

American University Kyiv

**RISK ASSESSMENT BY DEVELOPMENT FINANCE INSTITUTIONS
IN INVESTMENTS INVOLVING
EMERGING AND DISRUPTIVE TECHNOLOGIES**

**(ОЦІНКА РИЗИКІВ ФІНАНСОВИМИ ІНСТИТУТАМИ РОЗВИТКУ В ІНВЕСТИЦІЯХ,
ПОВ'ЯЗАНИХ З НОВІТНИМИ ТА ПРОРИВНИМИ ТЕХНОЛОГІЯМИ)**

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ABSTRACT

This paper critically examines the role of Development Finance Institutions (DFIs) in managing risks associated with Emerging and Disruptive Technologies (EDTs). As these technologies increasingly permeate various sectors, this research identifies a significant gap in DFI policies and risk assessment methodologies. The study employs a methodological approach combining in-depth interviews with key stakeholders and comprehensive reviews of existing policy documents. These approaches reveal a pressing need for enhanced risk assessment frameworks within DFIs, particularly concerning the unique challenges posed by EDTs. The paper introduces the Technology Assessment Questionnaire (TAQ), a tool developed to better equip DFIs in evaluating EDT-related risks. This tool's application in assessing investment projects has demonstrated its utility in improving the understanding and management of technology-related risks. The research underscores the necessity for DFIs to adopt more robust and technology-specific risk assessment tools to balance the promotion of innovation with the responsible deployment of EDTs. The findings suggest that while DFIs recognize the importance of EDT risk, their current practices and policies need refinement to effectively address these emerging challenges.

Keywords: *emerging and disruptive technologies, development finance institutions, risk assessment.*

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1. INTRODUCTION

The most recent Future Risks Report 2023 of AXA insurance company (AXA, 2023) ranks experts' perception of evolving and rising risks: the risks associated with artificial intelligence (AI) and big data have risen from the 14th place in 2022 to the 4th place in 2023. Most of the experts (64%) and the public (70%) even believe that AI research should be halted.

Technology is evolving at an unprecedented rate, with emerging and disruptive technologies (EDTs) playing a significant role in reshaping society and industries. There are complex challenges and consequences posed by the adoption of new technologies, balancing innovation and efficiency with workforce implications and environmental sustainability. Examples of significant shifts caused by EDTs are many in both the public and private sectors.

For instance, the implementation of automation and robotics in manufacturing by General Motors (GM) and the environmental impact of cryptocurrency mining represent two significant consequences of EDTs.

GM has integrated advanced robotics and automation in its manufacturing processes, aiming to enhance efficiency, productivity, and safety. However, this shift towards automation has resulted in substantial layoffs. In early 2024, GM announced the layoff of 1,300 workers at two Michigan auto factories, with the Orion Assembly plant and the Lansing Grand River plant being notably affected (Shepardson, 2023). These layoffs were partly attributed to GM's transition to electric vehicle production and the increased adoption of automation technologies, which, while improving operational efficiency, have also led to reductions in the workforce.

Cryptocurrency mining, particularly Bitcoin mining, has raised serious environmental concerns due to its significant energy consumption and resultant carbon footprint. Studies have shown that global Bitcoin mining activities have used vast amounts of electricity, contributed to substantial carbon emissions, and required large quantities of water (Chamanara, Ghaffarizadeh, & Madani, 2023). The environmental impact varies by country, with China being a major contributor due to its coal-intensive mining operations. This situation underscores the broader environmental implications

of cryptocurrency mining, which go beyond carbon emissions to include impacts on water and land resources.

The countries that have been able to harness new technologies have consequently been able to expand their economies. Advanced technology can improve these countries' manufacturing processes, help them produce more sophisticated products, and enable them to engage with increasingly complex regional and global markets and value chains. Advanced data analytics and artificial intelligence have enormous potential to propel manufacturing forward in these economies (IFC, 2020, July).

Development finance institutions (DFIs) play an especially significant role in developing countries and emerging economies. Do no harm is one the main principles of DFIs operations. Some DFIs investee companies may use technologies that are potentially dangerous when it comes to dual purpose, human rights and private data protection, and side harmful effects (e.g. a significant and rapid substitution of workers with AI in certain industries or job functions). How can DFIs safeguard themselves from financing potentially harmful technologies?

Most of the DFIs have sustainability policies against which they assess risks of financing projects, but these policies do not explicitly address EDT-related risks, as of now. Managing the risks associated with EDTs is considered complex, requiring practical tools and guidance for assessment and monitoring. By establishing norms, standards, procedures, and mechanisms that would ensure that EDTs provide opportunities and benefits while minimizing their inherent challenges, DFIs can contribute more to the public good.

Within the 2023 summer internship at RAND Europe, assumed by the AUK curriculum, I started focused research of DFIs practices related to EDTs technologies in their investee companies. Specifically in this research I have conducted desk research of DFIs' approaches towards EDT risks, interviewed representatives of 7 DFIs, applied narrative data analysis to interviews, reviewed DFIs policies related to risk assessment, developed and probed Technology Assessment Questionnaire

(TAQ) as an EDT screening tool for investment opportunities, and suggested some guidelines for further TAQ development.

By EDTs I mean in this paper different tech families, like fintech, health tech, agtech, climate tech, edtech, which do not have very precise definitions, but largely based on AI in the core, genetical modifications of organisms, crypto currency, blockchain, drones, 3D printing, autonomous machines, big data analytics, next-generation wireless communication, and robotics.

This research is inspired by IFC's Gordon Myeres and Kiril Nejkov's work on the Technology Code of Conduct. In October 2023, I had a pleasure of a videoconference interview with Dr. Myers. Driven by the idea of a practical tool to screen investment opportunities from EDT angle, I attempted to operationalize the Progression Matrix, suggested by IFC.

I hope, this research can contribute to the development of effective governance strategies and policies for EDTs.

2. LITERATURE REVIEW

2.1. EDTs Definition and Potential Harms

There are many definitions of the term Emerging and Disruptive Technologies (EDTs). In this paper, by EDTs I mean innovative technological advancements that significantly alter existing industries, markets, and societal norms, often leading to transformative changes in economic, social, and political landscapes. EDTs are technologies that are in the process of being developed or have recently been developed and have the potential to disrupt existing industries and create new ones.

Definition and scope of EDTs vary between countries and institutions. The NATO's Strategy on EDTs list nine priority technology areas: artificial intelligence (AI), autonomy, quantum, biotechnologies and human enhancement, hypersonic systems, space, novel materials and manufacturing, energy and propulsion, next-generation communications networks.

As another example, the US published a Critical and Emerging Technologies List, which is not identical to NATO's Strategy on EDTs but overlaps it (Rahamimoff-Honig, 2023).

Based on the literature I reviewed, potential harms from AI-based technologies include bias, privacy erosion, job displacement, security risks, lack of accountability, dependence, ethical dilemmas, social disruption, health impacts, environmental impact, dependency issues, inequality, weaponization, and economic disruption.

2.2. EDTs and Global Development

Despite the mentioned potential harms, the EDTs are assumed to be the driving force of the Fourth Industrial Revolution (4IR). 4IR is fast disrupting the global economic, political, and social norms and institutions. It is believed, that developing countries will feel this revolution's impact the most (Runde, 2019). Without the right human capital and adequate financial investments, developing countries may miss out on the promises and potential offered by the 4IR.

Technology is transformational for achieving the 17 sustainable development goals (SDGs) adopted by the UN in 2015. The 17 SDGs range from ending extreme poverty, ensuring energy sustainability, and securing gender equality on a global scale. In September 2018, the UN secretary-general issued a strategy on leveraging new technologies to support the ongoing global efforts to achieve the SDGs.

The evolved technological landscape opens new avenues that the development community can pursue to achieve the SDGs. Blockchain technology and the Internet of Things (IoT) have already demonstrated their value by helping urban communities without adequate governance capacity establish a credible and secure system for conducting transactions in the power and utility sector (Runde, 2019). Over the past few years, smart technologies and electronic devices have helped forge new and ground-breaking digital platforms that have embedded themselves into the everyday lifestyle and are fast modernizing the elements of the global economy.

For example, to achieve SDG16, blockchain reduces and secures transactions costs (cash/digital capital transfers) by removing intermediaries and improves monitoring, reporting, and collaboration, thereby enhancing policy implementation efficiency. Improves financial inclusion in developing communities and generates more stable and trustworthy economies through its immutable qualities. To achieve SDG11, Machine Learning makes resource allocation easier and production, water access, and sanitation more accessible through real-time satellite imaging (Runde, 2019).

For years, particularly in developing countries, the biggest obstacle to adopting EDTs was the high cost. Measured against inexpensive workers in low-wage economies, the investment made little sense. However, now the price of implementing EDTs, especially, AI technologies, is rapidly decreasing. Companies and governments in developing countries are re-evaluating their options and rethinking their policies (IFC, 2020, July). Furthermore, the global COVID-19 crisis has acted as a world-wide accelerator for the rollout of AI initiatives. Technologies deployment that would have taken place over five years have taken place over six months (Kaspersen, 2022).

There are numerous concerns associated with EDTs, especially in developing countries. It is feared that technology can institutionalize discrimination and inequality in developing countries that have underdeveloped markets and private sectors (Runde, 2019). Another challenge is that differentiation between civilian and military applications of EDTs is difficult if not impossible (Rahamimoff-Honig, 2023).

These challenges are compounded by a basic lack of technological literacy among states and institutions in the field of EDTs. The evolving and complex technological nature of EDTs, as well as the unique professional skills required to keep abreast of developments, creates a challenge even for the most technologically savvy states (Rahamimoff-Honig, 2023).

2.3. DFIs' safeguards in relation to EDTs

There are noticeable efforts at supranational levels to harness EDTs risks and invest wisely, especially when using public funds. The two most significant recent advancements in the field of specifically AI application are the adoption of the OECD Principles on Artificial Intelligence in May 2019 (OECD, 2019) and the European Commission (EC) Ethics Guidelines for Trustworthy AI in April 2019 (European Commission, 2019).

The challenge in this respect is to establish responsible regulation that does not hinder social and economic global development. Regulation of EDTs that is too stringent could have adverse effects on human prosperity and sustainable development. In this respect, EDTs regulation walks a very thin line (Rahamimoff-Honig, 2023).

Development Finance Institutions (DFIs), whose role is to support developing countries, may appear very important financing the technological shift. DFIs are specialized entities, often government owned or supported, that provide funding for projects aimed at economic development and improvement in developing countries, emerging economies, and fragile countries. DFIs can help channel private investments into new technologies and help emerging markets accelerate their efforts to achieve the sustainable development goals. DFIs' investments now equal half of all official

development assistance, outpacing other forms of foreign aid in terms of annual growth. They are much sought after in the developing world and also carry the reputation of being a trusted partner of private capital (Runde, 2019).

As EDTs have the potential to both benefit and disrupt those vulnerable regions, research on how DFIs handle EDT-related risks is essential for promoting sustainable development goals and mitigating negative impacts. DFIs protect themselves from financing projects with harmful EDTs by adopting safeguards systems to minimize and manage environmental and social risks associated with their projects, including those driven by EDTs (Crishna Morgado & Taşkın, 2019).

2.4. Technology Code of Conduct and Progression Matrix

DFIs create policies and tools to assess risks associated with EDTs. In 2020, the International Finance Corporation (IFC) developed a draft Technology Code of Conduct ("the Code") along with associated tools. IFC, being one of the largest DFIs and serving clients in emerging markets, is ideally positioned to bring together stakeholders to create and implement an actionable guidance on EDT-related investments, together with practical tools. The authors of the Code, Gordon Myers and Kiril Nejkov of IFC, posit that the principles outlined in the Code mirror the fundamental values inherent in the IFC's Environmental and Social Performance Standards (IFC PSs) (IFC, 2020, March).

The principles of the Code are organized into three hierarchical tiers, ranging from the most abstract to the most practical:

- *Core Values*: these include Benefit, Inclusiveness, and Fairness. They serve as the foundational priorities, providing a benchmark for resolving potential conflicts and inconsistencies during the implementation of safeguard and building block-level principles.

- *Safeguards*: based on the Core Values, six Safeguards have been identified: Transparency, Informed Consent, Validation, Security, Responsibility, and Accountability. These Safeguards are essential for the development of tangible, practical tools, processes, and systems necessary to realize outcomes in line with the Core Values.

- *Building Blocks: Governance, Proportionality, and Continuity.* This is the final layer of the Code's structure. These blocks form the overarching framework and play a crucial role in shaping, integrating, and setting realistic expectations for the development of tools and approaches.

As per the authors, these tiers collectively create a structured approach to applying the principles in various operational contexts, ensuring that the deployment of technologies like AI is both responsible and aligned with IFC's broader goals of sustainability and social responsibility. By aligning these principles with the relevant categories, the IFC Technology Code of Conduct provides a comprehensive framework for addressing the various aspects of technology development and implementation, ensuring that technology serves humanity in a beneficial, fair, and responsible manner.

In the process of developing this Code, the authors engaged in informal consultations with technology investors, other DFIs, and internal staff, including investment and ESG experts. The feedback received indicated that the Code effectively balances aspiration with practicality, managing to be neither excessively intrusive nor unrealistically abstract. The reviewers also recognized the potential of the Code to enhance public trust and provide a sustainable framework for investment in AI-driven innovation (IFC, 2020, March).

To ensure the Code is practical, it was essential to support it with practical tools. The authors developed a draft Progression Matrix (see Appendix 1). This matrix outlines the expected practices in relation to each principle of the Code, tailored to different stages of company maturity. It delineates the minimum acceptable practices for emerging companies, the expected practices for later-stage companies, and the leadership practices for mature companies. This tiered approach was purposed to ensure that the implementation of the Code is adaptable and relevant to companies at various stages of development, making the guidance both accessible and actionable for a wide range of organizations.

The IFC authors intended to create tools to help operationalize the principles outlined in the Code, providing practical, actionable guidance to navigate the complex and rapidly evolving landscape of disruptive technologies. To develop such tools, the authors conducted a comprehensive

analysis of 35 AI frameworks that include practical tools. This analysis involved mapping these existing tools against the principles outlined in the Code. The purpose of this mapping was to pinpoint good practices and identify any gaps. Based on this analysis, a draft framework of key tools was created (though not published), which client companies could utilize to implement the Code.

As per Myers and Nejkov, the subsequent phase would involve testing the draft principles and guidelines through a sandbox-style collaboration with chosen client companies. This will help verify the real-world utility and effectiveness of their methodology. It was the authors' aspiration that donors, impact investors, and other DFIs would recognize the merit in joining these endeavors. Ultimately, the authors aimed to introduce the Code in stages, ensuring swift deployment and ongoing enhancement by fostering the creation of a stakeholder community.

There are several frameworks and tools developed by different organizations around the world that align with the objectives similar to those of the IFC Technology Code of Conduct. These frameworks focus on the ethical development and deployment of EDTs, emphasizing principles like transparency, fairness, privacy, and safety. These frameworks and tools, similar in spirit to the IFC Technology Code of Conduct, highlight a global movement towards establishing ethical standards and best practices for AI and other disruptive technologies. They aim to guide organizations and governments in developing and deploying these technologies in a responsible and socially beneficial manner (d'Angelo, Flanagan, Motsi-Omoijiade, Virdee, & Gunashekar, 2022).

Unfortunately, COVID-19 crisis changed IFC priorities, and the development and implementation of the Code and the Matrix was paused. Gordon Myers retired from IFC in October 2022.

In my opinion, the Progression Matrix developed by the IFC's experts, is very complex to be used by investee companies and DFI staff, unless they are specially trained. Based on my experience, the usage of the Progression Matrix would require EDT qualification at a level that is typically not available at DFIs' investment professionals. The complexity of the Progression Matrix can also distort assessments it returns. Besides, the Progression Matrix is earmarked for AI technologies, whereas I

believe DFIs and other financial investors need a more universal tool applicable to a broader range of EDTs to filter out projects with harmful technologies and rank investment opportunities depending on how EDT-risky they are. However, the Matrix established a strong ground for developing more practical and useable tools. Judging on the categories of the Progression Matrix, I believe, the authors were thinking of extending its applicability beyond AI to a larger scope of EDTs.

It should be noted that many researchers believe that EDT-related risks largely belong to ESG risks, arising from the Environmental, Social, and Governance practices of an entity. ESG risks can include climate change, human rights violations, and corruption, among others (Schmucki, 2022). Gordon Myers and Kiril Nejkov also relate EDT risks to the family of ESG risks.

In this paper, I explore the implied challenge for DFIs in assessing risks in investment projects that involve EDTs. Given the novelty of this issue, there is a notable gap in practical assessment tools. Drawing on my 20 years' experience with IFU (the Danish Investment Fund for Developing Countries) and IFC (International Finance Corporation), and engagements in software, renewable energy, and electronics sectors, I propose a preliminary framework: the Technology Assessment Questionnaire (TAQ). This tool aims to provide initial guidance for DFIs navigating the complex landscape of EDTs in investment projects. My contribution seeks to add to the existing discourse by integrating practical insights into the discussion. This work is aimed to continue addressing the need for DFIs to evaluate and manage the risks associated with EDTs, recognizing their significant potential impacts on economies and societies.

3. RESEARCH

3.1. Interviews and desk research of DFIs

To investigate how as of now DFIs assess risks of investing in projects, involving EDTs, I have reached out to 30 of them (see the list in Appendix 2). The approached 30 DFIs are the most active and known, including two largest ones – IFC and EBRD. These DFIs operate in developing countries and emerging economies all over the world.

As an AUK student, pursuing a Masters' degree in Global Management, I emailed to DFIs and requested them to answer five questions. Relatively general questions were chosen to avoid question-biased answers and provoke discussion, leaving the respondents some space to tell more:

1. Does [your DFI] assess potential risks associated with EDTs in the projects you are invited to finance?
2. What function (e.g. Sustainability, Legal, Risks, IT, etc.) within [your DFI] is responsible for the EDT risk assessment?
3. What approaches, methodologies, frameworks, practices, tools your EDT risk assessment is based on?
4. Does [your DFI] assess EDT risk before decision to finance only or through the entire financing cycle till your exit?
5. Without naming specifically, can you recall cases when your institution refused to finance a project or terminated financing due to concerns over potentially harmful EDTs?

By far not all approached DFIs reacted to my inquiry. But a few DFIs responded with some limited info. Replying to them, I asked for an opportunity to discuss via a voice channel. I managed to have relatively essential interviews with seven of the approached DFIs (see Appendix 3 for the decoded texts). I studied a few other DFIs on the basis of publicly available information (see summary table in Appendix 4).

The interviews conducted for this study provided valuable qualitative data in the form of narratives and stories shared by the representatives of DFIs. Given the nature of the data, which

primarily consisted of these qualitative accounts, it was essential to select an analysis method that would best align with the characteristics of the information collected.

Several qualitative analysis methods, such as narrative analysis, content analysis, discourse analysis, thematic analysis, grounded theory, and interpretive phenomenological analysis (IPA), were considered. However, after careful consideration, narrative analysis and content analysis were chosen over the others for several reasons: relevance to the data type (narrative analysis and content analysis were deemed most relevant because the data gathered from the interviews consisted primarily of narratives and qualitative stories. These methods are particularly well-suited for examining narrative information and extracting meaningful insights from the accounts provided by the interviewees), simplicity and accessibility: given that the interviewees were not experts in EDTs but possessed a broad understanding of ESG issues, it was essential to use analysis methods that were straightforward and accessible. Narrative analysis and content analysis are relatively simple and pragmatic, making them suitable for extracting valuable insights from non-specialist narratives), practicality for primary observations: as the interviewer I was focusing on a specific aspect of EDT-related risks, the primary goal was to make initial observations and gain preliminary insights from the interview data. Narrative analysis and content analysis allowed for a practical approach to processing the information and deriving meaningful patterns or themes without delving into the complexities of more specialized qualitative analysis methods), minimizing assumptions and bias: since the interviewees were not EDT specialists and did not possess ready-made answers, there was a need to minimize potential biases and assumptions in the analysis process. Narrative analysis and content analysis facilitated a more objective examination of the narratives provided, reducing the risk of imposing preconceived notions or theoretical frameworks on the data).

While other qualitative analysis methods, such as discourse analysis, thematic analysis, grounded theory, and interpretive phenomenological analysis (IPA), may be valuable in specific research contexts, they were not considered as suitable choices for this study due to their potential complexity and theoretical depth. Given the characteristics of the interview data and the expertise of

the interviewees, the selection of narrative analysis and content analysis aligns with the practical and methodological needs of this research, allowing for a focused exploration of the narratives while acknowledging the limitations inherent in the data collected. The results of the narrative analysis and content analysis are combined in Tables 1 and 2.

Table 1. Summary of the narrative analysis of the interviews with DFIs

Theme	Description	Implications and Observations
General acknowledgment of EDT risks	All DFIs recognize the need to assess risks associated with EDTs. However, they pay insufficient specific attention to these risks.	Indicates a sector-wide awareness of EDT risks, but a lack of targeted focus or holistic understanding.
Lack of specific methodologies for EDT risks assessment and management	No specific tools or methodologies for assessing EDT risks are mentioned, except for IFC's AI-addressed Technology Code of Conduct with Progression Matrix.	Highlights a significant gap in specialized methodologies for EDT risk assessment.
Integration with E&S risk assessment	EDT risks are largely considered within the broader Environmental and Social (E&S) risk assessment frameworks.	Suggests that EDT risks might be oversimplified or not adequately addressed when lumped with E&S risks.
Lack of Practical Application Evidence	No instances were cited where EDTs were a decisive factor in investment decisions or defaults.	Implies either a rarity of such cases or a lack of transparency in acknowledging them.
Varying definitions and understanding of EDTs	Uncertainty and inconsistency in defining EDTs and associated risks, influenced by the interviewee's role and knowledge.	Reflects a need for clearer understanding and consistent definitions of EDTs across DFIs.
Infrequent use of the term "EDT"	Doubts about the regular use of the term "EDT" in working routines, despite it being mentioned in interviews. EBRD specifically referred to cybersecurity, which is not all-encompassing for EDTs.	Indicates potential gaps in understanding or prioritizing the full scope of EDTs.
Adoption of Equator Principles and IFC Performance Standards	Many DFIs follow the Equator Principles and IFC performance standards, which guide their investment decisions.	Suggests a reliance on established frameworks but may overlook specific challenges posed by EDTs.
Use of EBRD Performance Requirements	DFIs in the European region or those collaborating with EBRD follow its Performance Requirements for environmentally and socially sustainable projects.	Indicates regional variations in the standards and approaches to risk assessment.
Three Lines of Defence Model	Many DFIs use the Three Lines of Defence model to manage investment project risks.	Shows a structured approach to risk management, but its effectiveness for EDT risks is unclear.

Use of exclusion lists	Exclusion lists are commonly used to filter out investments in certain sectors, including those concerned with EDTs.	Reveals a basic, albeit broad, method of managing risks related to specific sectors or technologies.
Absence of specialized EDT policies	No specialized policies for investments in projects involving EDTs; reliance is on general ESG policies.	Highlights a lack of tailored approaches to managing the unique challenges of EDT investments.

The summary of the narrative analysis underscores the recognition of EDTs risks, but also a general lack of specific strategies, tools, or policies tailored to address them effectively. It is typical that DFIs have no EDT risks experts, whose job would be to assess investment opportunities from the angle of assumed technologies. Similarly, the DFIs have no tools that would allow an investment professional or an ESG professional without a special knowledge of technology to assess EDT risks. This lack of expertise and tools, the latter potentially partly compensating the insufficient knowledge, can lead to underestimating of consequences of an EDT application.

All DFIs refer to their guiding policies, usage of exclusion lists, and three lines of defence safeguarding model. The guiding policies of many DFIs are largely influenced by IFC’s Performance Standards. However, the latter does not refer to EDTs as risk bearing in ESG context. Still, exclusion lists, naming the industries prohibited for investments by a DFI, and the three lines of defence (see a discussion below) provide some barrier for the most technology-risky investments.

Applying content analysis to the interviews involved categorizing and quantifying aspects of the interviews to understand patterns and frequencies of specific themes related to how DFIs deal with risks associated with EDTs:

Table 2. Summary of the content analysis of the interviews with DFIs

Category	Frequency	Description and Observations
Acknowledgment of EDT risks	High	All interviewed DFIs recognize the need to assess risks associated with EDTs.
Consistency in defining EDTs	Low	Uncertainty and inconsistency in defining EDTs and associated risks were noted among DFI representatives.
Regular use of the term “EDT”	Uncertain	Doubts about the regular use of “EDT” in DFIs’ working routines, despite its mention in interviews.

Methodologies for assessing EDT risks	Low	Only IFC mentioned a specific tool for assessing EDT risks (AI-addressed policy (Technology Code of Conduct) and Progression Matrix).
Incorporation of EDT risk assessment into ESG risk assessment	High	All DFIs integrate EDT risks within the broader ESG risk assessment framework.
Evidence of EDT risk analysis impact on investment	None	No specific cases where EDTs affected investment decisions or defaults were reported. Only IFU mentioned existence of such cases, without naming them,
Reference to UN SDGs in a DFI's policy documents	High	Several DFIs reference UN SDGs in their approach, showing alignment with global sustainability goals.
Reference to OECD Guidelines in a DFI's policy documents	Medium	Adherence to OECD guidelines varies among DFIs, with some explicitly aligning and others not mentioning them.
Adherence to Equator Principles and IFC Standards	High	Many DFIs follow the Equator Principles and IFC performance standards.
Adherence to EBRD Performance Requirements	Medium	Regional DFIs or those collaborating with EBRD follow its Performance Requirements.
Use of Three Lines of Defence Model	High	Many DFIs refer to this model for managing investment project risks of all categories. This risk management model is commonly referenced and used by DFIs.
Use of Exclusion Lists	High	Commonly used by all DFIs to filter out investments in certain sectors, including those concerned with EDTs.
Use of proprietary (own, self-developed) ESG Policies	High	Many DFIs, such as IFU, FMO, and EBRD, have proprietary ESG policies, reflecting a trend towards developing internal frameworks and tools.
Use of proprietary (own, self-developed) ESG Assessment Tools	Medium	Tools such as IFU's Screening tool, IFC's AIMM, and EBRD's E&S Risk Management Toolkit are used for ESG assessment.
Assessment of E&S Risks throughout the whole financing cycle	High	All assess E&S risks at each stage of the investment cycle.
Specialized policies for EDT-related investments	None	Absence of specialized policies for EDT investments; reliance on general ESG policies was noted.
Investing in EDT-related projects via separate special financing vehicles	Medium	Risk-mitigating practices like investing in tech sector through special vehicles or programs are mixed among DFIs.
Separating managed funds earmarked for investments involving EDTs.	Medium	Some DFIs are considering or have implemented specialized programs or funds for the tech sector investments.
Involvement of Sustainability function of a DFI	High	Most DFIs have a Sustainability function typically involved in their investment selection approach.
Involvement of Risk function of a DFI	High	The risk function is a key component in the majority of DFIs' approaches.
Involvement of IT Function of a DFI	Medium	Involvement of IT function in EDT investment approaches varies among DFIs.
Use by a DFI of external consultants to help assessing EDT-risks	High	Many DFIs rely on external consultants for investment assessment and advice.

Table 2 quantifies the frequency of specific themes or categories mentioned in the information received from DFIs. It provides an overview of how frequently certain aspects are discussed or mentioned by DFIs in relation to their handling of risks associated with EDTs. The content analysis helps in identifying patterns and commonalities in the data, such as the high acknowledgment of EDT risks but a notable absence of specific methodologies or specialized attention towards these risks. The results of the content analysis largely confirm the outcomes of the narrative analysis. A new aspect highlighted within the content analysis is that some DFIs tend to finance EDT-risky investments via legally separated from them vehicles – separately own-managed funds, thematic financing facilities, or externally managed funds.

With regards to proprietary instruments for assessing ESG risks, mentioned by a few DFIs, a typical example is recently introduced by FMO its Environmental, Social and Governance tool for Financial Institutions (fi-esg-tool.com) (FMO, 2024). The instrument has been developed by FMO and Steward Redqueen, a private consultancy firm in the Netherlands. This is also an example of engaging external consultants.

Many DFIs refer to the Three lines of defence model to safeguard from any investment project related risks. The model is widely acknowledged by many industries and its implementation varies among industries and company sizes (Tammenga, 2020). The three lines defence model uses a comprehensive organizational approach to manage risk. Business units, compliance, audit and other risk management employees are among the groups that make up the three lines of defence and each has a specific function. The first line is management, department or process owners. Their primary responsibility is to control and take ownership of risks associated with daily activities via implementing controls, developing internal policies, supervising employee policy execution and monitoring risk factors with decisions and actions. The second line of defence includes risk management and compliance areas -- such as a risk manager, compliance officer or information security officer. The second line of defence areas are responsible for implementing the company's

risk management program and monitoring the process and implementation of these policies. The third line of defence includes both external and internal auditors. Their main responsibility is to ensure the effectiveness of the first and second lines of defence. They also review and evaluate the design and implementation of the risk management program. Internal auditors typically report to the board, regulators and external auditors about the company's risk management design and operation.

As per the information received from DFIs, all of them use exclusion lists (see Appendix 5 for a sample) as the simplest tool to filter out investment opportunities in unwanted sectors, including those EDTs-concerned. However, I presume, technologies develop faster than DFIs can update their exclusion lists.

The interviews largely confirm the hypothesis of Gordon Myers and Kiril Nejkov of IFC that EDT risks belong to the broad family of ESG risks. While ESG frameworks traditionally focus on more established risk factors related to environmental impact, social responsibility, and corporate governance, they are increasingly recognizing the significance of emerging and disruptive technologies. Companies and investors are beginning to integrate these technological risks into their broader ESG risk assessment and management strategies, acknowledging their potential to influence and be influenced by ESG factors.

I see the key differences between typical ESG risks and EDT risks in their primary focuses (EDT risks are centred on the challenges and implications of technological advancements, whereas ESG risks are broader, including environmental stewardship, social responsibility, and ethical governance) and pace and nature of addressed changes (technological risks are characterized by rapid innovation and a constant state of flux, while ESG risks are often more steady and predictable).

I agree that EDT risks can be considered a part of ESG risks. Then I can conclude that the task of EDT risk assessment belongs to ESG function at a DFI. However, to be conducted properly EDT risk assessors should properly designed tools. One of the conclusions from the research of the DFIs is that they do not have specially designed practical tools to assess risks coming from EDTs in the implied investment opportunities.

3.2. Review of DFIs' Guiding Policies

I have analysed selected policy documents, mentioned in the interviews with DFIs as guiding ones in relation to ESG risk assessment: (1) EBRD's Environmental and Social Policy; (2) EBRD's Performance Requirements; (3) IFC Performance Standards; (4) IFU's Sustainability and Impact Rules; and (5) EIB Environmental and Social Standards (EIB, 2022). The results of the content analysis of the named policies are presented in Table 3.

Table 3. Summary of the content analysis of the DFIs' guiding policies

Criteria	EBRD's Environmental and Social Policy	EBRD's Performance Requirements	IFC Performance Standards	IFU's Sustainability and Impact Rules	EIB Environmental and Social Standards
Purpose	Guide EBRD's commitment to sustainable development in investments and cooperation activities	Ensure projects comply with sustainable development practices	Guide clients in managing environmental and social risks sustainably	Promote sustainable development in investments, focusing on economic, social, and environmental dimensions	Guide sustainable development in EIB-financed projects, ensuring compliance with environmental and social requirements
Key Focus Areas	Environmental and social sustainability; stakeholder engagement	Ten specific requirements covering environmental and social issues	Eight standards including risk assessment, labor conditions, and community impacts	Sustainability risks and impacts, gender equality, decent work, energy, infrastructure	Human rights, social and environmental considerations, climate action, diversity, gender, migration
EDTs Reference	No specific mention of EDTs risks	No specific mention of EDTs risks	No specific mention of EDTs risks	No specific mention of EDTs risks	No specific mention of EDTs risks
Implementation Approach	Defines roles and responsibilities in project	Demands adherence to standards from project outset;	Directs clients on risk identification and management	Emphasizes compliance with IFC Performance Standards for	Comprises 11 standards that projects must meet

	design and operation	includes mitigation strategies		high-risk projects; includes ESG issues and business ethics	throughout their lifecycle
Review/Update Cycle	Reviewed in 2019, next review in 2024	Aligned with the Environmental and Social Policy	Regularly updated to reflect best practices	Updated handbook explaining requirements and implementation strategies	Part of the EIB Group Environmental and Social Policy, regularly updated
Distinctive Elements	Mainstreaming sustainability in all activities; strategic goals for high benefits	Avoidance or mitigation of negative impacts	Comprehensive coverage of environmental and social aspects	Focus on creating decent work and promoting gender equality; impact on SDGs; alignment with IFC Performance Standards	Wide-ranging coverage of environmental and social considerations; emphasis on human rights and climate action

It should be noted that none of the analysed documents mentions EDTs any specifically or technology as a source of potential harm. For instance, the frequency of the EDT-related words usage in the EBRD E&S Policy (was adopted in April 2019, to be reconsidered in 2024): “technology” – 3, “cyber” – 0, “emerging” – 1, disruptive – 0, intelligence – 0, artificial – 1. Meanwhile, the EIB Environmental and Social Standards issued in February 2022 do not refer in any way to EDTs.

3.3. Technology Assessment Questionnaire

Inspired by the IFC Technology Code of Conduct Progression Matrix I attempted to develop a relatively simple tool, purposed to help investment and risk assessment professionals (the first and second “lines of defence”) at DFIs assess risks in the investment opportunities involving EDTs.

I have developed a 75-questions tool –Technology Assessment Questionnaire (TAQ) (please see Appendix 6 for TAQ sample, populated by an investee company). I wanted to address the most

dangerous areas where the underlying EDTs can pose risks: harm for environment, violation of private privacy, acute large dismissals caused by technology, etc.

I divided the 75 questions into 11 groups: Economic and Market Factors, Ethical and Social Impact, Accessibility and Inclusiveness, User Experience and Adoption, Innovation and Development, Interoperability and System Integration, Privacy and Security, Legal and Compliance, Environmental and Health Considerations, Cultural Impact, and Global Impact and Scalability.

To practically simplify the relatively complex IFC Progression Matrix, the TAQ has been designed in a way allowing a respondent to answer in Yes / No / To be defined / Not applicable mode, easing answering and analysing a populated TAQ tool. Personally, due to my work for IFU, I am well acquainted with questionnaires, assessing general ESG risks. Standardized choice of answers significantly eases processing of them.

Table 4 displays the connection between elements of the IFC Progression Matrix and TAQ.

Table 4. IFC Progression Matrix elements in relation to TAQ groups of questions

Progression Matrix	Technology Assessment Questionnaire	Comments
1. Benefit. Technology should provide customers, individuals, and communities with access to products, services, and capabilities that benefit them.	Economic and Market Factors	The benefits often include economic growth and market development.
	Global Impact and Scalability	Benefits should extend globally and be scalable.
	Innovation and Development	New technologies should bring beneficial innovations.
2. Inclusiveness. Technology should be designed and developed in a manner that ensures outcomes reflecting the requirements and values of individuals and communities expected to use or benefit from the technology.	Accessibility and Inclusiveness	Technologies should be designed for diverse groups.
	Cultural Impact	They should respect and incorporate different cultural values.
3. Fairness. Technology should be designed, developed and used in a fair and non-discriminatory manner. Technology providers should avoid anti-competitive or unfair commercial practices that	Ethical and Social Impact:	Fair technology upholds ethical standards and promotes social justice.
	Legal and Compliance:	Adhering to laws ensures fair practice.
	Interoperability and System Integration	Fairness in technology integration across

unreasonably impede technology access and adoption.		different platforms and systems.
4. Transparency. Affected individuals, communities, and stakeholders should be provided with access to information sufficient to understand the risks, opportunities, and impacts of the technology.	User Experience and Adoption	Transparency enhances user trust and adoption.
	Privacy and Security	Clear policies about data handling and security practices.
10. Informed Consent. Affected individuals and communities should be provided with the right to give meaningful informed consent before using the technology.	Privacy and Security	Ensuring users are aware of data usage.
	Ethical and Social Impact	Respecting user autonomy and ethical norms.
10. Validation. The claimed principles, norms, and outcomes of the technology should be validated by training and confirmation against scenarios and datasets appropriate to the envisioned purpose, risks, stakeholders, and implementation scale.	Innovation and Development	Validating new technologies ensures they serve the intended purpose.
	User Experience and Adoption	Ensuring technology meets user expectations and needs.
7. Security. Technology should be designed, developed, and used in line with technical and organizational safeguards sufficient to assure its secure use and protect against misuse, especially in relation to personal data.	Privacy and Security	Fundamental to protecting user data and ensuring safe technology use.
	Interoperability and System Integration	Secure integration across different systems.
8. Responsibility. Technology providers and the technology developed shall comply with applicable law and should respect human rights. Technology providers should assist public authorities to understand the risks, impacts, and opportunities of the technology in order to develop effective policy and regulatory frameworks.	Legal and Compliance	Compliance with laws and regulations.
	Ethical and Social Impact	Responsibility to society and ethical standards.
9. Accountability. Technology providers should be accountable for the performance and foreseeable	Global Impact and Scalability	Accountability in the face of global challenges and technology scaling.

<p>ethical implications of the technologies they develop and for managing evolving and emerging issues from continuous technology improvement. This includes ensuring that affected individuals and communities have recourse to judicial and administrative remedies, as well as to appropriate mechanisms for consultation and redress.</p>	<p>Environmental and Health Considerations</p>	<p>Being accountable for environmental and health impacts.</p>
<p>10. Governance. Technology providers should maintain governance and management systems appropriate to the purpose, scale, and potential impacts of the technology to assure reasonable control over such impacts. Technology providers should seek to avoid, minimize, and mitigate potential risks and impacts, including environmental, social, governance, and privacy risks and impacts.</p>	<p>Legal and Compliance</p>	<p>Effective governance requires adherence to legal frameworks.</p>
	<p>Environmental and Health Considerations</p>	<p>Governance to manage environmental and health risks.</p>

I have asked 4 companies, employing EDTs, invested by IFU, to run the TAQ. These companies operate in security surveillance, energy storage, electronics components production, and ground self-propelled drones. Table 6 displays the statistics of answers of each type.

Table 5. Number of answers of each type in the test run of the TAQ

	Yes	No	To be defined	Not applicable
Company 1 (ground drones)	47	3	11	14
Company 2 (electronics)	42	4	12	17
Company 3 (surveillance)	59	3	3	10
Company 4 (energy storage)	62	0	1	12

I have applied content analysis to the above data. I quantitatively analysed the responses from the four companies (see Table 6). I came to the following observations: (1) the majority of responses are 'Yes', suggesting a tendency for companies to present their projects positively; (2) 'No' responses are notably low across all companies, which might indicate a reluctance to provide negative information; (3) 'To be defined' and 'Not applicable' responses vary, indicating areas of uncertainty or irrelevance in the questionnaire for different companies.

Table 6. Statistics of respondents' replies to TAQ

Response Type	Company 1 (Ground Drones)	Company 2 (Electronics)	Company 3 (Surveillance)	Company 4 (Energy Storage)	Total
Yes	47	42	59	62	210
No	3	4	3	0	10
To be defined	11	12	3	1	27
Not applicable	14	17	10	12	53

I also received feedback from the four companies, who ran the TAQ. I have combined the results of the thematic analysis of their feedback in Table 7.

Table 7. Thematic analysis of the feedback to the TAQ.

Theme	Description & Analysis	Implication for TAQ Design & Use

Preference for Positive Framing	High 'Yes' responses across companies indicate a tendency to present projects positively.	Reflects potential optimism bias; questions may need to probe for challenges.
Reluctance to Negate	Low 'No' responses suggest reluctance to provide negative information about projects.	Indicates a need for questions that encourage honest, critical assessment.
Potential for Response Bias	Overall response trends suggest a bias towards answers perceived favourably by DFIs.	Implies the need for questions that mitigate response bias.
Need for Clearer Questionnaire Design	Variation in unclear responses underscores the necessity for clearer, more specific questions.	Highlights the importance of designing clear, concise, and relevant questions.

The thematic analysis largely confirms the statistics of answers displayed above. “Yes” was the assumed right answer, chosen by the respondents. Also, it was noticed, that a clearer language of questions was necessary for more accurate answers.

Table 8. Narrative analysis of the feedback to the TAQ

Theme	Observation	Interpretation
Respondent Understanding and Confidence	Respondents often unsure about understanding questions as intended by the questionnaire developer.	Indicates a need for clearer, more elaborative question design to ensure accurate understanding.
Limited Explanation for Answers	Few respondents elaborated on their <i>Yes/No/To be defined/Not applicable</i> answers due to possible time constraints, perceived low importance, or lack of understanding.	Suggests that additional guidance or motivation might be necessary to elicit more comprehensive responses.
Answer Bias Towards Positive Perception	Respondents inclined to guess answers they think DFIs would view positively.	Implies a tendency to respond in a way that is believed to

		favorably influence investment decisions.
Cultural and Regional Interpretation Variance	Different interpretations of questions in various countries, particularly concerning social norms and environmental impact.	Highlights the influence of cultural and regional factors on how questions are perceived and answered.
Tendency to Answer 'Yes' to Favour Projects	Respondents likely to answer 'yes' to present their projects more positively.	Suggests a risk of biased responses aimed at portraying the project in a favorable light.
Qualification of Respondents	Some respondents may lack the necessary qualifications to accurately answer questions.	Points to the importance of ensuring that respondents have the requisite knowledge and expertise.
Diverse Stakeholder Perspectives	Different stakeholders, such as those in energy storage vs. thermo power generation, may have varying views on the same project.	Emphasizes the need to consider diverse stakeholder perspectives for a holistic assessment.
Prediction of Technology Consequences	Doubts about respondents' qualifications to predict the consequences of technology usage.	Indicates potential gaps in understanding the long-term impacts of EDTs.
Diligence of Final Customers	Concerns about less diligent application of technology by final customers.	Suggests a need to consider end-user engagement and compliance in technology application.
Questionnaire Length and Complexity	Perception that 75 questions are too many for companies to answer.	Reflects on the questionnaire's practicality and potential respondent fatigue.
Question Design for Clarity	Need for questions to be formulated to minimize self-interpretation and ambiguity.	Highlights the importance of clear, unambiguous questions in obtaining accurate responses.

Risk Categorization and Investment Decision	Possibility of indexing investments (green, yellow, red) based on answers to categorize EDT risks and inform DFI action.	Proposes a structured approach to categorizing investment risks based on questionnaire responses.
Awareness of Developers	Total scores in TBD and N/A categories indicate the developers' awareness of EDT issues.	Suggests a method to gauge developers' awareness and preparedness regarding EDT risks.
Need for Questionnaire Updates	Requirement to update questions with technological advancements.	Emphasizes the dynamic nature of EDTs and the need for the assessment tool to evolve accordingly.
Awareness Enhancement through Questionnaire	Belief that answering the questionnaire itself raises developers' awareness of potential technology consequences.	Indicates the questionnaire's potential role in educating and sensitizing developers about the impacts of EDTs.

The respondents noticed that a wider circle of stakeholders may answer the same questionnaire differently, having a different perspective. For example, in the case of the energy storage project, representatives of the thermopower generation may assess the project less positively.

As I see it, depending on the number of answers in each of the categories, it is possible to index investment opportunities relating them to different categories e.g. green, yellow, red, with green indicating minimum EDT risks, and red – maximum. In terms of action for a DFI, red would mean to reject an investment opportunity; yellow – keep it on hold, to learn more or to invest together with another investor presumably more knowledgeable with the technology; green – no unmanageable EDTs-related precautions to invest.

I have also noted, that already by answering the questions, the project companies became more alerted about potential consequence of a technology application.

3.4. Technology Assessment Questionnaire Development

TAQ should be continuously evaluated and updated based on responses and evolving standards. Analysing the results of TAQ testing, I developed recommendations for further development of Technology Assessment Questionnaire (TAQ). They concern the design of the tool, in particular, to reduce the number of sections and questions, avoid language that would allow guessing the right answers, to word questions more precisely, leaving minimum room for self-interpretation by respondents.

TAQ respondents should be instructed to assess consequences and potential impacts on environmental, social, human rights, and governance structures, use their best judgment to select an answer and encouraged comment on each of it, and be clearly aware that answers may influence investment decisions.

TAQ usage guidelines should include requirements to ensure that the investment opportunity does not conflict with the DFI's exclusion list, is compliant with the law in the host country. Conducting a Know-Your-Customer assessment for anti-money laundering, anti-corruption, and anti-terrorist financing regulations is a prerequisite to run the TAQ. Special attention should be paid to TBD and N/A answers to ensure clarity and completeness of the EDT risk assessment. TBD and N/A answers can also indicate that a question is formulated in an unclear way, the project sponsors are not sufficiently qualified or informed to answer, or the project sponsors are trying to hide something.

It is advisable that a few representatives from different company's functions respond independently to the TAQ. Running TAQ by independent tech experts for unbiased assessment for an investment opportunity can be very valuable and less biased for risk assessment.

It is recommendable to assign different weights to TAQ questions reflecting the DFI's policies. Also, different weights can be assigned at different investment project cycle stages. TAQ can be run at different stages of an investment project cycle: before the project (ex-ante), immediately upon implementation, and then in a few years, e.g. in 3 and 5 years, with flexibility for different time horizons, and finally after DFI's exit (ex-post).

Making TAQ an online platform will allow to include a user-friendly glossary to explain TAQ terminology and ensure data completion and consistency. It will be possible to use AI instruments for on-going analysis of responses, use pre-defined algorithms of selecting consequent questions based on previous responses, ease the data analysis.

I believe, TAQ should include questions addressing most sensitive areas such as data privacy protection (i.a. to reduce data trafficking and discrimination), employment impact (employment development, primary employment (people hired by the project), secondary employment (people hired within upstream and downstream supply chains), acute layoffs, usage of AI-based technologies, possible environmental changes, addiction to products or services, changes to critical infrastructure, producing dual-purpose goods and services, and others.

CONCLUSION

The advancement of new technologies brings both potential benefits and risks. It is vital for scientists, policymakers, and the public to assess these implications and ensure their use is safe, ethical, and beneficial.

Emerging and Disruptive Technologies (EDTs) are becoming as common as electricity and the Internet. They drive innovation and growth, influenced by institutional support. Trust in these technologies is key, ensuring they are safe, ethical, and promote inclusivity and fairness. This trust is vital for realizing their social, commercial, and governmental benefits.

Development Finance Institutions (DFIs) are the guardians of the public good. They should not restrict the development by limiting EDT-related investments. However, it is important that the deployment of EDTs is happening in a manageable and predictable mode. I believe, *Responsible Application of Technology* could be another, the 18th, Sustainable Development Goal, in addition to the existing UN's 17 SDGs.

The research has confirmed my initial hypothesis and revealed a gap in DFIs' policies and approaches in relation to methods and tools to assess risks of investment projects involving EDTs. Despite the recognition of the risks associated with EDTs, the practice of the risks assessment lags behind the actual EDTs impact and has not been sufficiently elaborated in terms of policies and tools. Most of the DFIs assign their ESG (often called Sustainability) function to deal with EDT-related risks, fairly relating them to the broad family of ESG risks, which I agree with. Sustainability officers and front office investment professionals, as a rule, do not have sufficient qualification and training to assess EDT risks. This should be corrected through equipping them with tools allowing to efficiently run risk assessment to evaluate investment opportunities. This will also send a clear message to all stakeholders that DFIs do care practically about making no harm due to technologies.

Given EDTs' potential impact on economies and societies, there is a critical need for DFIs to develop and implement comprehensive risk assessment tools specifically in relation to EDTs.

In the paper, I elaborated on my research of the current DFIs' EDT risk assessment practices, conducted via interviews and desk studies. I reviewed a few DFIs' policy documents, that guide their ESG risk assessment practices, and found a very limited reference to EDT risks. I think, this should be amended in the nearest future, and EDTs get full recognition as a source of significant but controllable risk.

IFC has made a solid work to control AI usage in its investments by developing Technology Code of Conduct and related Progression Matrix. Unfortunately, this work has not been completed but for me it has been clearly a source of inspiration.

As a tool to do the initial screening of investment opportunities from the EDT angle, I have developed Technology Assessment Questionnaire (TAQ), a project self-assessment tool, which I tested with a few investment projects. The test confirmed its practical value to improve understanding of a project from the technology angle and allowed to suggest some further improvements to TAQ. On top of returning a screening result, running TAQ rises the awareness of the investment project sponsors of typical concerns involving new technologies. The self-assessment questionnaire approach is not innovative, however, there are no publicly known examples of its usage by DFIs for EDT risk assessment.

It would be advisable to create an online TAQ and continue using it in application for investment opportunities. The usage practice and collected data would allow for further improvements of the TAQ. As a practical step in this regard, I plan to approach European Development Finance Institutions association (EDFI), headquartered in Brussels, to seek for their facilitation to present TAQ at their meetings in order to propose TAQ test drives at some European DFIs.

REFERENCES

AXA. (2023). Future Risks Report 2023. Retrieved from <https://www.axa.com/en/press/publications/future-risks-report-2023-report>

Chamanara, S., Ghaffarizadeh, S. A., & Madani, K. (2023). The Environmental Footprint of Bitcoin Mining Across the Globe: Call for Urgent Action. *Earth's Future*, 11(10). DOI: 10.1029/2023EF003871

Crishna Morgado, N., & Taşkın, Ö. (2019). Managing environmental risks in development banks and development finance institutions – what role for donor shareholders? OECD Development Co-operation Working Papers, No. 55. OECD Publishing. <https://doi.org/10.1787/ca0f0d4f-en>

d'Angelo, C., Flanagan, I., Motsi-Omojiade, I. D., Virdee, M., & Gunashekar, S. (2022). Labelling initiatives, codes of conduct and other self-regulatory mechanisms for artificial intelligence applications: From principles to practice and considerations for the future. RAND Corporation. Retrieved from https://www.rand.org/pubs/research_reports/RRA1773-1.html

European Commission. (2019). Ethics guidelines for trustworthy AI. Retrieved from <https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai>

European Investment Bank. (2022, February 2). Environmental and Social Standards. Retrieved from <https://www.eib.org/en/publications/eib-environmental-and-social-standards>

FMO. (2024). Environmental, Social and Governance tool for Financial Institutions. <https://fi-esg-tool.com/>

International Finance Corporation (IFC). (2020a, March). Developing Artificial Intelligence Sustainably: Toward a Practical Code of Conduct for Disruptive Technologies. IFC Note 80. <https://www.ifc.org/content/dam/ifc/doc/mgrt/emcompass-note-80-10.pdf>

International Finance Corporation (IFC). (2020b, March). IFC Technology Code of Conduct, Progression Matrix, Public Draft. Note 80A. <https://www.ifc.org/content/dam/ifc/doc/mgrt/emcompass-note-80a-tocc-matrix.pdf>

International Finance Corporation (IFC). (2020c, July). AI Investments Allow Emerging Markets to Develop and Expand Sophisticated Manufacturing Capabilities. IFC Note 87. <https://www.ifc.org/content/dam/ifc/doc/mgrt/emcompass-note-87-for-web.pdf>

International Finance Corporation (IFC). (2020d, September). Artificial Intelligence in Emerging Markets: Opportunities, Trends, and Emerging Business Models. Retrieved from <https://www.ifc.org/content/dam/ifc/doc/mgrt/ai-report-web.pdf>

International Finance Corporation (IFC). (n.d.). Anticipated Impact Measurement and Monitoring (AIMM). <https://www.ifc.org/en/our-impact/measuring-and-monitoring>

Kaspersen, A., & Wallach, W. (2022, January 14). We're failing at the ethics of AI. Here's how we make real impact. World Economic Forum. Retrieved from <https://www.weforum.org/agenda/2022/01/we-re-failing-at-the-ethics-of-ai-here-s-why/>

NATO. (2023, June 22). Emerging and disruptive technologies. Retrieved from https://www.nato.int/cps/en/natohq/topics_184303.htm

OECD. (n.d.). AI Principles overview. Retrieved from <https://oecd.ai/en/ai-principles>

Rahamimoff-Honig, T., & Shahar, K. (2023, September 12). Managing the Promise and Threat of Emerging Technologies. BESA Center Perspectives Paper No. 2,212. Retrieved from <https://besacenter.org/wp-content/uploads/2023/09/Rahamimoff-Honig-and-Shahar-Emerging-Technologies-1.pdf>

Runde, D. F., Bandura, R., & Ramanujam, S. R. (2019, June). The Role of Development Finance Institutions in Enabling the Technology Revolution. Center for Strategic & International Studies (CSIS) Briefs. Retrieved from https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/190617_RundeRominaRamanujam_DFI_v3.pdf

Shepardson, D. (2023, December 14). GM to lay off 1,300 workers at two Michigan plants. Reuters. Retrieved from <https://www.reuters.com/business/autos-transportation/gm-lay-off-1300-workers-two-michigan-plants-automaker-2023-12-14/>

Tammenga, A. (2020). The application of Artificial Intelligence in banks in the context of the three lines of defence model. *Maandblad Voor Accountancy en Bedrijfseconomie*, 94(5/6), 219-230. <https://doi.org/10.5117/mab.94.47158>

The Equator Principles. (n.d.). Retrieved from <https://equator-principles.com/>

UNESCO. (n.d.). Ethics of Artificial Intelligence. Recommendation on the Ethics of Artificial Intelligence. Retrieved from <https://www.unesco.org/en/artificial-intelligence/recommendation-ethics>

APPENDIX 1. IFC TECHNOLOGY CODE OF CONDUCT, PROGRESSION MATRIX



Core Values

		Expected Practices for EMERGING COMPANIES	Expected Practices for LATER STAGE COMPANIES	Expected Practices for MATURE COMPANIES
1. BENEFIT Technology should provide customers, individuals, and communities with access to products, services, and capabilities that benefit them.	BUSINESS PROCESS	Commercially viable product providing benefits to as many customers, individuals, and communities as possible	Same	Same
		No inherent harm that cannot be sufficiently minimized, mitigated, or responsibly accepted in the context of the industry and relevant social norms	Clearly articulated purpose of using the technology for the benefit of individuals, communities, and the environment; and not causing harm to individuals, communities, or the environment. All potential benefits and risks, with relevant mitigants, clearly documented	Full Well-Being Impact Assessment (for example, based on the Maslow Hierarchy of Needs) developed, with regular updates
	TECHNICAL ASPECTS	Product performs intended function consistently and correctly	Same , and guards against immediate negative side effects of technology incorporated into product design	Product design addresses potential indirect and negative longer-term impact of adoption
			Feedback about user experience incorporated into product design to increase benefit provided by product	Product continually updated to maximize benefit based on user experience and feedback

		Expected Practices for EMERGING COMPANIES	Expected Practices for LATER STAGE COMPANIES	Expected Practices for MATURE COMPANIES
2. INCLUSIVENESS Technology should be designed and developed in a manner that ensures outcomes reflecting the requirements and values of individuals and communities expected to use or benefit from the technology.	BUSINESS PROCESS	Consultations with users and beneficiaries inform product design	Regular and formalized consultations to assure outcomes consistent with community and consumer expectations, and their systematic integration into product design	Best-practice stakeholder engagement , including with specifically affected communities
		Diversity of technical and business staff involved in product design, and of management and governance functions	Same , and specialized forms of consultation with vulnerable categories (children, individuals with disabilities, elders without IT literacy, etc.)	Same
	TECHNICAL ASPECTS	Product fulfills a need identified by user base	Same , and feedback about user experience (UX Design) incorporated to increase benefit provided by product	Same , and transparent use of appropriate, real-time feedback mechanism; appropriate AB testing to maximize usability
		Product can be used by all members of the intended user base	Same , and product enables access to individuals and groups with disabilities or similar access challenges	Same , and product is customized to maximize usability given a specific user profile, such as accommodating language spoken
		Datasets used are representative of most intended users and use cases	Underlying dataset is largely representative of the world the product will operate in	Underlying dataset is representative of the world the product will operate in; updated continually as new user profiles/edge cases are identified

3. FAIRNESS Technology should be designed, developed and used in a fair and non-discriminatory manner. Technology providers should avoid anti-competitive or unfair commercial practices that unreasonably impede technology access and adoption.	BUSINESS PROCESS	Potential discriminatory impact of the technology on various individuals, groups, and communities identified, mitigated, and disclosed	Same , and the identified impacts, mitigations, and disclosures clearly documented and regularly reviewed with all product iterations and in response to new information	Full Bias Impact Statement developed
			Governance body tasked with proactive risk assessment of emerging public and policy concerns and fairness considerations, including in relation to use of personal data and tax impact on markets	Same , and responsible tax practices consistent with relevant international best practice such as OECD, BEPS etc.
				Proactive fairness and reputational risk assessment integrated into robust compliance function
	TECHNICAL ASPECTS	Product does not derive insights or knowledge from protected classes, including indigenous or historically disadvantaged communities, without their knowledge or compensation	Same	Same
		Product uses heterogeneous data set (for example, collecting data from a variety of reliable sources)	Same , and industry standard toolkits used to identify and address potential bias (using agreed-upon definition of fairness to determine what constitutes objectionable results)	Same , and mechanism for continuous bias testing and related response of incorporated into design; repeated for any updates
		Algorithmic bias risks considered in development or acquisition of tools	Same , and outcomes of bias testing iterated into product improvement	Same



Safeguards

		Expected Practices for EMERGING COMPANIES	Expected Practices for LATER STAGE COMPANIES	Expected Practices for MATURE COMPANIES
4. TRANSPARENCY Affected individuals, communities, and stakeholders should be provided with access to information sufficient to understand the risks, opportunities, and impacts of the technology.	BUSINESS PROCESS	High-level disclosures on the application of the Technology Code of Conduct to public—in any terms of use; and to investors—in any fundraising	Same , and integrated into privacy disclosure of the company	Same , and plain language explanation readily available to the public and as part of regular integrated reporting of the company
		Detailed periodic reporting on the application of the Technology Code of Conduct to governance body and investors	Same , and ability to explain individual decisions in a manner understandable by human expert	Same , and transparency by design, for example, with embedded reporting capacity and metrics
		Any material concerns relating to the Technology Code of Conduct are mitigated and/or escalated to management, as practical	Same	Same
	TECHNICAL ASPECTS	No algorithms used in the product are a “black box” and all underlying documentation is available for review	Same	Same
		Developers understand which factors are relevant for decision making and the general process by which those decisions are made	Developers and other experts can trace how any algorithm used makes individual decisions (for example, by using the LIME package)	Same
			External post-hoc explanation is available: observing output and reverse internal explanation; And counter-factual explanation: how specific factors influence algorithmic decisions	Same , and supplementary explanatory infrastructure, with immediate, easily understandable explanations of any decision making incorporated into regular use of the product, and shown to user automatically or upon request
5. INFORMED CONSENT Affected individuals and communities should be provided with the right to give meaningful informed consent before using the technology.	BUSINESS PROCESS	Notify individuals that their data are collected and for what purpose, in compliance with applicable law	Same , and easily understandable, plain-language consent language, with examples available to users	Same , and intuitive and customized for the different types of users; and design Terms of Service as negotiable to consumers (with company determining “deal-breakers” or non-negotiable conditions ahead of time)
			Users have the ability to request information update and to be able to provide consent again	Same , and conditional and dynamic consent, with downstream consequences (positive and negative) explicitly called out; and make easily available personal data management tools

		Expected Practices for EMERGING COMPANIES	Expected Practices for LATER STAGE COMPANIES	Expected Practices for MATURE COMPANIES
INFORMED CONSENT <i>(continued)</i>	BUSINESS PROCESS		Data are not used to make sensitive inferences, infer traditional knowledge or practice, or make important eligibility determinations without the free prior informed consent of the individuals or communities concerned	Same
				Affirmative consent (on a rolling basis): initial consent based on currently available information, can be revoked at any time as information is being updated
	TECHNICAL ASPECTS	Product does not use any data obtained illegally or without consent	Same	Same , and identification technologies used to assure user control over data sharing and use preferences, including possible compensation
		Any algorithms used are not trained on datasets containing data obtained illegally or without consent	Same	Same
		If applicable, interface presents user with terms of service before use; user must agree before they are allowed to engage with product	Same , and terms of service are presented clearly, without any unnecessary barriers to comprehension (for example, requiring user to link to another page or zoom in on small text)	Same , and users are automatically re-prompted for consent when encountering a new use case or when organization plans to use their data in new ways; and any terms presented are clear, readable, and customized for maximum comprehension based on the available information on user
		If the technology involves "affective systems": opt-in policy with explicit consent	Same	Same
		Company business plan outlines roadmap for managing data, privacy, and consent issues	Project team assesses and mitigates data, privacy, and consent issues raised by proposed product offering	Company undertakes Privacy Impact Assessment on project, product, service, program level; and these cover various aspects of privacy, including personal information, personal behavior, personal communications, location.
				Appropriate AB testing employed to maximize engagement/understanding of terms
				Integration of tech solution such as value-based identity management system

		Expected Practices for EMERGING COMPANIES	Expected Practices for LATER STAGE COMPANIES	Expected Practices for MATURE COMPANIES
6. VALIDATION The claimed principles, norms, and outcomes of the technology should be validated by training and confirmation against scenarios and datasets appropriate to the envisioned purpose, risks, stakeholders, and implementation scale.	BUSINESS PROCESS	Validate algorithms on separate dataset overseen by separate data team and report the findings to management and governance body	Same , and periodic validation, including in response to specific concerns and emerging risks	Same
		Limitations and assumptions of the system, as well as data sources are fully documented	Same , and the following is also documented: data used to train the system, algorithms and components used; results of behavior monitoring	Same , and such documentation is in line with methodology approved by the Board and reviewed by independent third party
	TECHNICAL ASPECTS	Any algorithms perform within acceptable window of accuracy (as determined for the use case) and consider appropriate information when making decisions	Same , and in known cases where algorithm fails, developers understand why (to trace root-causes in case of caused harm)	Same , and product failures are extremely rare and promptly addressed when identified
		Dataset contains no known pollution	Same , and data provenance record in place to trace the potential data update, missing and error cause by data transformation within the organization	Same , and validation methodologies and outcomes audited by an independent party
			Different data sets are required for training, testing, and validation	Same
			Behavior is constant under constant conditions	Same

7. SECURITY Technology should be designed, developed, and used in line with technical and organizational safeguards sufficient to assure its secure use and protect against misuse, especially in relation to personal data.	BUSINESS PROCESS	Key security vulnerabilities throughout operational lifetime of the technology (data pollution, physical infrastructure, cyber-attacks, etc.) understood and addressed	Same , and such understanding properly documented, including the corresponding controls	Same , and regularly checked/ updated and integrated into comprehensive risk governance system reflecting "three lines of defense"
			Security maturity assessed in line with industry good practices (such as NIST or similar)	Same , and such documentation is in line with methodology approved by the Board and reviewed by independent third party
	TECHNICAL ASPECTS	Product contains no significant known security flaws	Same , and product designed with consideration of potential security risks	Same , and ISO or similar process certifications in place
			Targeted stress testing performed for high-likelihood/risk scenarios	Same , and comprehensive stress testing performed regularly, results implemented quickly and effectively

		Expected Practices for EMERGING COMPANIES	Expected Practices for LATER STAGE COMPANIES	Expected Practices for MATURE COMPANIES
8. RESPONSIBILITY Technology providers and the technology developed shall comply with applicable law and should respect human rights. Technology providers should assist public authorities to understand the risks, impacts, and opportunities of the technology in order to develop effective policy and regulatory frameworks.	BUSINESS PROCESS	Compliance with applicable law (NOTE: this is cross-cutting requirement relevant for all the other principles, most notably: Transparency, Informed Consent and Accountability)	Same	Same
			Positive response to asks for engagement with the community	Same, and proactively engaging with stakeholders including regulators and civil society to identify and manage risks, impacts, and opportunities
	TECHNICAL ASPECTS	Product developed with safeguards to not support illegal activities	Same, and use of industry best practice methodology for efficiently flagging and addressing suspicious activity	Same, and working with other members of the ecosystem to develop industry leading detection and removal technology for objectionable content
		Escalation mechanisms, including product development checkpoints, for modifying product if found to be supporting such illegal activities	Same	Same
		Data/other evidence could be extracted from system if requested by law enforcement	Same, and data can be easily extracted and explained to law enforcement or the general public when requested	Same, and effectiveness of processes periodically audited by independent third party
				Features proactively designed to minimize misuse and toxic behavior; updated continuously in response to data on engagement

9. ACCOUNTABILITY Technology providers should be accountable for the performance and foreseeable ethical implications of the technologies they develop and for managing evolving and emerging issues from continuous technology improvement. This includes ensuring that affected individuals and communities have recourse to judicial and administrative remedies, as well as to appropriate mechanisms for consultation and redress.	BUSINESS PROCESS	Company-level redress mechanism exists and does not impede access to judicial and administrative remedies	Same, and sophistication of redress mechanism scaled to the risks and adverse impacts and primarily focused on affected individuals and communities	Same, and reporting to the affected individuals and communities on the effectiveness of the redress mechanism
		Sufficiently independent function responsible for receiving and addressing concerns including escalation to management	Same	Fully independent function, reporting directly to Board, tasked exclusively with redress mechanism responsibilities
	TECHNICAL ASPECTS	Product team is equipped to modify product, if necessary, in response to results of redress process	Same, and method for submitting requests for redress is built into product	Same, and redress mechanism is highly intuitive, and presents clearly at the time a request would be likely
		Record of parties responsible for work on different products/features exists in case problems emerge	User can access data about their experience with product that could be relevant in a judicial or administrative remedy	Same, and relevant information for a redress case is clearly and easily available to user; suggestions are made for what information would be potentially relevant
			Modifications due to reported issues implemented quickly and effectively	Appropriate AB testing to maximize usability of these systems



Building Blocks

		Expected Practices for EMERGING COMPANIES	Expected Practices for LATER STAGE COMPANIES	Expected Practices for MATURE COMPANIES
10. GOVERNANCE Technology providers should maintain governance and management systems appropriate to the purpose, scale, and potential impacts of the technology to assure reasonable control over such impacts. Technology providers should seek to avoid, minimize, and mitigate potential risks and impacts, including environmental, social, governance, and privacy risks and impacts.	BUSINESS PROCESS	Governance body and investors give innovation and technical teams clear direction on the values and norms to be promoted in the technology design, reflecting the Technology Code of Conduct	Technology provider has developed a full Risk Governance Framework , reflecting the Technology Code of Conduct , comprising: risk identification, high-level and detailed risk assessment, risk mitigation (through policies and procedures, training and communication), monitoring, reporting, and third-party audit	Same , and has established governance functions with appropriate level of independence, including a second line of defense role for programmatic implementation of the Risk Governance Framework , to support staff and supply them with methodology on how to consider the principles of the Technology Code of Conduct
		Sufficient knowledge and understanding of risk issues addressed in the Technology Code of Conduct on all levels of the organization, from individual teams to management, governance bodies, and investors	Same , and Board reviews effectiveness of Risk Governance Framework at least annually.	Same , and Board adopts maturity roadmap on key risks , mapped to business plan milestones, reflecting NIST-type frameworks and disclosed in fundraising documents

APPENDIX 2. DFIS INQUIRED FOR INFORMATION

	DFI	enquiry date	first contact channel	reply email date	interview date	comment
1	Swedfund	09-Nov-23	email			
2	African Development Bank	10-Nov-23	web form			
3	Asian Development Bank	10-Nov-23	web form			
4	KfW	09-Nov-23	email			
5	Finnfund	10-Nov-23	email			
6	JP Morgan Development Finance	10-Nov-23	email			
7	DEG	09-Nov-23	email			
8	FMO	09-Nov-23	email	13-Nov-23	21-Nov-23	
9	SIFEM	09-Nov-23	email			
10	Norfund	09-Nov-23	email			
11	responsAbility	09-Nov-23	email			
12	DFC	09-Nov-23	email			
13	BIO Invest	09-Nov-23	email			
14	Proparco	09-Nov-23	email			
15	JICA	09-Nov-23	web form	16-Nov-23	16-Dec-23	
16	EBRD	09-Nov-23	web form	14-Dec-23	21-Dec-23	
17	IFC	10-Nov-23	web form	07-Dec-23	11-Dec-23	
18	CDP Italy	10-Nov-23	email			
19	Finance in Motion	10-Nov-23	email			
20	BII	10-Nov-23	email			
21	OeEB	10-Nov-23	email	13-Nov-23		cannot reveal info
22	COFIDES	10-Nov-23	email			
23	EIB	11-Nov-23	email	27-Nov-23		ref to web-site
24	IDB Invest	12-Nov-23	email	28-Dec-23		asked for more time
25	Islamic Development Bank	12-Nov-23	email			
26	Asian Infrastructure Investment Bank	13-Nov-23	web form	21-Nov-23	21-Nov-23	
27	Triodos	13-Nov-23	email			
28	Triple Jump	13-Nov-23	email			
29	Blue Orchard	13-Nov-23	email			
30	IFU	10-Oct-24	call	none	11-Dec-23	
31	Horizon Capital	18-Oct-23	call	01-Nov-23	02-Nov-23	

APPENDIX 3. DECODED DFI INTERVIEWS TEXTS

[the name is deliberately hidden], Senior Investment Officer at AIIB, 21 Nov 2023

1. Does AIIB assess potential risks associated with EDTs in the projects you are invited to finance?

The Asian Infrastructure Investment Bank (AIIB) focuses on financing sustainable infrastructure that is green, technology-enabled, and promotes regional connectivity. We prioritize sustainability in our investments and we are committed to supporting the Paris Agreement, with a goal of directing 50% of our financing towards climate finance by 2025. We do not address specifically risks associated with EDTs in our financing projects.

2. What function (e.g. Sustainability, Legal, Risks, etc.) within AIIB is responsible for the EDT risk assessment?

Our Risk Management Framework is aimed at providing a coherent foundation for effective risk management by outlining an overarching methodology and guideline for governing the key risks that the Bank faces.

You may wish to check AIIB's Digital Infrastructure Sector Strategy at <https://www.aiib.org/en/policies-strategies/operational-policies/digital-infrastructure-strategy/index.html>

and the Risk Management Framework at <https://www.aiib.org/en/policies-strategies/framework-agreements/risk-management-framework.html>.

The AIIB's Digital Infrastructure Sector Strategy emphasizes the integration of digital technologies in infrastructure projects, focusing on their potential to boost efficiency, inclusivity, and sustainability. The Risk Management Framework outlines the Bank's approach and attitude toward various types of risks, including operational, strategic, financial, and reputational risks. This framework provides a comprehensive methodology for risk management across the institution.

However, the specific function within AIIB responsible for assessing risks associated with EDTs is not explicitly stated in these documents. The responsibility for assessing such risks falls under the broader risk management practices outlined in the Risk Management Framework, involving multiple

departments including risk management, sustainability, and legal functions, depending on the nature and scope of the project.

3. What approaches, methodologies, frameworks, practices, tools AIIB's EDT risk assessment is based on?

The AIIB's approach to risk assessment, particularly concerning EDTs, is guided by our comprehensive Risk Management Framework.

We have also reaffirmed our commitment to environmental and social standards by approving a revised Environmental and Social Framework (ESF) Environmental and Social Framework - Framework Agreements - AIIB , which serves as the cornerstone of AIIB commitment to supporting environmentally and socially sustainable infrastructure projects. Key changes in the revised ESF include strengthened language on climate change and enhancing transparency for the disclosure of environmental and social documentation.

AIIB has recognized the impact of climate change on infrastructure and the role of technology in enhancing climate resilience. They acknowledge that the current stock of critical infrastructure is not adequately coping with increasingly frequent extreme weather events, especially in Asia. Technologies such as the Internet of Things (IoT), artificial intelligence (AI), and digital twins can play a major role in enhancing the climate resilience of critical infrastructure through data collection, processing, and communication.

In terms of specific projects, AIIB's approach to environmental and social risk management can be seen in their investment in the eWTP Arabia Technology Innovation Fund II. This fund focuses on growth-stage technology and technology-enabled investments in the Gulf Community Countries (GCC) region. The project is categorized as a Financial Intermediary (FI) operation, where AIIB's Environmental and Social Policy (ESP), including the Environmental and Social Exclusion List (ESEL) and Environmental and Social Standards (ESSs), is applicable. This involves the selection, appraisal, approval, and monitoring of sub-projects in accordance with AIIB's ESP requirements.

4. Does AIIB assess EDT risk before decision to finance only or through the entire financing cycle till AIIB's exit?

Certainly, we assess the risks during the entire investment cycle from deal origination to ex-post our exit from a project.

5. Without naming specifically, can you recall cases when AIIB refused to finance a project or terminated financing due to concerns over potentially harmful EDTs?

none

[the name is deliberately hidden], Director, Environment and Sustainability at EBRD

21 December 2023

1. Does EBRD assess potential risks associated with EDTs in the projects you are invited to finance?

As a rule, EBRD conducts thorough due diligence ahead of signing any financial transaction. As part of the process, the EBRD assesses cybersecurity risks of client-facing projects regardless of having EDTs. If a project were to finance EDTs a full cybersecurity due diligence would be conducted, and risks would be assessed to make sure the EDT is not harmful. Contextual environmental and social risks, which can include the issues related to emerging technologies, are assessed prior to Board approval as part of project due diligence required to comply with the Bank's Environmental and Social Policy.

Yes, EBRD does assess potential risks associated with Emerging Disruptive Technologies (EDTs) in the projects they finance. As with any development bank, the EBRD takes into account a wide range of factors when evaluating investment opportunities, and this includes assessing the risks and opportunities presented by EDTs.

The EBRD's risk assessment process typically includes:

- market and financial risks: evaluating the viability of the technology in the market, potential financial returns, and economic sustainability.
- environmental and social risks: ensuring that projects comply with the EBRD's Environmental and Social Policy, which includes assessing the environmental impact and social implications of the technologies involved.
- technical and operational risks: analyzing the feasibility of the technology, its stage of development, and any operational risks associated with its implementation and scalability.
- regulatory and legal risks: considering the regulatory environment of the host country, especially how it pertains to innovative technologies, and ensuring that projects comply with local and international laws and regulations.
- ethical and sustainability risks: assessing the ethical implications of the technology, particularly in terms of data privacy, security, and potential societal impacts, aligning with the EBRD's commitment to sustainable development.

- governance risks: looking at the governance structure of the investee company, including its risk management practices and ethical standards, especially important for EDTs which can have significant governance implications.

The EBRD's approach to risk assessment in the context of EDTs reflects our broader commitment to promoting sustainable development and innovation in the regions it serves, while also ensuring the financial stability and viability of its investments.

2. What function (e.g. Sustainability, Legal, Risks, etc.) within EBRD is responsible for the EDT risk assessment?

The Risk department is responsible for assessing the risks associated with all projects we finance. The Environmental and Sustainability Department is in charge of assessing and monitoring all ESG-related risks. The Digital Hub is not doing risk assessment, except for cybersecurity, and keeps track of recent development of new technologies such as AI or crypto to improve knowledge sharing and pilot digitalisation programs across the countries of operations. The Digital Hub also has advisory functions to advise bankers and other teams across the Bank, as well as clients, on new technologies which could include EDTs.

The EBRD's approach is typically holistic, involving these various departments to ensure that all aspects of risk are considered, from financial viability and market potential to environmental impact and social implications. The exact involvement of each function can vary depending on the nature and specifics of the individual project or investment.

3. What approaches, methodologies, frameworks, practices, tools your EDT risk assessment is based on?

The EBRD's risk assessment methodologies and frameworks incorporate a blend of financial, environmental, social, and technical analyses, among others. Key aspects of their approach include:

1. Financial Analysis: This involves evaluating the financial health and projections of the project or company, assessing the potential return on investment, and analyzing market risks and opportunities.

2. Environmental and Social Impact Assessment (ESIA): The EBRD follows its Environmental and Social Policy to ensure that financed projects meet specific environmental and social standards. This policy is aligned with international best practices and includes detailed guidelines for environmental and social due diligence.

3. Technical Assessment: For EDTs, a technical assessment of the technology's viability, scalability, and technical risks is crucial. This might involve in-house experts or external consultants.

4. Regulatory and Legal Compliance: Assessing the compliance of the project with local and international legal and regulatory requirements is essential, especially for EDTs which may operate in areas with evolving legal frameworks.

5. Sustainability Assessment: EBRD often evaluates the alignment of projects with sustainable development goals and the bank's own sustainability criteria. This includes assessing the long-term impact of the project on economic, environmental, and social factors.

6. Market and Sector Analysis: Understanding the market dynamics and the specific sector's trends is vital, especially for EDTs where market readiness and adoption rates can vary significantly.

7. Governance and Management Evaluation: Assessing the quality of governance and management within the investee company, particularly their experience, track record, and approach to risk management.

8. Country-Specific Risks: Analyzing country-specific risks such as political stability, economic conditions, and legal environment that might impact the project.

9. Stakeholder Engagement and Public Consultation: In many projects, especially those with significant environmental and social impacts, stakeholder engagement is a critical component of the risk assessment process.

10. Scenario Analysis and Stress Testing: Conducting various scenarios and stress tests to understand the resilience of the project or technology under different market and economic conditions.

11. Project Structuring and Security Arrangements: Assessing the project's structure and the security arrangements in place to mitigate financial and operational risks.

These approaches and methodologies enable the EBRD to comprehensively assess the risks and opportunities associated with investments in EDTs, ensuring that they are aligned with the bank's mission and objectives, including promoting sustainable development and innovation in the regions it serves. The bank combines these tools with its extensive experience and expertise in development finance to make informed investment decisions.

4. Does EBRD assess EDT risk before decision to finance only or through the entire financing cycle till your exit?

EBRD conducts risk assessments of EDTs not just before the decision to finance, but throughout the entire financing cycle until exit. This ongoing risk assessment process is crucial for managing and mitigating risks effectively over the life of the investment. The key stages of this process include:

1. Pre-Investment Assessment: Before making a financing decision, the EBRD conducts a thorough risk assessment. This includes evaluating the potential risks associated with the specific EDTs involved in the project, along with financial, environmental, social, and governance risks.

2. Due Diligence Process: During the due diligence phase, the EBRD examines the technical, legal, environmental, social, and market aspects of the project in detail. This process helps in identifying any potential risks or issues that need to be addressed.

3. Approval and Initial Financing Phase: Once the investment is approved and the financing is provided, the EBRD continues to monitor the project closely. This involves regular reviews to assess

how the project is progressing against its objectives and to identify any new risks that may have emerged.

4. Ongoing Monitoring and Support: Throughout the investment period, the EBRD actively monitors the project's performance. This includes tracking the financial health of the project, its adherence to environmental and social standards, and the effectiveness of its governance structures. The EBRD may provide support and guidance to address any issues that arise during this phase.

5. Regular Reporting and Evaluation: Investee companies are usually required to provide regular reports on various aspects of the project, including financial performance, environmental and social impact, and progress towards the project's goals. The EBRD uses this information to continually reassess the risk profile of the project.

6. Adjustments and Interventions: If significant risks or challenges are identified during the investment period, the EBRD may work with the investee company to make necessary adjustments. This could involve restructuring the financing terms, providing additional support, or implementing new risk mitigation strategies.

7. Exit Phase: As the project approaches the exit phase, the EBRD assesses the success of the investment and the realization of its objectives, including the sustainable impact of the EDTs involved. The exit strategy is designed to ensure that the project can sustain its operations and impacts after the EBRD's exit.

5. Without naming specifically, can you recall cases when your institution refused to finance a project or terminated financing due to concerns over potentially harmful EDTs?

Nothing public

[the name is deliberately hidden], Senior Sustainability Strategy Officer | Sustainability Strategy & Policy Team | Strateg FMO

21 nov 2023

1. Does FMO assess potential risks associated with EDTs in the projects you are invited to finance?

As means of an introduction, please be informed that FMO invests ([Products and Services | Dutch Development Bank - FMO](#)) in key sectors that are crucial to economic and social progress, using our expertise and networks to support sustainable growth of your business: these are AFW (Agribusiness, Food, and Water), Financial Institutions and Energy. As such, the likelihood that we will encounter investment opportunities in the field that you describe is rather limited. We screen all our opportunities against our Exclusion list ([Exclusion list](#)) for activities that we do not want to be involved with. In general, FMO conducts robust Environmental, Social and Governance (ESG) due diligence ([Responsible Investment | Dutch Development Bank - FMO](#)) on our (potential) investments, where we use the IFC performance Standards as our benchmark. If said technologies would play a material role in the investment opportunity, we would scrutinize it to identify risks.

2. What function (e.g. Sustainability, Legal, Risks, etc.) within FMO is responsible for the EDT risk assessment?

We have a dedicated E&S and Corporate Governance department within our Front Office (reporting to our Chief Investment Officer) who is responsible for the first line of ESG risk management both prior to contracting and monitoring after contracting. Our Credit department (second line of defence) scrutinizes financial proposal for financial and ESG risks.

FMO has been focusing on aligning its fund investments with the Sustainable Development Goals (SDGs) agenda. They have been assessing the development impact of their investments and incorporating feedback into their strategic choices, indicating a proactive approach to addressing any challenges in our investment strategy, including in the tech sector.

3. What approaches, methodologies, frameworks, practices, tools FMO's EDT risk assessment is based on?

Given the limited likelihood of financing these practices, we (currently) do not use specific frameworks for that subject. As included in our Sustainability Policy ([Sustainability Policy](#)), we

adhere to the OECD guidelines for MNE and the UN Guiding principles for Business and Human Rights and apply the IFC Performance Standards to our clients. In our E&S due diligence we also conduct a Contextual Risk analysis to apply a human rights lens to the E&S due diligence findings.

4. Does FMO assess EDT risk before decision to finance only or through the entire financing cycle till FMO's exit?

FMO conducts ESG risk management both prior to contracting and monitoring after contracting: [Responsible Investment | Dutch Development Bank - FMO](#) (more detail in in Annual report 2022 page 38-39 ([Report \(fmo.nl\)](#)))

5. Without naming specifically, can you recall cases when FMO refused to finance a project or terminated financing due to concerns over potentially harmful EDTs?

n/a

[the name is deliberately hidden] , Compliance Director, Horizon Capital, 2 November 2023

1. Does the fund manager (Horizon Capital) assess potential risks associated with EDTs in the projects it is invited to finance?

Yes, the fund manager does assess potential risks associated with emerging and disruptive technologies (EDTs) in the projects they are invited to finance. This assessment is part of the comprehensive due diligence process, which includes environmental, social, and governance (ESG) reviews conducted by Big-4 consultancies. These reviews consider various aspects including human rights, data protection, legal compliance, and potential harmful side effects. The fund manager involves qualified industry experts to evaluate these risks and ensures that the technology complies with local legislation, international sanctions, and trade regulations.

2. What function (e.g. Sustainability, Legal, Risks, etc.) within Horizon Capital is responsible for the EDT risk assessment?

In the fund manager's organization, the risk assessment for EDTs is a collaborative effort involving multiple functions:

1. Compliance Director: Oversees the overall compliance, including adherence to the exclusion list and investment limitations.
2. Legal Counsel: Assists in ensuring legal compliance, particularly in areas like data protection, labor and employment legislation, environmental protection, and occupational health and safety.
3. Partners Group and Investment Committee (IC): They are consulted, especially in cases where potential exclusions or restrictions might be triggered.
4. Big-4 Consultancies: Conduct Environmental, Social, and Governance (ESG) due diligence, as well as legal and IT & Cybersecurity due diligence reviews.

This approach establishes a comprehensive and integrated risk assessment process involving legal, compliance, ESG, and technology aspects.

3. What approaches, methodologies, frameworks, practices, tools JICA's EDT risk assessment is based on?

Horizon Capital's approach to assessing risks associated with EDTs is comprehensive and multidisciplinary. This assessment is based on the following approaches, methodologies, frameworks, practices, and tools:

1. Compliance and Legal Frameworks: Checking against an exclusion list and investment limitations to ensure compliance with legal standards, particularly in sectors that are strictly regulated or ethically sensitive.

2. ESG Due Diligence: Conducted by Big-4 consultancies, focusing on environmental, social, and governance risks associated with investments.

3. Data Protection and Cybersecurity Reviews: Addressing risks related to data breaches, unauthorized access, and other cybersecurity concerns.

4. Expert Consultations: Engaging qualified industry experts for specialized assessment, particularly in the case of complex technologies.

5. Legal Compliance with International Standards: Ensuring adherence to international sanctions, trade regulations, and bans.

6. Monitoring and Reporting: Continuous monitoring and reporting mechanisms to track compliance and risk exposure.

4. Does Horizon Capital assess EDT risk before decision to finance only or through the entire financing cycle till HC's exit?

We keep a close grip on the company's risks from the very start till the very end. It is our reputation and money.

5. Without naming specifically, can you recall cases when Horizon Capital refused to finance a project or terminated financing due to concerns over potentially harmful EDTs?

We have rejected dozens of investment opportunities because of EDTs risks. When we cannot understand the technology and consequences of its application, it is too risky to deploy the money of our limited partners.

[the name is deliberately hidden], ESG Advisory Team Lead at IFC, 11 December 2023 (email and follow up call)

1. Does IFC assess potential risks associated with EDTs in the projects you are invited to finance?

The International Finance Corporation (IFC), a member of the World Bank Group, has a focused approach towards investments in digital infrastructure, particularly in emerging

markets. This approach is driven by the recognition of the significant growth opportunities presented by the telecommunications, media, and technology (TMT) sector across these markets.

A key aspect of IFC's investment strategy is to bridge connectivity gaps, with a particular emphasis on expanding digital technologies, enterprise IT services, and cloud infrastructure. For instance, in 2022, IFC's investments in this sector surpassed \$1.3 billion, marking a five-fold increase in digital infrastructure commitments over the previous five years. These investments are not only about improving digital connectivity but also aim at contributing to green and inclusive economic growth, as well as equitable access to digital services.

In Africa, IFC's investments have been substantial, including commitments to the expansion of digital infrastructure across several countries. These investments support projects like the creation of open-access fiber networks and the expansion of data center infrastructure, thereby enabling high-quality and affordable digital connectivity.

IFC also focuses on strengthening digital infrastructure in Latin America and Southeast Asia. This includes investments in data center operators and tower platforms, with an emphasis on promoting the use of renewable energy and improving rural connectivity. The goal is to provide quality digital services like mobile communications, online medical advice, electronic payments, and online food delivery, which are crucial for economic growth and productivity in these regions.

Overall, IFC's investment strategy in the digital infrastructure sector is guided by the objective of supporting mobile network operators and financing digital infrastructure, like broadband networks and data centers, in challenging and less developed markets. This approach helps bridge the digital divide and is considered vital for the recovery of these markets from the impacts of the COVID-19 pandemic, which has highlighted the importance of digital adoption globally.

The International Finance Corporation (IFC) actively supports innovative technology ventures, acknowledging the transformative potential of emerging and disruptive technologies (EDTs) in advancing economic development and improving lives, especially in emerging markets. However, the nature of investments in emerging and disruptive technologies inherently involves certain risks, as with any venture capital investment.

The IFC's approach to mitigating these risks includes a comprehensive strategy of supporting the entire lifecycle of startups. This is evident in initiatives like the IFC Startup Catalyst Program, which has supported more than 1,180 startups in 24 emerging markets by investing \$60 million in accelerators and seed funds. These investments have helped startups mobilize \$4.5 billion in follow-on funding, driving innovation and job creation. The program focuses on strategically important areas such as climate innovations, gender, and inclusion, and aims to develop digital economies and support startups with market expertise, access to global and local networks, and capital.

Moreover, the IFC's investment strategy is deeply intertwined with its commitment to achieving measurable development impact, focusing on tech-driven business models in high-impact sectors like Fintech, Health Tech, Agtech, and others. This focus on impact investing and the careful evaluation of each investment opportunity help in addressing and managing the risks associated with investing in EDTs.

While IFC recognizes the inherent risks in investing in projects involving EDTs, its approach is to mitigate these risks through strategic support, impact investing, and a focus on sustainable and inclusive growth in emerging markets. This strategy not only manages investment risks but also aligns with IFC's broader mission of fostering economic growth and improving lives in developing countries.

2. What function (e.g. Sustainability, Legal, Risks, etc.) within IFC is responsible for the EDT risk assessment?

To give you an idea, we have at IFC a department called Disruptive Technologies and Funds.

The risk assessment of EDTs within IFC typically involves multiple functions, given the complexity and varied nature of risks associated with such technologies. The primary functions involved in this assessment include:

Investment Teams: these are the front-line teams responsible for identifying, assessing, and managing the risks associated with any investment. They play a crucial role in the initial risk assessment of EDTs in potential investment opportunities.

Risks: this function is involved in more in-depth risk analysis, particularly focusing on financial risks, market risks, and operational risks associated with EDTs.

Sustainability: the team, located in many country offices, assesses risks related to environmental impact, social implications, and governance issues. Given the potential impact of EDTs on these areas, their involvement is crucial, particularly in how they align with sustainable development goals and IFC's broader sustainability criteria.

Legal and Compliance: these departments are responsible for ensuring that investments in EDTs comply with all relevant laws and regulations, both locally and internationally. They assess legal risks and help navigate complex regulatory landscapes.

In-house technology and innovation experts: depending on the specific nature of the EDTs, specialists in technology and innovation may also be consulted to understand the technical aspects and potential future trajectories of the technology.

External consultants or advisory services: in some more complex or sensitive cases, external experts or consultants might be brought in to provide specialized knowledge or insights, particularly for novel or highly complex technologies.

3. What approaches, methodologies, frameworks, practices, tools your EDT risk assessment is based on?

IFC employs a range of principles and methods to assess and manage risks associated with investments in EDTs. Some key aspects of their risk assessment strategy include:

- impact investing: IFC focuses on impact investing, which involves selecting projects that not only provide financial returns but also contribute to sustainable development and have a measurable positive impact.
- Measuring & Monitoring (AIMM): IFC employs the Anticipated Impact Measurement and Monitoring (AIMM) system, which helps in assessing the anticipated results and impacts of its investments. This system is crucial for ensuring that investments align with IFC's goals of promoting sustainable development.
- Evaluation: regular evaluation of investment projects is another vital component of IFC's strategy. This involves assessing the development outcome ratings of various industry groups, including those focused on disruptive technologies and funds.

- Aligning with the Sustainable Development Goals (SDGs) is also a critical aspect of IFC's investment strategy, ensuring that the investments contribute to broader global development objectives.
- collaboration with repeat clients: working with repeat clients has shown higher ratings in project performance. This strategy reduces sponsor selection risks and positively impacts project performance and development outcome ratings.
- risk identification in sector highlights: IFC identifies high-probability and high-impact risks common in low development outcome ratings. This identification helps in mitigating risks specific to sectors, including those related to disruptive technologies.

Look also at:

<https://www.ifc.org/en/what-we-do/sector-expertise/venture-capital>

<https://www.ifc.org/content/dam/ifc/doc/mgrt/ai-report-web.pdf>

<https://ieg.worldbankgroup.org/evaluations/results-and-performance-world-bank-group-2021/chapter-3-international-finance>

4. Does IFC assess EDT risk before decision to finance only or through the entire financing cycle till your exit?

Throughout the entire investment cycle.

5. Without naming specifically, can you recall cases when your institution refused to finance a project or terminated financing due to concerns over potentially harmful EDTs?

Nothing which would be publicly disclosed.

1. Does IFU assess potential risks associated with EDTs in the projects you are invited to finance?

We do assess all potential risks in connection with the investment opportunities we consider. As a rule, we do not invest in tech sector companies, thus our exposure to EDTs risks is limited. Though we admit, that there can be EDTs employed in non-tech companies, like conventional agriculture or water sewage.

The major guiding document in the E&S risk assessment is the IFU Sustainability and Impact Rules.

2. What function (e.g. Sustainability, Legal, Risks, etc.) within IFU is responsible for the EDT risk assessment?

These risks are usually assessed by Sustainability, to the extent we have knowledge and tools to approach such a risk assessment.

However, the primary responsibility for identifying EDTs risks in a proposed investment opportunity stays with an investment professional who works with the transaction.

3. What approaches, methodologies, frameworks, practices, tools IFU's EDT risk assessment is based on?

We do not have anything specifically related to EDTs, since the tech sector is not our major. But all investment leads are taken through the Screening Tool, which allows to filter out leads which are deemed non-priority or too risky for us.

4. Does IFU assess EDT risk before decision to finance only or through the entire financing cycle till IFU's exit?

Like most of other DFIs, we assess all risks, associated with an investment from the first contact to our exit, meaning that we make the final assessment already ex-post our investment.

5. Without naming specifically, can you recall cases when IFU refused to finance a project or terminated financing due to concerns over potentially harmful EDTs?

I believe, we rejected many investment opportunities at very early stages, i.a. in the light of the risks of their technologies, which were too innovative for us, or too unproven, or too vulnerable. Fortunately, I cannot recall an investment which we were forced to exit prematurely because of something wrong happened on their EDT side. We are rather a conservative investor.

[the name is deliberately hidden], JICA HQ operation planning department. 16 Nov 2023

1. Does JICA assess potential risks associated with EDTs in the projects you are invited to finance?

JICA (Japan International Cooperation Agency) is actively engaging with emerging and disruptive technologies (EDTs) to address development challenges in various countries. In collaboration with Accenture, JICA is supporting digital transformation projects in six countries across Asia and Africa. These projects include a range of applications such as digital currency verification in Cambodia, a public-private platform to improve loan efficiency in India, and a feasibility study of a smart city OS for disaster management in Mauritius. This initiative reflects JICA's commitment to leveraging digital technologies in its international development operations to enhance development impacts

With regard to emerging technologies, JICA is extending our development finance in accordance with recommendations and guidance by OECD. Emerging technologies - OECD

2. What function (e.g. Sustainability, Legal, Risks, etc.) within JICA is responsible for the EDT risk assessment?

Spread over all functions, depending on the maturity of a project

3. What approaches, methodologies, frameworks, practices, tools JICA's EDT risk assessment is based on?

We employ standard risk assessment methodologies, which include identifying potential risks, evaluating their likelihood and impact, and developing strategies for mitigation. These assessments consider various factors such as technological feasibility, socio-economic impacts, environmental concerns, and political and regulatory environments.

4. Does JICA assess EDT risk before decision to finance only or through the entire financing cycle till JICA's exit?

Throughout the whole investment cycle

5. Without naming specifically, can you recall cases when JICA refused to finance a project or terminated financing due to concerns over potentially harmful EDTs?

Info is not available

APPENDIX 4. SUMMARY OF INFORMATION COLLECTED ON DFIS.

Proparco	+	+	+	+	+	+	+	+	+	+	?	+	+	+
DEG	+													
BII	+													
AFD														
KfW														

EBRD PRs⁽²⁾

APPENDIX 5. A SAMPLE EXCLUSION LIST

The Exclusion List of the Investment Fund for Developing Countries (IFU), updated in April 2022, outlines activities and industries that IFU will not finance. This includes forced or child labor, illegal activities, environmental hazards, and high conservation value area destruction. Additionally, it prohibits investment in industries like pornography, racist media, certain alcoholic beverages, tobacco, weapons, gambling, and fossil fuel-related sectors. The list reflects IFU's commitment to responsible financing and aligns with their Climate Policy 2022 and the European Development Finance Institutions' principles.

IFU'S EXCLUSION LIST (APRIL 2022)

IFU applies, as a starting point, the European Development Finance Institution (EDFI) "Principles for Responsible Financing", where EDFI members have mutually agreed on the following Harmonized EDFI Exclusion List (September 2011 and October 2020) for co-financed projects. IFU's exclusion list consolidates the EDFI exclusion list and commitments from IFU's Climate Policy 2022. Future revisions to the EDFI Exclusion List will be considered for inclusion into IFU's Exclusion List.

IFU will not finance any activity, production, use, distribution, business or trade involving:

1. Forced labour¹ or child labour²
2. Activities or materials deemed illegal under host country laws or regulations or international conventions and agreements, or subject to international phase-outs or bans, such as:
 - a) Ozone depleting substances, PCB's (Polychlorinated Biphenyls) and other specific, hazardous pharmaceuticals, pesticides/herbicides or chemicals;
 - b) wildlife or products regulated under the Convention on International Trade in Endangered Species or Wild Fauna and Flora (CITES); or
 - c) Unsustainable fishing methods (e.g. blast fishing and drift net fishing in the marine environment using nets in excess of 2.5 km in length)
3. Cross-border trade in waste and waste products, unless compliant with the Basel Convention and the underlying regulations
4. Destruction³ of High Conservation Value areas⁴
5. Radioactive materials⁵ and unbounded asbestos fibres
6. Pornography and/or prostitution
7. Racist and/or anti-democratic media
8. In the event that any of the following products form a substantial part of a project's primary financed business activities⁶:
 - a) Alcoholic Beverages (except beer and wine);
 - b) Tobacco;
 - c) Weapons and munitions; or
 - d) Gambling, casinos and equivalent enterprises.

¹ Forced labour means all work or service, not voluntarily performed, that is extracted from an individual under threat of force or penalty as defined by ILO conventions.

² Persons may only be employed if they are at least 14 years old, as defined in the ILO Fundamental Human Rights Conventions (Minimum Age Convention C138, Art. 2), unless local legislation specifies compulsory school attendance or the minimum age for working. In such cases the higher age shall apply.

³ Destruction means the (1) elimination or severe diminution of the integrity of an area caused by a major, long-term change in land or water use or (2) modification of a habitat in such a way that the area's ability to maintain its role is lost.

⁴ High Conservation Value (HCV) areas are defined as natural habitats where these values are considered to be of outstanding significance or critical importance (See <http://www.hcvnetwork.org>).

⁵ This does not apply to the purchase of medical equipment, quality control (measurement) equipment or any other equipment where the radioactive source is understood to be trivial and/or adequately shielded.

⁶ For companies, "substantial" means more than 10% of their consolidated balance sheets or earnings. For financial institutions and investment funds, "substantial" means more than 10% of their underlying portfolio volumes.

IFU's exclusion list extends beyond the EDFI harmonised exclusion list on fossil fuels and commitments made by the Danish Government to end both public finance and export promotion for fossil fuels in the energy sector abroad by 1 January 2022.

IFU will not engage in new investments within the following activities:

9. Standalone fossil fuelled power plants
10. Drilling, exploration, extraction, refining and sale of crude oil, natural gas and thermal coal
11. Storage, supporting infrastructure (pipelines etc.), transportation and logistics, and services primarily related to fossil fuels
12. Any business using captive coal for power and/or heat generation
13. Electricity generation from peat and activities leading to deforestation
14. Investments and/or other projects that aim to produce or make use of agricultural or forestry products associated with unsustainable expansion of agricultural activity into land that had the status of high carbon stock and high biodiversity areas
15. Biomaterials and biofuel production that make use of feedstock that could otherwise meaningfully serve as food or compromise food security
16. Export-oriented agribusiness models that focus on long-haul air cargo⁷ for commercialisation
17. Meat and dairy industries based on production systems that involve unsustainable animal rearing and/or lead to increased GHG emissions as compared to best industry, low-carbon standards/benchmarks⁸

⁷ Following Eurocontrol's definition, long-haul is taken to be longer than 4 000 kilometres (The EIB Group Climate Bank Roadmap 2021-2025).

⁸ For agrifood value chain projects in countries with vulnerable food supply systems, benchmarking of GHG emissions of agro-industry projects on local instead of international best standards is possible on a case-by-case basis. This would apply in particular to smallholder and agriculture microfinance schemes or agrifood industries that target local demand and may involve derogation of general carbon footprint thresholds related to power and heat generation established in this bioeconomy section and under the industry and energy tables above (The EIB Group Climate Bank Roadmap 2021-2025).

APPENDIX 6. TECHNOLOGY ASSESSMENT QUESTIONNAIRE (TAQ)

Note: The answers displayed below were provided by a project that is going to employ an energy storage technology of 20MW capacity.

Questions to be answered by the project developers / sponsors

Are there any new technologies to be employed in your project?

If yes, please answer in relation of each identified EDT:

yes	no	to be defined	not applicable	comment by the project sponsors
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Privacy and Security

1	Does the technology comply with relevant data protection laws?			1	
2	Are potential security risks identified and mitigated?	1			
3	Is informed consent obtained for data collection and use?			1	
4	Are the algorithms used by the technology transparent and auditable?	1			
5	Can users control, retrieve, or delete their personal data easily?			1	
6	Is the technology's resource consumption sustainable?	1			
7	Are there robust measures against unauthorized access and breaches?	1			
8	Is data integrity maintained throughout the technology's use?	1			
9	Does the technology ensure data sovereignty?	1			
10	Is there a monitoring system for technology use and impact?	1			
Privacy and Security Score		7	0	0	3

Ethical and Social Impact

11	Are all ethical concerns addressed in the technology deployment?	1			
12	Are health or safety risks to users/public eliminated or minimized?	1			
13	Is there a mechanism to prevent the spread of misinformation?			1	

14	Have conflicts of interest been identified and resolved?	1				
15	Is the technology development socially accepted and approved?	1				
16	Does the technology mitigate the digital divide?				1	
17	Are psychological harms or addiction potentials addressed?				1	
18	Is the technology accessible to individuals with disabilities?				1	
19	Does the technology include a process for continuous improvement?	1				
20	Are moral or existential risks assessed and mitigated?	1				
Ethical and Social Impact Score		6	0	0	4	

Legal and Compliance:

21	Is the technology compliant with current laws and regulations?	1				
22	Are potential future legal issues identified and addressed?	1				
23	Are intellectual property rights respected?	1				
24	Is there a protocol for regular updates and security patches?	1				
25	Is there an incident response plan for malfunctions?	1				
26	Does the technology respect cultural norms?				1	
27	Is there an end-of-life plan for the technology?	1				
28	Is technological sovereignty maintained?	1				
29	Does the technology meet international standards and practices?	1				
30	Are supply chain ethics ensured?	1				
Legal and Compliance Score		9	0	0	1	

Economic and Market Factors:

31	Are economic implications of the technology beneficial?	1				
32	Are dependencies created by the technology manageable?	1				
33	Are market disruptions and employment impacts assessed and mitigated?	1				
34	Does the technology provide economic benefits across different socioeconomic groups?	1				
35	Does the technology maintain market diversity and consumer choice?	1				
36	Are societal norms positively influenced by the technology?	1				

37	Is the impact on traditional industries positive or managed?	1				
38	Does the technology foster further innovation?	1				
39	Is the technology neutral in terms of international conflict potential?	1				
40	Are international relations positively maintained or unaffected?	1				
Economic and Market Factors Score		10	0	0	0	

Environmental and Health Considerations:

41	Does the technology have a low environmental footprint?	1				
42	Is a full life cycle assessment conducted with favorable results?			1		
43	Are ecosystem disruptions identified and minimized?	1				
44	Are long-term effects on health and environment considered and positive?	1				
45	Is the technology's scalability without negative implications?	1				
46	Can the technology operate during crises without added risks?	1				
47	Is the impact on public infrastructure positive or manageable?	1				
48	Can the technology be controlled or modified as needed?	1				
49	Is the technology's reliability ensured in critical applications?	1				
50	Is cultural heritage preserved or enhanced by the technology?				1	
Environmental and Health Considerations Score		8	0	1	1	

Accessibility and Inclusiveness:

51	Does the technology offer equal access to all users?	1				
52	Does it promote interoperability and open standards?	1				
53	Is technology operation transparent with accountability mechanisms?	1				
54	Are feedback mechanisms for assessing impact implemented?	1				
55	Are data and algorithm biases addressed?	1				
56	Is the technology safe for children and vulnerable populations?	1				
57	Is digital literacy required at a reasonable level?	1				
58	Does the technology enhance rather than detract from human interaction?	1				

59	Does the technology encourage positive collaboration?	1				
60	Does the technology support collective positive behavior change?	1				
Accessibility and Inclusiveness Score		10	0	0	0	

Cultural Impact:

61	Does the technology respect and preserve cultural diversity?				1	
62	Can the technology adapt to different cultural contexts without imposing homogenizing effects?				1	
63	Is the technology sensitive to local traditions and languages?				1	
Cultural Impact Score		0	0	0	3	

Innovation and Development:

64	Does the technology contribute to scientific or technological advancement?	1				
65	Does the technology support and foster creativity and innovation within the industry?	1				
66	Does the technology provide opportunities for professional development and learning?	1				
Innovation and Development Score		3	0	0	0	

User Experience and Adoption:

67	Is the technology designed with user-friendly interfaces that accommodate diverse user groups?	1				
68	Does the technology have a clear value proposition for its users?	1				
69	Are there mechanisms for gathering and integrating user feedback into future development?	1				
User Experience and Adoption Score		3	0	0	0	

Global Impact and Scalability:

70	Does the technology have the potential for global scalability without significant negative implications?	1				
71	Can the technology adapt to global challenges such as climate change and social inequality?	1				
72	Does the technology contribute to or detract from global sustainable development goals?	1				
Global Impact and Scalability Score		3	0	0	0	

Interoperability and Systems Integration:

73	Can the technology easily integrate with existing systems without causing disruptions?	1				
74	Does the technology support data portability and compatibility with other systems?	1				
75	Is the technology built on open standards to facilitate broader ecosystem compatibility?	1				
Interoperability and Systems Integration Score		3	0	0	0	
Total Score:		62	0	1	12	