance of 9-15%.

7. *Importance of the following:*

- *Direct physical impact on an ecological value or system*
- *Indirect physical impact on an ecological value or system*
- *On-site compensation for the impact*
- *Off-site compensation for the impact*
- *Financial compensation for the impact*

According to the survey, 80% of respondents ranked on-site compensation as *high* to *very high*, whereas 77% and 71% ranked direct physical impact and indirect physical impact as *high* to *very high*, respectively. For other risk characterization factors, <50% of participants ranked them as *high* to *very high*. The WSM-based comparison is provided in Table 7.

Table 7 Importance of ESG criteria based on responses

Direct physical impact	Indirect physical impacts	On-site compensation	Off-site compensation	Financial compensation
Maximum	8-17%	2-16%	28-46%	26-29%

Overall it was observed that direct physical impacts are more important for decision-making in prioritizing the investments in the project. Indirect physical impacts are 8-17% less important than direct physical impacts under different environmental settings. Similarly, the on-site compensation is also considered relatively lower by 2-16% compared to direct physical impact. Off-site and financial compensation were >25% less important than a direct physical impact.

8. *Importance of consulting the local community:*

≈68% of respondents believe it is *very important* to consult with the local community, whereas 32% of respondents believe it is *important* to consult with the local community. Consulting with the local community is considered *highly important* in general.

9. *Importance of engaging with the local Indigenous peoples:*

>90% of respondents ranked consultation and engagement with local Indigenous people as *high* to *very high*, thus, reflecting the importance of this aspect in evaluating the overall ESG risk. The confidence interval for each rank category is provided in Table 8.

Table 8 Confidence interval of responses

Rank category	Confidence interval
Moderate	3% to 25%
High	5% to 29%
Very high	60% to 89%

10. Importance of implementing the following:

- *Public consultation process*
- *Community benefits agreement*

>95% of respondents ranked the implementation of the public consultation process as *high* to *very high*, whereas implementing a community benefits agreement was ranked *high* to *very high* by 84% of respondents. The WSM provided a relative comparison of both considered scenarios, given in Table 9.

Table 9 Importance of ESG criteria based on responses

Public consultation process	Community benefit agreement
Maximum	↓ 6.5-13%

11. Rank the importance of the following:

- *Qualified professional (with required professional designations) has completed the design specifications or assessment of a physical project*
- *A competent professional (without professional designations) has completed the design specifications or assessment of a physical project*
- *A professional without specific competencies or professional designations has completed a physical project's design specifications or assessment*

According to the survey, 70% of respondents ranked the presence of a qualified professional (with required professional designations) as *high* to *very high*, whereas 60% of respondents ranked the presence of a competent professional (without professional designations) as *high* to *very high*. Table 10 provides the relative importance and comparison of the mentioned aspects using the WSM method.

Table 10 Importance of qualified personnel in evaluating the risk and assessment

Qualified personnel	Competent personnel (Without qualification)	Non-competent
Maximum	↓ 8-21%	↓ 32-40%

12. Importance of following risk characterization factors:

- *Chronic air pollution*
- *Chronic water pollution*
- *Solid waste generation*

All respondents ranked water pollution as *high* to *very high*, whereas 96% of respondents ranked air pollution as *high* to *very high*. The solid waste generated was ranked *high* to *very high* by 70% of respondents. More specifically, water and air pollution were ranked *very high* by 73% of respondents. The WSM provides the relative importance of risk characterization (operational phase) factors, as shown in Table 11. It is important to note that WSM was applied considering the *high* and *very high* categories, as the respondents gave less weightage to *very less* and *moderate* impact categories. Furthermore, probabilistic analysis was not applicable in this case; therefore, the impact comparison was not presented in a range.

Table 11 Relative importance of risk characterization factors (operational phase)

Water pollution	Air pollution	Solid waste
Maximum	↓ 3%	↓ 37%

Water and air pollution were relatively more important as the relative impact of air pollution was only 3% lower than water pollution. The impacts of solid waste were 37% lower compared to air and water pollution.

13. Importance of environmental and social guidelines in reducing risk to ESG values:

The survey results showed that ≈30% of respondents ranked the environmental and social guidelines as *highly* important in reducing ESG risks. At the same time, ≈47% of respondents ranked environmental and social guidelines as *moderately* important in reducing ESG risks. Table 12 shows the confidence interval range of each rank category based on the survey response.

Table 12 Confidence interval of environmental and social guidelines in reducing ESG risks

Rank category	Confidence interval
Very less	12% to 41%
Moderate	30% to 64%
High	5% to 30%
Very high	7% to 34%

14. Importance of comprehensive environmental assessment for minimizing the risk to ESG:

The survey results showed that ≈57% of respondents ranked the comprehensive environmental assessment as *very high*, ≈33% of respondents ranked the environmental assessment as *high*, and 10% ranked the environmental assessment as *moderate*. Table 13 provides the confidence interval range of each impact category based on the survey response.

Table 13 Confidence interval of environmental assessment importance in reducing the risk

Rank category	Confidence interval
Moderate	4% to 26%
High	19% to 51%
Very high	39% to 73%

15. Importance of the following primary assessment (concept design) aspects:

- *baseline environmental studies*
- *archaeological aspect*
- *culture and heritage value*
- *socio-economic*
- *consideration of alternatives*

According to the survey, ≈90% of respondents ranked baseline environmental studies and socio-economic impacts as *high* to *very high*, whereas ≈83% ranked consideration of alternatives as *high* to *very high*. Similarly, ≈77% and ≈67% of respondents ranked the cultural and archaeological aspects *high* to *very high*. The WSM and probabilistic results are provided in Table 14.

Table 14 Relative importance of primary assessment factors in evaluating the ESG risk

Baseline environmental studies	Archaeological aspects	Cultural and heritage value	Socio-economic impacts	Consideration of alternatives
Maximum	↓ 19-30%	↓ 15-21%	↓ 6%	↓ 10-13%

It was identified that baseline environmental studies are most critical in decision-making during the early planning stage, followed by socio-economic impacts (6% less importance). Consideration of alternatives, culture and heritage values, and archaeological aspects were ranked relatively low by 10-30%, as shown in Table 14.

16. Importance of following the primary assessment (in operation) aspects:

- *Residual impacts of operational pollution*
- *Cumulative impacts*
- *Operational pollution generation.*

>90% of respondents ranked operational pollution and residual impacts of operational pollution as *high* to *very high*. In contrast, around 83% of respondents ranked cumulative impact as *high* to *very high*. The respondents did not respond to *very less* and *moderate* impact categories; therefore, only *high* and *very high* categories were considered for WSM, and probabilistic assessment was not conducted in this case, as provided in Table 15.

Table 15 Relative importance of primary assessment (in operation) in the evaluation of the ESG risk

Baseline environmental studies	Cumulative impacts	Residual impacts of operational pollution
Maximum	↓ 11%	↓ 9%

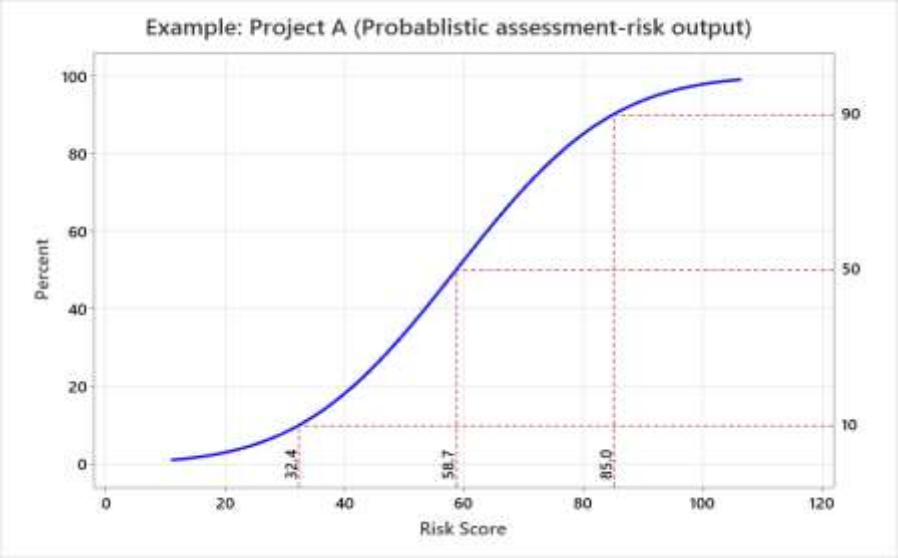
5 Future prospects

In the present study, ESSAFIN, with the support of LCML at UBCO, established and validated the relative importance of different ESG criteria and pillars, as discussed in sections 3 and 4. The next step for ESSAFIN is to incorporate these input ESG criteria and pillars into the ESSAFIN software to establish a comprehensive risk profile project or process. Probabilistic assessments can be applied to include uncertainty and variability in a system or process. They can assist in describing the likelihood of the risk occurring from a range of inputs, ESG criteria, and pillars rather than a single deterministic value.

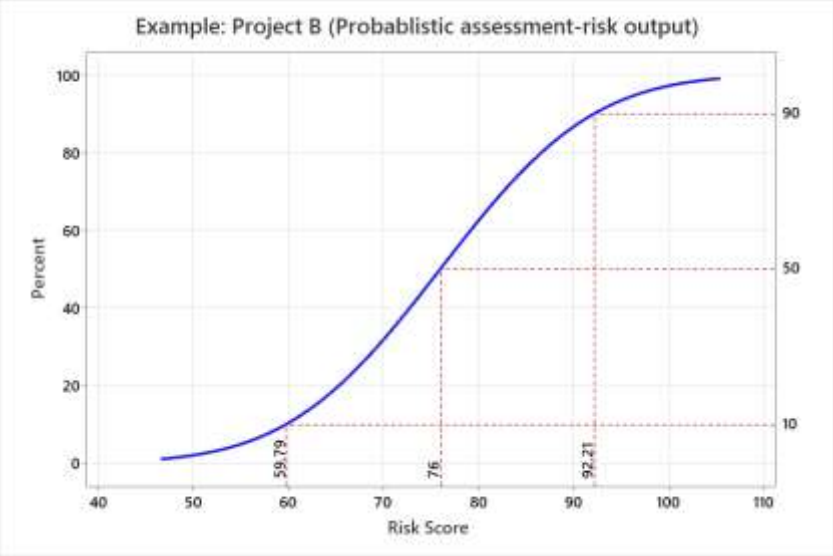
The first step will be to choose a probability distribution representing the range of responses or data. For example, if the input was a single value of 10, now it has a range of 5 to 15. A distribution function could be used to represent the range. There could be a variety of distribution functions, which can be applied to see which function matches that data and use it to represent a value. The choice of distribution would depend on the characteristics of the data and the nature of the survey question.

Following the distribution selection, the Monte Carlo method will be applied to generate a range of output risk scores. The simulation would involve random sampling of the input range and generating probability distribution of output risks. This will lead towards developing a cumulative distribution function and generating a risk score range rather than a single value.

With cumulative distribution function, the existing ESSAFIN's existing risk scale, i.e., Low (<40), Moderate (40-70), and High (>70), will be transformed into a probabilistic scale, as shown in Figure 1.



(1-a)



(1-b)

Figure 1 Distribution functions of output risks for project A (1-a) and project B (1-b)

Figure 1 shows a conceptual version of the probabilistic output risk score for projects A and B. The deterministic risk scores of project A and B is assumed as 55 and 76, respectively.

Figure 1-a shows the probabilistic risk associated with Project A. The most likely risk score is 59, which can be as low as 32 and as high as 85, considering an 80% confidence interval. For Project A, the 10^{th} percentile risk score is 32, the 50^{th} percentile (most likely) is 59, and the 90^{th} percentile is 85. Similarly, for Project B (Figure 1-b), the most likely risk score is 76, which can be as low as 59 and as high as 92, considering an 80% confidence interval. Project B's 10^{th} percentile risk score is 59, the 50^{th} percentile (most likely) is 76, and the 90^{th} percentile is 92.

At an existing deterministic scale, the risk score of project A is 55, reflecting a moderate risk. However, transforming risk into the probabilistic scale would allow ESSAFIN to provide a range of output risk scores. Using a probabilistic scale, the ESSAFIN team can better capture the uncertainty and variability in their risk assessments and allow for a more nuanced understanding of the possible outcomes. This development will help ESSAFIN's clients to understand better the potential risks and uncertainties associated with different projects.

6 Conclusion and recommendations

The rise of sustainable financing and ESG has brought about significant changes in the investment landscape. Investors and companies increasingly adopt ESG criteria and metrics, while governments support funding sustainable and responsible investing initiatives. ESSAFIN Logic is a reputable ESG consulting service that has been helping companies improve their environmental and social outcomes through ESG risk analysis and performance evaluation against ESG metrics. However, the prevalence of greenwashing and social washing has made it necessary for decision-makers and investors to incorporate evolving ESG trends to obtain reliable information on a company's or project's ESG performance.

To ensure that their software decision tree and algorithm align with best-in-practice standards and adapt to evolving ESG trends, ESSAFIN commissioned an independent evaluation by the LCML at UBCO. The LCML evaluation involved a literature review and content analysis of global ESG practices, a forensic examination of ESSAFIN's software and algorithm, and a research survey to validate critical ESG factors. The survey received a response rate of >50%, and the overall analysis found that the ESSAFIN algorithm was generally validated in its current state. The LCML also provided a detailed analysis of ESG criteria to increase the validity and applicability of ESSAFIN's algorithms and decision trees.

The literature review and research survey results found that ESSAFIN's software and algorithm aligned well with EPs, UN sustainable development goals, PRI, and IFC standards; and were generally validated in their current state. It was recommended that the tool incorporate probabilistic assessment and generate output risk distribution, which would allow project owners and decision-makers to identify the relationship between ESG criteria and associated risks.

Additionally, it is recommended to collect data on different project types and test the applicability of risk analysis software considering the variations of sectors. This will allow for the incorporation of uncertainty by estimating the differential risk and facilitate data sharing between various stakeholders. Continuous research, development, and collaboration involving scientists and experts are also required to establish the evolving ESG trend and provide the right information to the wider community. Such efforts can drive regulation by identifying the need, evaluating effectiveness, informing policy, and encouraging compliance.

Overall, the ESSAFIN decision tree and algorithm provide users with a comprehensive tool for managing environmental and social risk, ensuring good governance and transparency, and complying with global ESG standards. By incorporating the recommendations provided by the LCML and promoting data sharing and collaboration, the tool will continue to evolve and offer valuable insights to investors, decision-makers, and stakeholders.

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Appendix A1

Incorporating risk to environmental, social, and governance (ESG) values into a firm's financial investment decision-making

Environmental, social, and governance (ESG) criteria are a set of metrics a firm can use to evaluate environmental and social impact. The investment community can also use these metrics to screen financial opportunities[1] for potential environmental and social impact. This study identifies key criteria and their relative importance in evaluating risk to ESG values. **Please answer all questions in your professional capacity based on your knowledge and experience**.

Environmental criteria consider how a proponent safeguards the environment and promotes environmental sustainability (e.g., corporate policies to address climate change). *Social criteria* examine how a proponent manages relationships with employees, suppliers, customers, and the communities it operates in. *Governance* deals with leadership, executive pay, audits, internal controls, and shareholder rights[1]. Table 1 shows the qualitative scale, scores, and description to define the importance of each factor

Table 1: Linguistic scale

Scale	Score	Description
VL	1	Considered factor has a *very low* impact in evaluating the overall ESG risk of the investment
M	3	Considered factor has a *moderate* impact in evaluating the overall ESG risk of the investment
H	5	Considered factor has a *high* impact in evaluating the overall ESG risk of the investment
VH	7	Considered factor has a *very high* impact in evaluating the overall ESG risk of the investment

ESG= Environmental, Social, and Governance

Q1. Please rank the importance of environment, social, and governance criteria in selecting an investment; please fill the importance columns with VL, M, H, or VH. Note that each criteria grouping can have the same importance level.

Criteria	Importance in *investment* selection
Environment	
Social	
Governance	

[1] Environmental, Social, and Governance (ESG) Criteria (2022), https://www.investopedia.com/terms/e/environmental-social-and-governance-esg-criteria.asp. Accessed on 26th May 2022.

Q2. How important is the proponent's existing ESG framework in determining risk to environmental and social factors when expanding operations into under-regulated jurisdictions? (e.g., emerging markets) Please rank both environmental and social factors with one of the following VL, M, H, or VH.

Factor to the risk profile	**Importance**
Environmental factors	
Social factors	

Q3. Life cycle thinking minimizes social and environmental impact by conscientiously selecting project type, specifying design, material sourcing, and operational life. Assuming that the proposed investment is a physical project that incorporates life cycle thinking into the various stages, please rank the importance of each stage in evaluating the risk to ESG values. Please fill the importance columns with VL, M, H, or VH. Please note that each risk factor can have the same importance level.

Risk factor	**Importance in the *investment* selection**
Project type	
Design	
Material sourcing	
Operational life	

Q4. Considering the investment is a physical project located within a region prone to climate effects and/or natural hazards (e.g., earthquakes, hurricanes, flooding, erosion, wildfire, etc.), please rank as VL, M, H, or VH how critical the frequency of the expected occurrence is to overall ESG risk. For example, VH reflects the expected occurrence is critical to overall ESG risk.

Hazard occurrence	**Importance/Realistic**
Expected occurrence of climate effects and/or natural hazard within 1 year	
Expected occurrence of climate effects and/or natural hazard within 3 years	
Expected occurrence of climate effects and/or natural hazard within 5 years	
Expected occurrence of climate effects and/or natural hazard within 7 years	
Expected occurrence of climate effects and/or natural hazard within 10 years	

Q5. Suppose the investment is a physical project in a location prone to climate effects and/or natural hazards. Based on your knowledge and experience, how likely is available control technology able to mitigate the impact?

☐ Not Likely ☐ Likely ☐ Moderate Likely ☐ Very Likely

Q6. Among the risk characterization factors for investments that are physically located projects, please rank the importance of the following with VL, M, H, or VH. Multiple factors can have the same ranking or level of importance.

Risk characterization factors	**Importance**
Surface contamination	
Terrestrial habitat loss	
Aquatic habitat impact	
Sensitive species impact*	

**Sensitive species: Extirpated, endangered, threatened etc.*

Q7. Based on your experience and knowledge of ecological accounting, please rank the importance of following with VL, M, H, or VH. Each aspect can have the same level of importance.

Impacts/Compensation	**Importance**
Direct physical impact on an ecological value or system	
Indirect physical impact on an ecological value or system	
On-site compensation for the impact	
Off-site compensation for the impact	
Financial compensation for the impact	

Q8. Based on your experience and knowledge, for a proposed investment that is a physically located project, rank the importance of consulting with the local community?

☐ VL ☐ M ☐ H ☐ VH

Q9. When conceptualizing a proposed physical project, how important is it to engage with the local Indigenous peoples?

☐ VL ☐ M ☐ H ☐ VH

Q10. Assuming the investment is the physical project, please rank the importance of the following aspects with VL, M, H, or VH in consideration of the overall risk to ESG values. Multiple factors can have the same ranking or level of importance.

Community aspect	**Importance**
Implementing a public consultation process	
Implementing a community benefits agreement	

Q11. Rank the following with VL, M, H, or VH risk considering the following situations:

Situation	**Risk**
The design specifications or assessment of a physical project has been completed by an appropriately qualified professional (with required professional designations)	
The design specifications or assessment of a physical project has been completed by a competent professional (without professional designations)	
The design specifications or assessment of a physical project has been completed by a professional without specific competencies or professional designations.	

Q12. Among risk characterization factors that occur during operation, please rank the importance of the following factors with VL, M, H, or VH. Multiple factors can have the same ranking or level of importance.

Risk characterization *(Operational)* factors	**Importance**
Chronic air pollution	
Chronic water pollution	
Solid waste generation	

Q13. Based on your knowledge and experience, how useful are environmental and social guidelines in reducing risk to ESG values as compared to enforced legislation?

☐ VL ☐ M ☐ H ☐ VH

Q14. Based on your knowledge and experience, please rank the importance of completing a comprehensive environmental assessment (inclusive of environmental, social, and economic factors) for identifying and minimizing the risk to ESG values from a proposed physical project.

☐ VL ☐ M ☐ H ☐ VH

Q15. Assuming the investment is the physical project, in the primary assessment phase (concept design), please rank the importance of the following aspects with VL, M, H, or VH. Multiple factors can have the same ranking or level of importance.

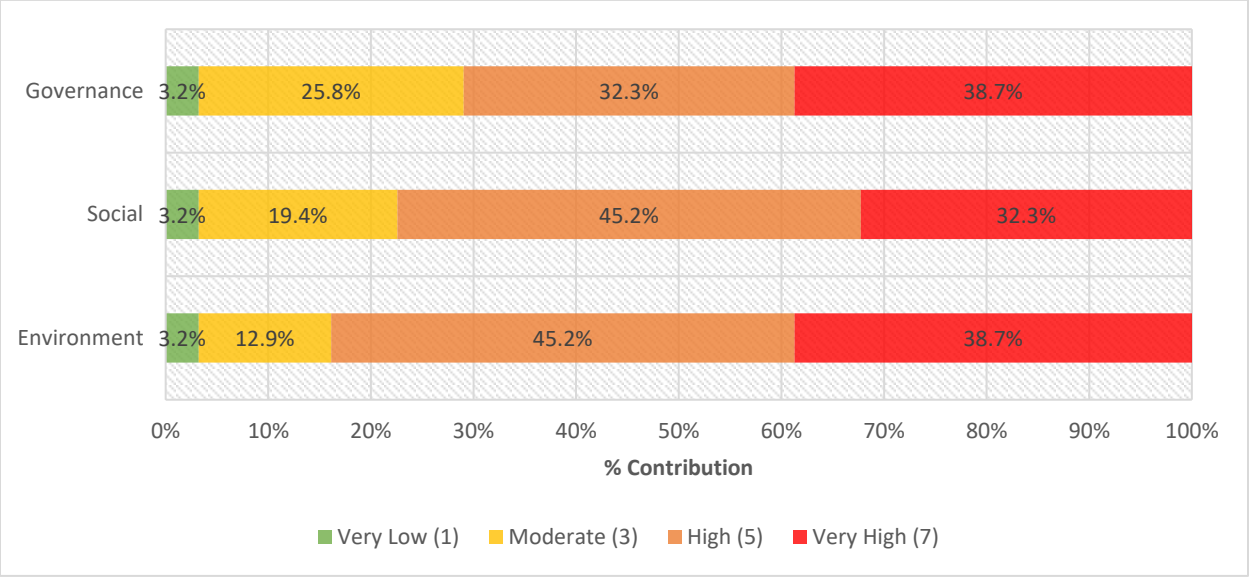
Primary assessment aspect	Importance
Consideration of alternatives to the proposed project during the review	
Consideration of socio-economic impacts	
Consideration of culture and heritage values	
Consideration of archaeological aspects	
Consideration of baseline environmental studies	

Q16. Assuming the investment is the physical project, for the primary assessment phase (in operation), please rank the importance of the following aspects with VL, M, H, or VH. Multiple factors can have the same ranking or level of importance.

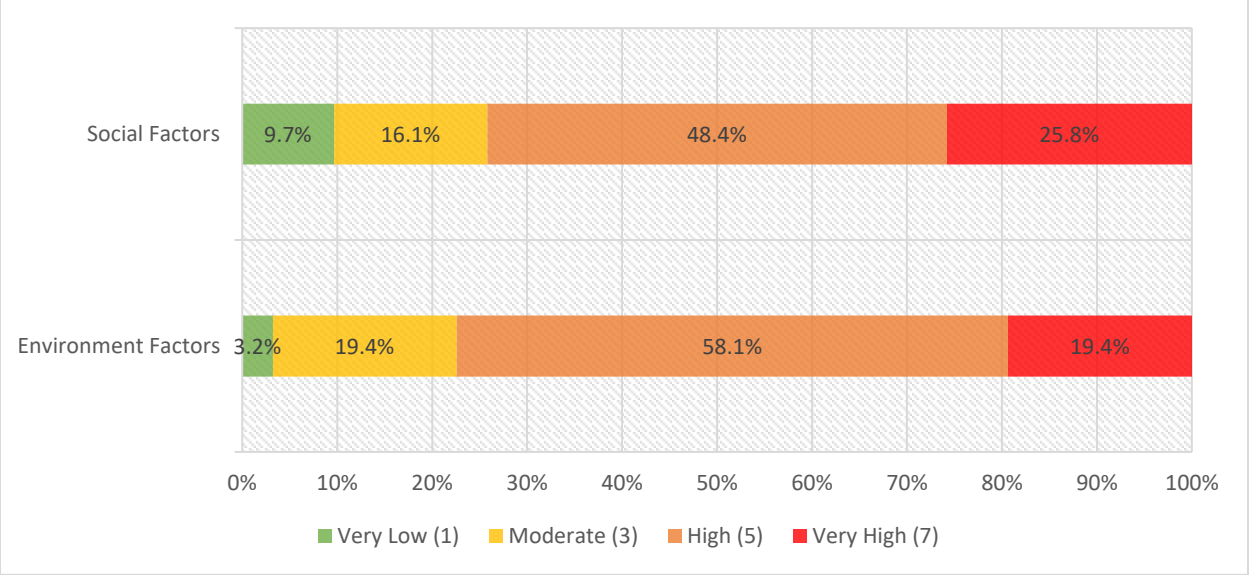
Primary assessment aspect	Importance
Consideration of operational pollution generation	
Consideration of cumulative impacts	
Residual impacts of operational pollution (post mitigation)	

Appendix A2

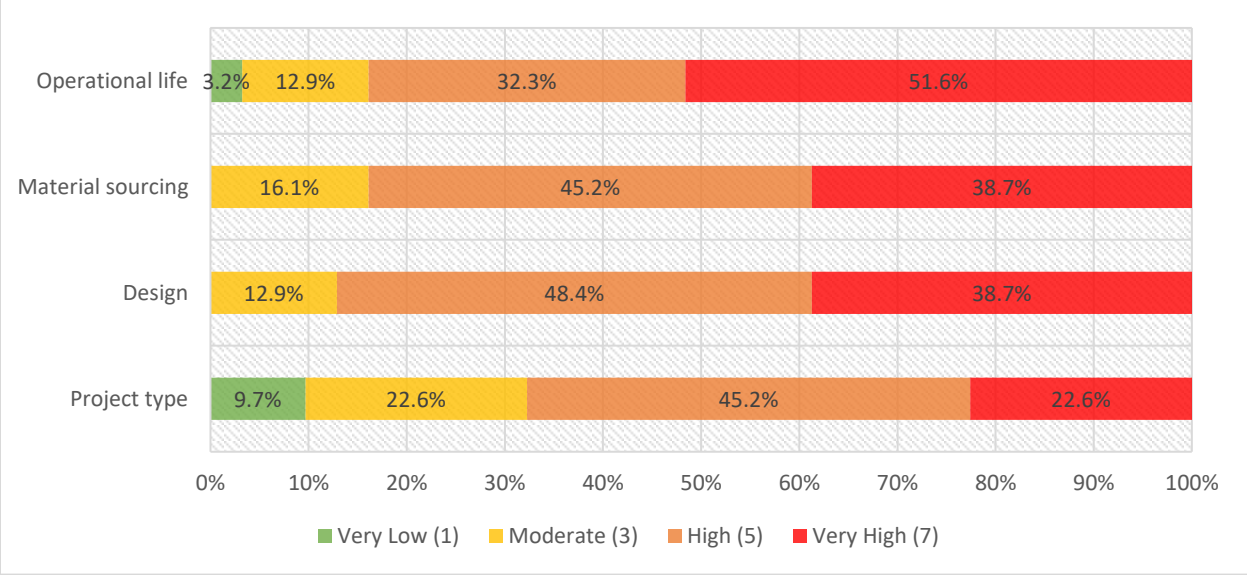
A2-1: Importance of Environment, Social, and Governance criteria in selecting an investment.



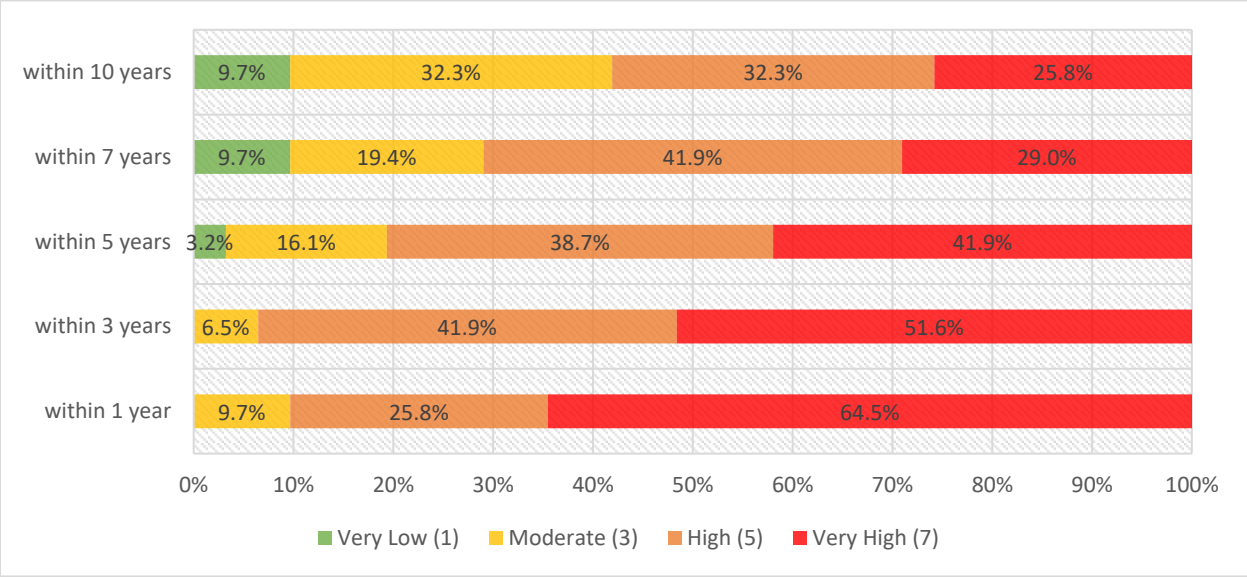
A2-2: What is the importance of the proponent's ESG framework in determining risk to environmental and social factors when expanding operations into under-regulated jurisdictions? (e.g., emerging markets)



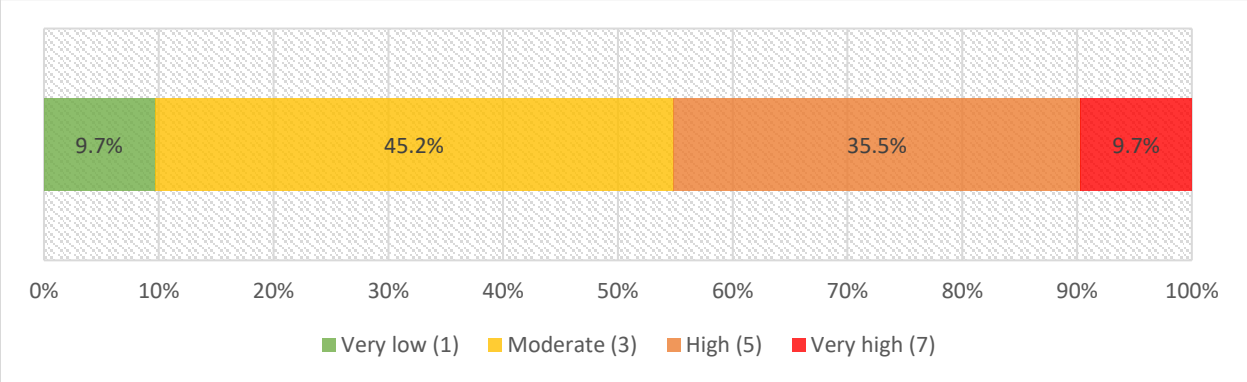
A2-3: By conscientiously selecting, life cycle thinking minimizes the social and environmental impact. Assuming that the proposed investment is a physical project that incorporates life cycle thinking into the various stages, rank the importance of each stage, i.e., project type, specifying design, material sourcing, and operational life in evaluating the risk to ESG values.



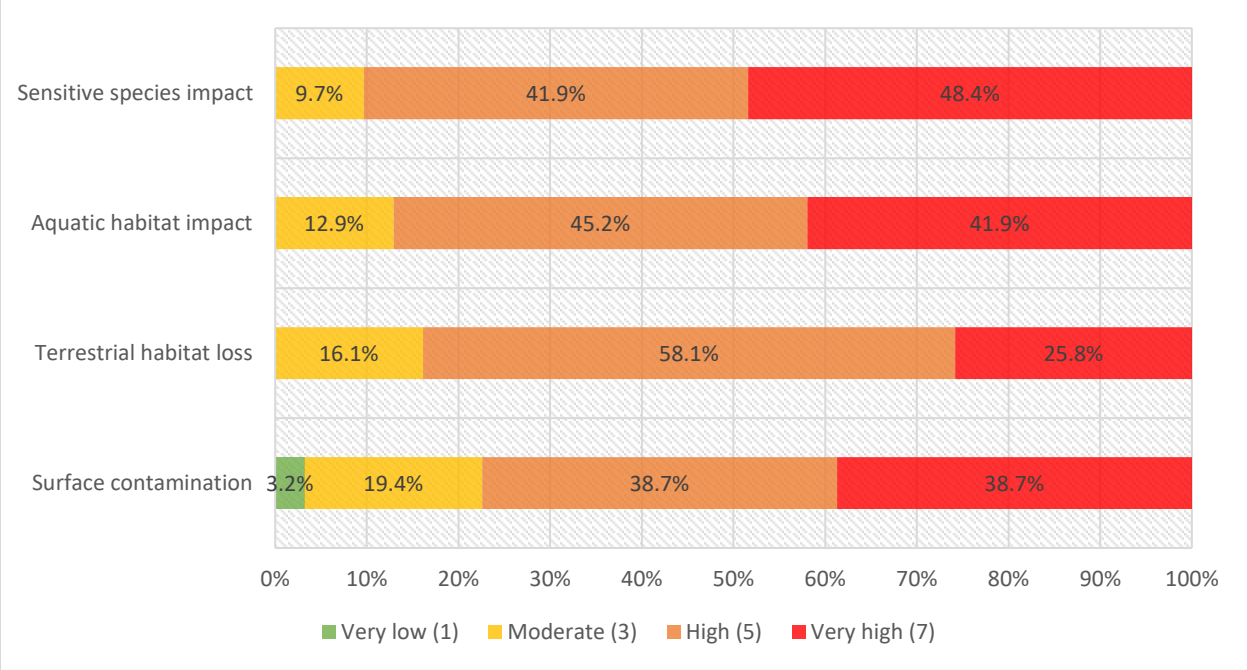
A2-4: Considering the investment is a physical project located within a region prone to climate effects and/or natural hazards (e.g., earthquakes, hurricanes, flooding, erosion, wildfire, etc.). Rank the importance of different frequencies of expected hazard occurrence to evaluate the overall project ESG risk.



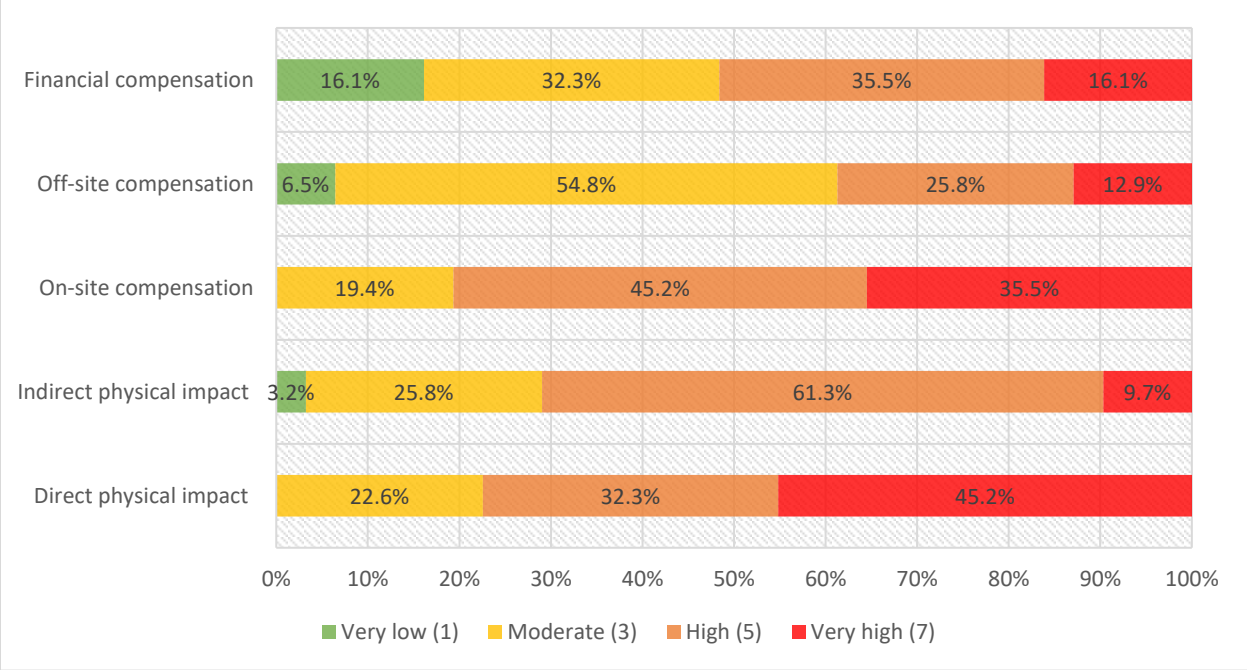
A2-5: Suppose the investment is a physical project in a location prone to climate effects and/or natural hazards. How much is an available control technology able to mitigate the impact?



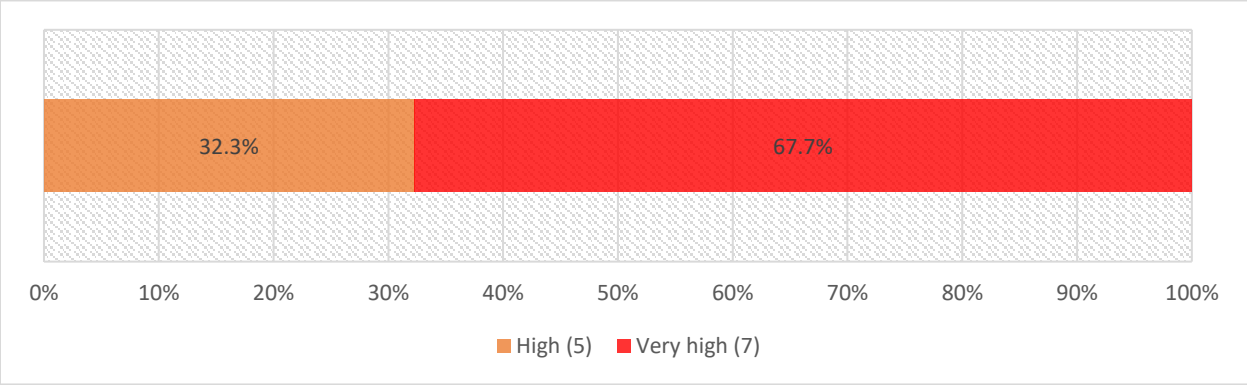
A2-6: Among the risk characterization factors for investments in physically located projects, please rank the importance of 1) Surface contamination; 2) Terrestrial habitat; 3) Aquatic habitat; 4) Sensitive species impact.



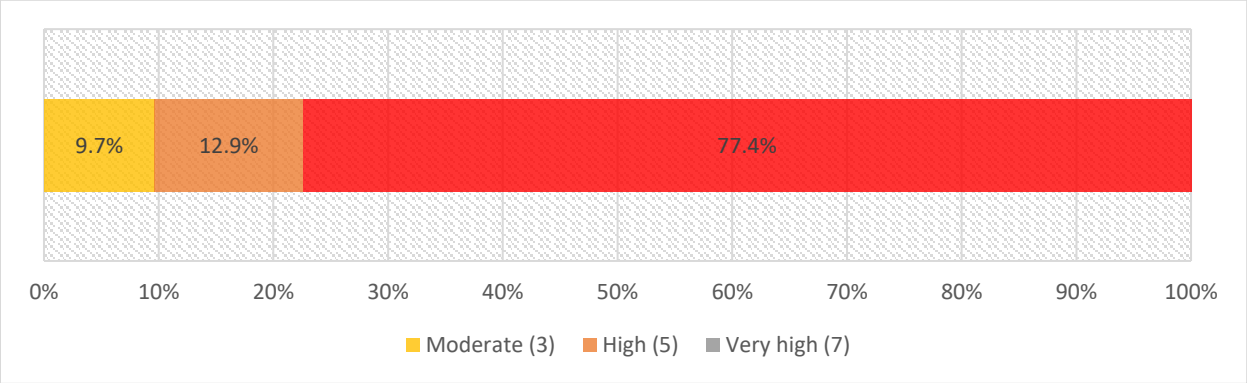
A2-7: Based on your experience and knowledge of ecological accounting, please rank the importance of 1) Direct physical impact on an ecological value or system; 2) Indirect physical impact on an ecological value or system; 3) On-site compensation for the impact; 4) Off-site compensation for the impact; 5) Financial compensation for the impact.



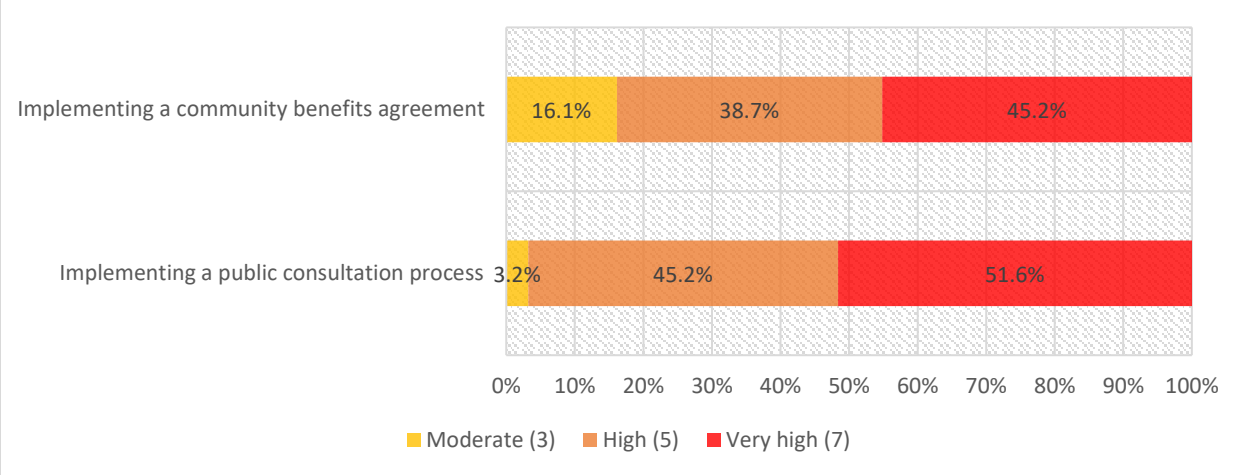
A2-8: Considering a proposed investment that is a physically located project, how important is it to consult the local community?



A2-9: When conceptualizing a proposed physical project, how important is it to engage with the local Indigenous peoples?

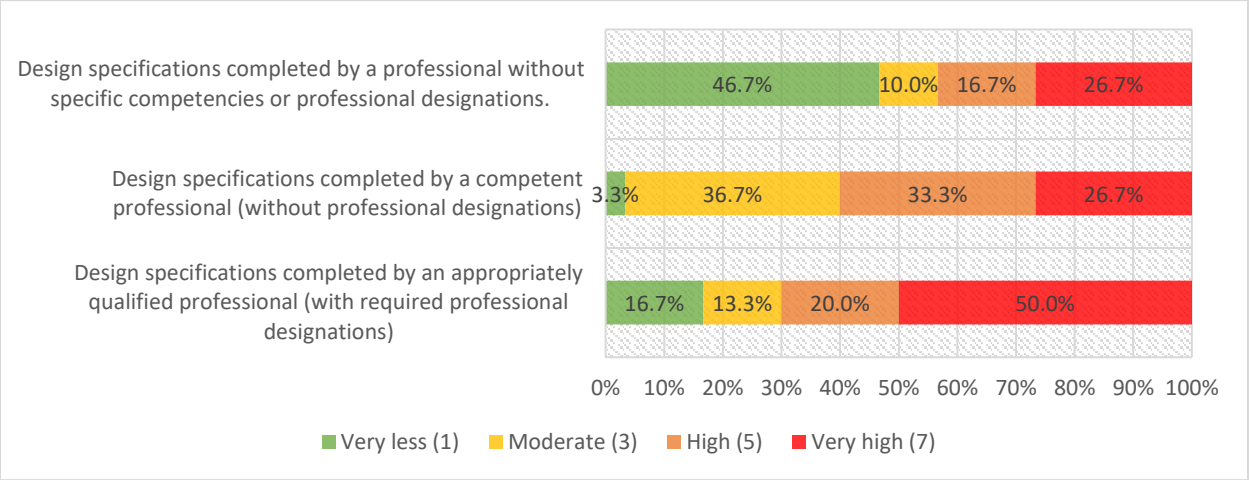


A2-10: Assuming the investment is the physical project, please rank the importance of implementing a 1) public consultation process and 2) community benefits agreement.

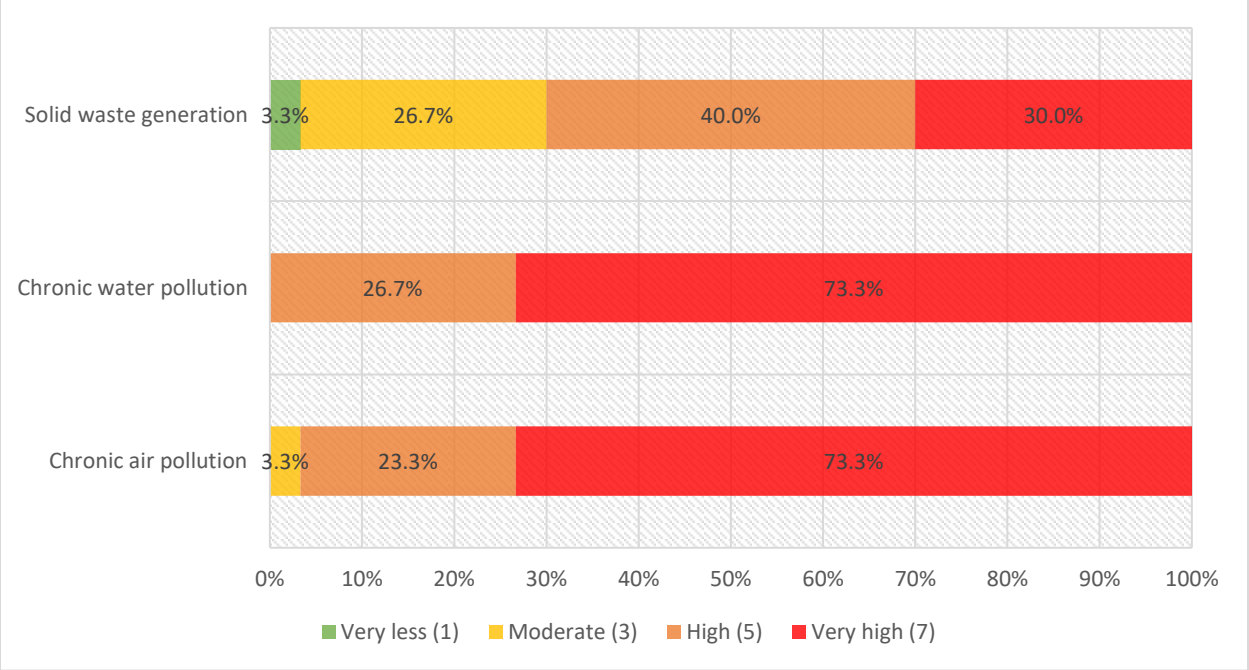


A2-11: Rank the importance of the following;

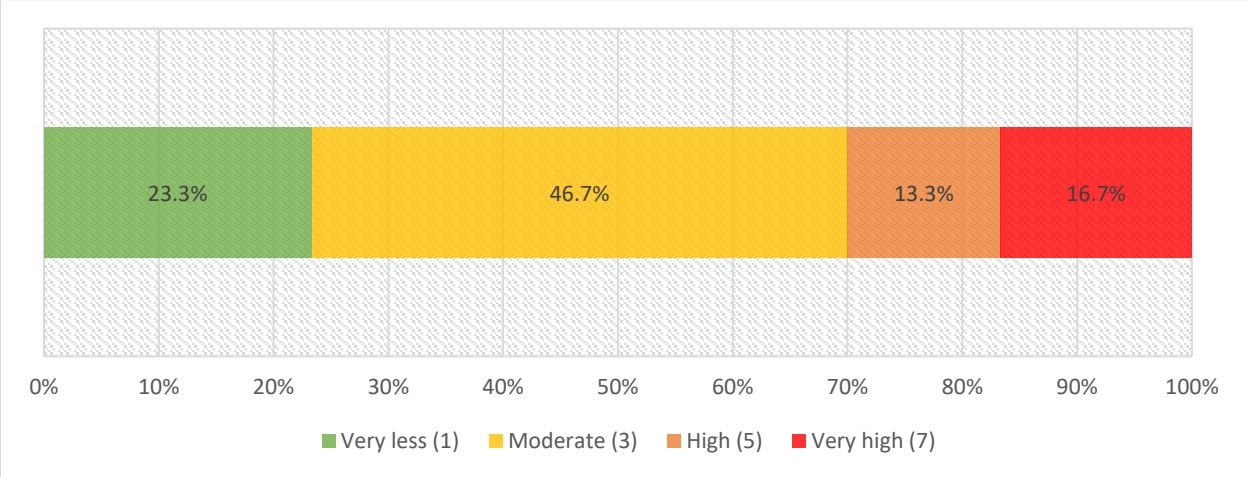
- Qualified professional (with required professional designations) has completed the design specifications or assessment of a physical project
- A competent professional (without professional designations) has completed the design specifications or assessment of a physical project
- A professional without specific competencies or professional designations has completed a physical project's design specifications or assessment.



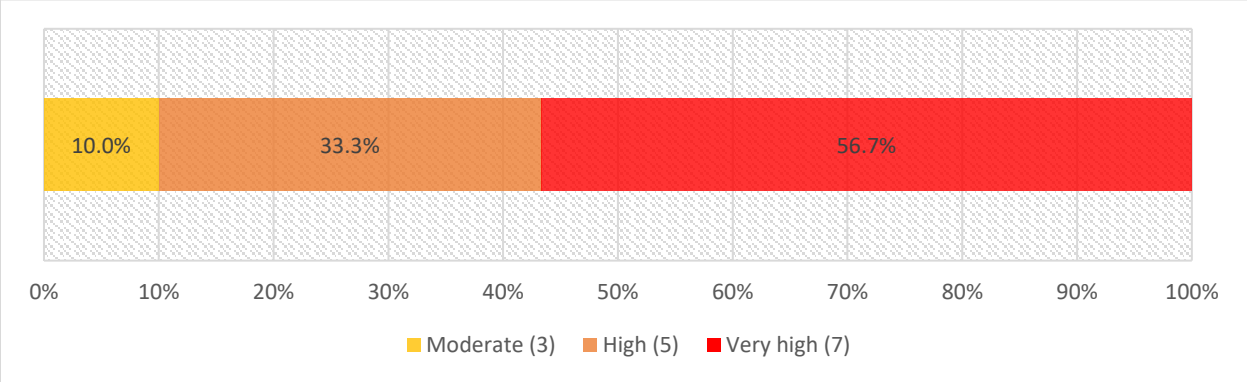
A2-12: Among risk characterization factors that occur during operation, please rank the importance of the following factors 1) Chronic air pollution, 2) Chronic water pollution, 3) Solid waste generation



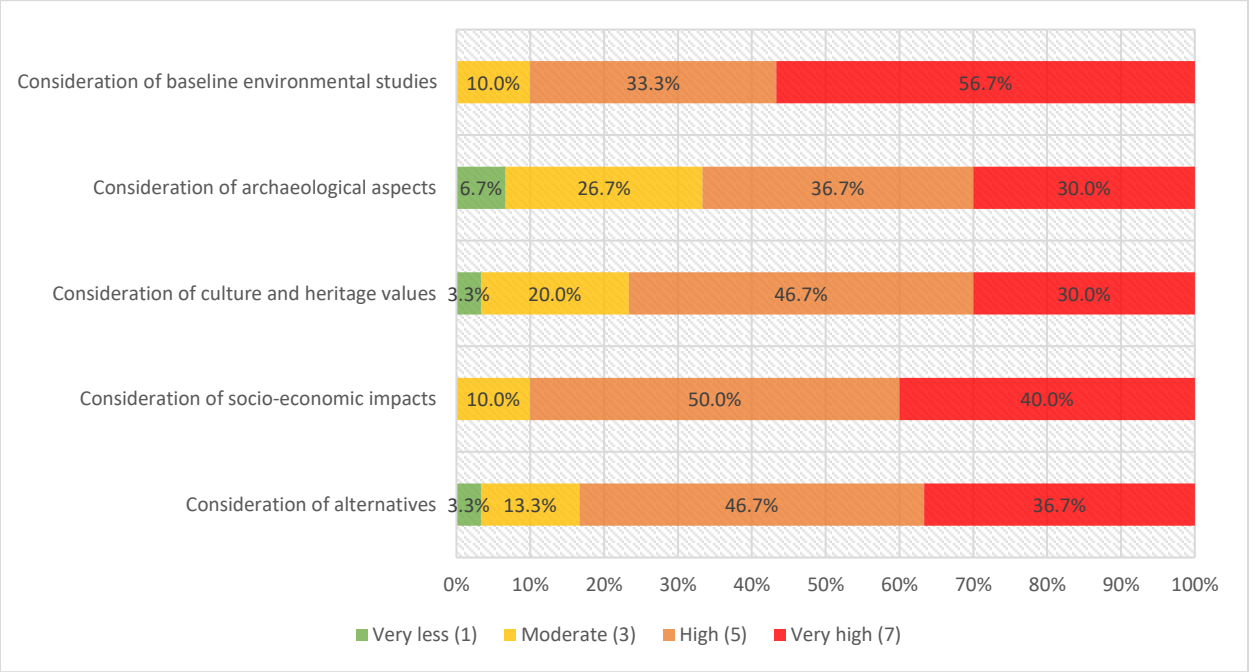
A2-13: How useful are environmental and social guidelines in reducing risk to ESG values compared to enforced legislation?



A2-14: Please rank the importance of completing a comprehensive environmental assessment (inclusive of environmental, social, and economic factors) for identifying and minimizing the risk to ESG values from a proposed physical project.



A2-15: Assuming the investment is the physical project, in the primary assessment phase (concept design), rank the importance of the following aspects: 1) baseline environmental studies, 2) archaeological aspect, 3) culture and heritage value, 4) socio-economic, and 5) consideration of alternatives



A2-16: Assuming the investment is the physical project, for the primary assessment phase (in operation), please rank the importance of 1) residual impacts of operational pollution, 2) Cumulative impacts, and 3) operational pollution generation.