Project Final Report

Capacity-Building Workshop on Digital Economy for Environmental Sustainability and Circular Economy in APEC

APEC Digital Economy Steering Group

June 2026

Asia-Pacific
Economic Cooperation

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Produced by
Project Overseer: Mauricio Gonzales Ministry of Environment – MINAM

Alternate Project Overseer: Wagner Del Aguila Ojanama
Ministry of Environment - MINAM

Independent Researcher: Alvaro Miyagusuku

For
Asia-Pacific Economic Cooperation Secretariat
35 Heng Mui Keng Terrace
Singapore 119616
Tel: (65) 68919 600
Fax: (65) 68919 690
Email: info@apec.org
Website: www.apec.org

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1. Executive Summary

The Capacity-Building Workshop on Digital Economy for Environmental Sustainability and Circular Economy in APEC brought together government officials, technical specialists, researchers, and industry representatives to explore how digital tools can strengthen environmental management and support the transition toward more sustainable and resource-efficient practices across the Asia-Pacific region.

The workshop was organized by the Ministry of Environment of Peru (MINAM) under the framework of the APEC Digital Economy Steering Group (DESG), in response to increasing institutional demands for timely information, improved monitoring capacity, and more effective coordination among agencies involved in environmental oversight. The discussions reflected the growing urgency faced by economies in addressing environmental degradation, climate-related impacts, biodiversity loss, and resource pressures that often surpass the capabilities of traditional regulatory approaches.

Throughout the sessions, participants examined practical uses of digital technologies such as artificial intelligence, satellite monitoring, remote-sensing platforms, blockchain-based traceability systems, and sensor networks. Presenters highlighted how these tools can support day-to-day regulatory work, improve the accuracy and speed of environmental information, and contribute to more consistent and transparent decision-making processes. Several economies shared ongoing initiatives demonstrating how digital tools are being applied to compliance monitoring, land-use supervision, emissions tracking, waste-management oversight, and circular-economy planning.

Three broad conclusions emerged from the workshop discussions. First, digital tools produce meaningful results only when integrated into existing institutional processes, with clear mandates, defined responsibilities, and adequate resources. Second, the scalability of digital solutions depends on investments in data governance, interoperability, and human capacity, particularly the ability of agencies to manage, interpret, and act upon digital information. Third, cooperation across APEC economies provides an opportunity to exchange methodologies, avoid duplication, and strengthen the overall technical basis to address environment-related challenges in the region.

The workshop also incorporated approaches that encouraged the participation of specialists, policymakers, and practitioners from multiple groups across the region. Ensuring equitable access to digital skills and leadership roles was recognized as an important factor for environmental digitalization.

The report summarizes the content presented during the workshop, outlines the main insights shared by participants, and provides a set of practical recommendations for economies seeking to advance the use of digital tools in environmental governance and circular-economy implementation.

2. Introduction: Digital Transformation and the Future of Environmental Governance in APEC

Environmental institutions across the Asia-Pacific region continue to face pressures associated with deforestation, biodiversity loss, pollution, unsustainable resource use, and climate-related impacts. These challenges are increasingly complex, often transboundary, and require faster and more coordinated responses than those provided by traditional regulatory systems. Many agencies still rely on fragmented information

sources, limited monitoring coverage, and processes that make it difficult to obtain timely and reliable environmental data.

The Capacity-Building Workshop on Digital Tools to Address Environment-Related Challenges was convened in Guangzhou, China, on 6–7 February 2026, under the leadership of Peru's Ministry of Environment (MINAM) and within the framework of the APEC Digital Economy Steering Group (DESG). The workshop was designed as a space for technical exchange and policy dialogue, with the aim of identifying how digital solutions can support environmental sustainability objectives and improve regulatory performance across APEC economies.

The central premise discussed during the event is that effectively addressing environment-related challenges in the twenty-first century increasingly depends on the ability of institutions to process and interpret large volumes of data, respond to emerging environmental threats, and coordinate action across sectors. Digital technologies, such as artificial intelligence, satellite-based monitoring systems, blockchain traceability, and networks of environmental sensors, are no longer experimental tools. They are now part of a broader shift in which governments increasingly rely on data, interoperability, and integrated information flows.

This report provides a structured synthesis of the workshop proceedings. It outlines the technological approaches presented, summarizes case studies and economy experiences, and reflects on the institutional lessons and policy considerations that emerged. The intention is to support economies in understanding how digital innovation can be incorporated to help address environment-related challenges in a way that improves transparency, anticipates risks, and supports long-term environmental priorities.

2.1 Background and Objectives

The Asia-Pacific region is experiencing growing environmental pressures driven by rapid economic development, expanding urban areas, demand for natural resources, and the accelerating impacts of environmental-related challenges. Issues such as illegal logging, declining air and water quality, marine debris, land-use change, and extreme weather events increasingly require monitoring systems capable of capturing changes in real time and generating information that supports swift regulatory action.

At the same time, the digital economy is reshaping how governments collect, store, analyze, and use information. Technologies such as artificial intelligence, geospatial analytics, cloud-based processing, remote-sensing platforms, blockchain verification, and large-scale data systems are becoming more accessible and more widely applied in public administration. These tools offer environmental authorities the opportunity to strengthen surveillance, improve transparency, and incorporate evidence-based approaches into environmental decision-making.

The workshop was designed to support APEC economies in enhancing their technical and institutional capacity to use digital tools effectively. Its objectives were to:

- Share up-to-date information on digital technologies relevant to environmental oversight, compliance monitoring, disaster-risk reduction, and circular-economy planning;
- present case studies demonstrating how these tools are being implemented in different institutional and geographic contexts;

- promote dialogue among policymakers, regulators, technical experts, and private- sector providers to identify areas of convergence and opportunities for continued cooperation; and
- contribute to broader APEC efforts to link digital innovation with sustainable, resilient, and inclusive growth in the region.

By addressing both technological capabilities and institutional needs, the workshop aimed to help economies understand not only what digital tools can do, but also how they can be integrated into institutional approaches to address environment-related challenges in a practical and sustainable manner.

2.2 Scope and Relevance of the Project

The project focused on examining a wide range of digital tools that can support environmental monitoring, regulatory enforcement, conservation efforts, emissions tracking, disaster-risk reduction, and the implementation of circular economy policies. The technologies discussed included artificial intelligence applications, remote-sensing and satellite-based platforms, integrated digital dashboards, IoT monitoring systems, and blockchain-enabled traceability solutions.

Its relevance stems from the increasing recognition that environmental objectives cannot be achieved without modern tools capable of providing accurate, timely, and interoperable information. Much of the environmental data used by regulators today is dispersed across different systems, produced at varying levels of accuracy, and often delivered too slowly to inform rapid decision-making. Digital tools can help address these gaps by offering continuous monitoring, automated analysis, and standardized reporting mechanisms.

For many APEC economies, digital transformation is becoming essential, not optional, for achieving policy targets related to climate mitigation, biodiversity protection, pollution control, and long-term resource management. The discussions during the workshop emphasized that the capacity to integrate real-time data, connect different sources of information, and produce actionable insights is critical for improving transparency, reducing regulatory uncertainty, and supporting more effective compliance strategies.

By exploring concrete examples and institutional experiences, the project aimed to help economies identify where digital tools can be most useful, what investments and governance arrangements are required, and how digital innovation can be aligned with broader environmental and economic development strategies.

2.3 Target Audience and Stakeholders

Participants in the workshop represented a broad mix of institutions involved in environmental management, digital transformation, and technology development. Delegations included officials from ministries of environment, agencies responsible for digital governance, regulatory and enforcement bodies, and economy-level institutions focused on disaster-risk management, climate policy, and natural-resource oversight. Their participation ensured that discussions reflected both policy priorities and operational realities.

The workshop also included contributions from academic institutions, research centers, and technical organizations with experience in digital innovation, data analysis, and environmental monitoring. These perspectives helped contextualize the scientific and

methodological aspects of digital tools, including their potential applications, limitations, and requirements for effective implementation.

Representatives from the private sector shared practical insights on the deployment of digital platforms and monitoring technologies in areas such as remote sensing, artificial intelligence, supply-chain traceability, and environmental data management. Their participation helped illustrate how technological solutions are evolving and how partnerships between public institutions and service providers can support scalable and sustainable implementation.

This diverse group of stakeholders allowed the workshop to address not only technological feasibility, but also institutional coordination, capacity needs, and regulatory considerations that influence the successful integration of digital tools into environmental governance across APEC economies.

3. Regional Context: Digital Economy and Environmental Protection in APEC

The APEC region accounts for a significant share of global economic activity, energy use, and greenhouse gas emissions, while also containing some of the world's most diverse ecosystems and populations highly exposed to environmental and climate- related risks. As economies expand, environmental pressures such as land-use change, pollution, resource depletion, and waste generation continue to grow, increasing the need for stronger and more coordinated environmental management.

Digital transformation is progressing rapidly across many sectors in the region, improving productivity, service delivery, and access to information. However, systems for addressing environment-related challenges have not always kept pace with this broader digital development. In several economies, monitoring and enforcement processes still rely on limited or fragmented data, manual procedures, and institutional arrangements that make it difficult to respond to environmental issues with the speed and consistency required.

The integration of digital tools offers an opportunity to bridge these gaps. Technologies such as satellite monitoring, predictive analytics, automated data processing, and digital traceability systems can help regulators detect trends, identify risks, and prioritize actions more effectively. Digital platforms can also improve transparency by enabling broader access to environmental information for citizens, businesses, and policymakers.

Aligning efforts to address environment-related challenges with digital capabilities is becoming increasingly important as economies advance climate commitments, pursue long-term targets, and seek to strengthen public confidence in regulatory systems. The workshop provided a platform for economies to compare their progress, share practical experiences, and explore ways to align digital innovation with long-term environmental priorities in the region.

4. Overview of Digital Technologies for Environmental Governance

Artificial intelligence (AI) was presented as one of the most transformative technologies currently influencing environmental governance. Machine learning models can process large volumes of environmental data, identify irregular patterns, and help forecast potential risks. Examples included systems that assist in the review of Environmental Impact Assessments (EIAs), detect inconsistencies in emissions reports, or highlight unusual changes in land use. By automating parts of the analytical workload, these tools

allow regulators to focus on cases that require closer examination and support more efficient allocation of inspection resources.

Satellite monitoring and remote-sensing applications play an equally important role. Several economies shared experiences using satellite imagery to assess deforestation, track land-use changes, and support compliance with environmental regulations. Brazil's National Institute for Space Research (INPE), for example, demonstrated how long- standing programs such as Prodes and Deter provide both annual deforestation measurements and near real-time alerts. These systems have strengthened environmental enforcement, supported climate reporting, and increased transparency for civil society and the international community.

The workshop also highlighted the importance of IoT-based monitoring systems capable of providing continuous data on air quality, water resources, industrial emissions, and other environmental indicators. These sensor networks can enhance the accuracy and timeliness of environmental information, support early detection of pollution events, and improve oversight of regulated facilities.

Blockchain and digital traceability tools were presented as solutions for increasing supply-chain transparency, particularly in sectors vulnerable to illegal extraction or unsustainable practices. Case examples included systems promoted by the International Tropical Timber Organization to support traceability and legality verification in the forestry sector.

Integrated regulatory dashboards were also emphasized as practical tools for decision-making. By combining data from various sources, including satellite imagery, sensors, administrative records, compliance reports, and geospatial platforms, these dashboards provide regulators with accessible and actionable insights. Economies noted that such platforms help agencies prioritize inspections, monitor compliance trends, and coordinate actions across different departments.

Taken together, these technologies illustrate the wide range of digital solutions that can support efforts to address environment-related challenges when they are integrated into institutional processes and used to complement regulatory practices.

5. Workshop Proceedings and Thematic Sessions

The workshop was designed as a structured dialogue that progressively connected the regional context, the technological tools presented, and the institutional considerations required for their effective implementation. Rather than functioning as a series of isolated technical presentations, the sessions were organized to build on one another, moving from strategic framing to applied demonstrations and concluding with reflections on institutional integration and regional cooperation.

Participants emphasized that digital innovation must be understood within the broader context of efforts to address environment-related challenges. While new technologies can significantly improve monitoring, prediction, and analysis, their effectiveness depends on how well they are aligned with existing mandates, operational procedures, and institutional capacities. Presenters repeatedly noted that digital tools are not stand-alone solutions; they need to be incorporated into regulatory workflows, supported by adequate resources, and guided by clear rules for data management and use.

Each session offered examples of how economies are adopting digital tools to address environmental-related challenges, land-use monitoring, disaster-risk reduction, and circular economy initiatives. The discussions highlighted both the opportunities and the challenges associated with implementation, including issues related to data availability, interoperability, financing, and institutional coordination.

The workshop also encouraged active participation through open discussions and Q&A sessions, giving attendees the opportunity to compare approaches, clarify technical concepts, and explore practical considerations for scaling digital solutions. These exchanges contributed to a deeper understanding of the conditions under which digital systems can produce sustained and impactful results within frameworks for addressing environment-related challenges.

5.1 Opening Session and Strategic Framing

The opening session established the overall direction of the workshop by emphasizing the growing intersection between digital transformation and environmental governance. Speakers noted that the environmental challenges faced by APEC economies, such as deforestation, pollution, biodiversity loss, and climate-related impacts, are increasingly complex and interconnected. These challenges require institutions to work with more timely, accurate, and integrated information systems than those traditionally available.

Participants highlighted that conventional enforcement approaches, which often rely on periodic inspections and delayed reporting, are not always sufficient for responding to rapid or large-scale environmental-related challenges. Digital tools, when effectively integrated into institutional processes, can help authorities detect risks earlier, prioritize responses, and strengthen compliance.

The session underscored three elements that shape the successful use of digital technologies to address environment-related challenges. First, institutions need clear mandates that define how digital information will be used and how responsibilities are shared across agencies. Second, systems must be interoperable to ensure that data generated from different platforms, including satellites, sensors, administrative records, or reporting systems, can be combined and interpreted consistently. Third, regional cooperation is essential to support learning, encourage the exchange of methodologies, and promote coordination among economies confronting similar environmental issues.

Speakers emphasized that digital transformation is not only a technological shift but also an organizational one. Effective adoption requires planning, investment, and sustained leadership to ensure that digital tools are fully integrated into the broader regulatory framework and produce lasting improvements in environmental oversight.

5.2 Session I: AI and Technology for Smarter Environmental Oversight

The first thematic session focused on how artificial intelligence and other advanced digital technologies are being used to support environmental enforcement across APEC economies. Presenters shared examples of AI tools that assist regulators by processing large volumes of information, identifying irregularities, and helping prioritize cases that may require closer examination.

Several economies demonstrated how machine learning models can analyze environmental impact assessments, detect inconsistencies in self-reported data, and highlight unusual trends in emissions or land-use change. Computer vision applications

were also discussed as tools capable of identifying unauthorized activities in satellite imagery or recognizing patterns associated with non-compliance. These examples illustrated how AI can help environmental authorities manage workloads more efficiently by automating initial screenings and guiding inspectors toward higher-risk cases.

Participants also discussed important considerations for the responsible use of AI in public administration. Speakers emphasized that AI systems should complement, rather than replace, human judgment. They highlighted the need for mechanisms that ensure transparency in algorithmic processes, safeguards for data privacy, and oversight structures that allow regulators to understand how the tools reach their conclusions. These aspects were recognized as critical for maintaining public trust and ensuring that AI contributes to fair and consistent enforcement.

Overall, the session showed that AI can help improve the accuracy and efficiency of environmental monitoring and compliance verification when institutions have the frameworks, technical skills, and data management practices necessary for its effective use.

5.3 Session II: Data and Cooperation: Technology for Transboundary Environmental Solutions

The second session explored how satellite monitoring and geospatial intelligence are being used by APEC economies to address environmental challenges that extend across large territories or involve activities that are difficult to detect through traditional field inspections. Presenters highlighted the value of remote-sensing systems for identifying land-use changes, detecting illegal activities, and generating reliable data to support enforcement and policy formulation.

Speakers described how satellite imagery provides continuous and objective information, enabling authorities to track deforestation, monitor protected areas, and assess the condition of ecosystems more efficiently. Examples included economy-level programs that generate alerts on forest loss, as well as platforms that integrate satellite data with administrative records to improve the targeting of enforcement actions. These systems have contributed to greater transparency, stronger regulatory oversight, and more timely responses to environmental risks.

Discussions also focused on the importance of methodological consistency in interpreting satellite data. Participants noted that different economies use a wide range of analytical approaches, data sources, and classification methods, which can affect comparability and reliability. Establishing technical standards or shared guidance could help reduce discrepancies and facilitate regional cooperation, particularly in contexts such as transboundary pollution, shared ecosystems, or climate-related reporting.

The session also underscored the need for institutional arrangements that enable authorities to act on satellite-derived information. Effective use of geospatial intelligence depends not only on the availability of data, but also on clear procedures for verifying alerts, coordinating enforcement agencies, and integrating geospatial analysis into regulatory workflows. Several speakers emphasized that long-term investment in technical capacity, data infrastructure, and interagency collaboration is essential for maintaining and scaling these systems.

5.4 Session III: Digital Solutions for Circular Economies and Emissions Reduction

The third session examined how digital technologies support disaster risk reduction and strengthen climate resilience across APEC economies. Presenters shared examples of early-warning systems, predictive analytics, and platforms that integrate meteorological, hydrological, and environmental data to improve preparedness and response capacities.

Speakers described how machine learning models and climate-related forecasting tools can help anticipate floods, landslides, extreme weather events, or other hazards by analyzing historical patterns and real-time observations. These tools enable authorities to issue earlier and more precise alerts, reducing potential impacts on communities and ecosystems. Examples were also presented of digital dashboards that consolidate information from multiple monitoring stations, allowing decision-makers to visualize risk levels and coordinate emergency actions more efficiently.

The session emphasized that technology alone does not guarantee effective disaster risk reduction. The usefulness of digital tools depends on their integration into response protocols, communication systems, and institutional arrangements. Participants noted that alerts must be linked to clear procedures, designated responsibilities, and mechanisms for reaching local populations quickly. Coordination among scientific agencies, civil protection authorities, and local governments was identified as essential for ensuring that data-driven warnings translate into timely and appropriate action.

Speakers also highlighted the value of regional cooperation for improving climate resilience. Shared methodologies, interoperable data platforms, and collaborative research initiatives can help economies benefit from one another's experiences and strengthen their technical foundation for disaster-risk management. The session concluded that digital solutions, when coupled with strong governance and clear institutional processes, can significantly enhance the region's capacity to anticipate and manage climate-related risks.

5.5 Session IV: From Data to Decision: Policy Frameworks

The fourth session focused on how digital tools are supporting circular economy initiatives and helping economies transition toward more efficient, low-waste production and consumption models. Presenters discussed a range of digital applications used to track material flows, improve waste management, optimize resource use, and enhance transparency across supply chains.

Speakers highlighted how AI-driven analytics can support industrial processes by identifying opportunities to reduce waste, increase energy efficiency, or improve the recovery of materials. Examples included systems that analyze operational data to optimize logistics, guide recycling processes, or detect inefficiencies in production chains. These applications enable both companies and regulators to understand more clearly how resources progress through different stages of the value chain.

Digital traceability platforms, including blockchain-based systems and digital product passports, were also presented as tools that can strengthen accountability and support responsible sourcing. Such systems provide detailed information on the origin, transformation, and disposal of products, enabling regulators, businesses, and consumers to verify compliance with standards. Participants noted that these tools can also improve market access for environmentally responsible products.

Several speakers emphasized that digital tools for circular economy implementation depend on reliable data and shared standards. Material tracking and lifecycle analysis require consistent reporting practices, interoperable systems, and coordination across different sectors. Without clear regulatory frameworks, traceability platforms risk remaining voluntary or limited in scope.

The session concluded with the recognition that digital innovation can play a central role in advancing circular economy policies when integrated into regulatory frameworks, procurement strategies, and industrial practices. Coordinated action among environment, industry, and trade institutions was identified as essential for creating the enabling conditions needed for large-scale adoption.

5.6 Interactive Discussions and Q&A Highlights

The interactive components of the workshop allowed participants to discuss challenges, clarify technical points, and reflect on the practical steps needed to implement digital tools within their respective institutions. These exchanges highlighted several recurring themes that complement the formal presentations.

Participants noted that long-term sustainability of digital systems remains a significant concern. While many economies have developed pilot projects or short-term initiatives, maintaining these tools requires stable funding, continued technical support, and clear institutional responsibilities. Several attendees emphasized that digital transformation should be understood as an ongoing process rather than a single investment, requiring periodic updates, training, and adaptation to evolving regulatory needs.

Interoperability was another topic repeatedly raised during the discussions. Many institutions use separate databases, monitoring systems, or reporting platforms that are not fully compatible, making it difficult to consolidate information or generate a comprehensive view of environmental conditions. Attendees highlighted the need for governance structures that clarify data ownership, establish common standards, and create mechanisms for secure and coordinated information-sharing.

Cybersecurity and data protection were identified as additional considerations, particularly as environmental authorities adopt cloud-based platforms or systems that handle sensitive information. Participants discussed the importance of establishing protocols to safeguard data integrity and ensure continuity of operations in the event of disruptions.

The discussions also touched on the cultural and organizational aspects of digital adoption. Participants pointed out that introducing new tools often requires changes in workflows, decision-making processes, and staff practices. Building technical capacity, through training, guidance materials, and knowledge exchange, was recognized as essential to ensuring that digital systems are used effectively and consistently.

Finally, the Q&A sessions reaffirmed that cooperation among APEC economies can help accelerate progress. Sharing methodologies, jointly developing open-source tools, and exchanging experiences on implementation challenges can support economies in navigating the technical and institutional complexities associated with digital transformation.

6. Lessons from APEC Economies

The comparative experiences presented during the workshop revealed a set of shared lessons across economies, despite differences in institutional structures, technological capacity, and environmental priorities. These lessons reflect common patterns observed in the adoption and use of digital tools to address environment-related challenges.

First, digital transformation is most effective when it is aligned with existing mandates and integrated into formal regulatory processes. Economies that have achieved measurable progress, such as in satellite-based monitoring, AI-supported compliance screening, or integrated data platforms, have done so by incorporating these tools into inspection procedures, reporting frameworks, and decision-making protocols. This institutional alignment ensures that digital information directly supports regulatory action rather than functioning as an isolated analytical exercise.

Second, sustained public investment in digital infrastructure and technical expertise is essential. Many economies highlighted the importance of developing domestic capacity to generate, interpret, and use environmental data. Building teams capable of managing digital systems, validating analytical outputs, and maintaining information platforms was recognized as critical for long-term success and resilience.

Third, cross-sector collaboration accelerates innovation. Partnerships among environmental authorities, research institutions, and private-sector providers have allowed economies to test new approaches, develop tailored solutions, and share responsibilities for system maintenance. These collaborations also help ensure that digital tools reflect operational needs and scientific rigor while benefiting from technological advancements.

Fourth, transparency enhances the effectiveness of efforts to address environment-related challenges. Economies that publish environmental data through dashboards, open-data portals, or public reporting mechanisms have seen improvements in accountability and trust. Transparent systems encourage compliance by making information accessible to citizens, businesses, and civil society groups.

Finally, scalability depends on institutional continuity. Pilot initiatives that remain disconnected from long-term strategies or lack sustained funding tend to lose momentum. Economies emphasized that successful digital systems require planning, predictable resources, and follow-through to ensure that they expand beyond initial testing phases and become embedded within the governance architecture.

Collectively, these lessons point toward a shared regional understanding: digital innovation must evolve from experimentation to institutionalization in order to produce durable improvements in environmental oversight and sustainability outcomes.

7. Integrating Digital Solutions into Environmental Policy Frameworks

The workshop discussions made clear that digital technologies are increasingly becoming core components of how institutions address environment-related challenges. However, the presentations and experiences shared by APEC economies also demonstrated that the impact of these tools depends largely on how they are embedded within institutional mandates, legal frameworks, and coordination mechanisms across government agencies.

7.1 Institutional Embedding: From Pilot Projects to Regulatory Architecture

Several speakers noted that digital initiatives often begin as pilot projects that demonstrate potential but remain limited in scope if they are not formally integrated into regulatory procedures. Economies that have adopted AI-supported tools for compliance screening, anomaly detection, or risk assessment emphasized that these systems produce meaningful results only when linked to inspection protocols, administrative processes, and clearly defined responsibilities.

Similarly, experiences with satellite-based forest monitoring showed that real-time alerts must be connected to enforcement mandates, investigative procedures, and judicial processes to support timely and effective action. Institutionalizing the use of geospatial intelligence ensures that digital evidence remains traceable, admissible, and operationally useful.

The overarching lesson is that digital tools should evolve from experimental innovations to recognized elements of regulatory systems. Formal integration within environmental agencies provides continuity, consistency, and clear pathways for acting on the information these systems generate.

7.2 Data Ecosystems and Interoperability: A Foundational Requirement

Throughout the sessions, participants highlighted the need for data ecosystems that allow information from multiple sources to be accessed, combined, and interpreted reliably. Environmental data is often dispersed across satellite platforms, IoT sensors, industrial reporting systems, hydrological networks, academic research initiatives, and community-based monitoring programs. Without structured protocols for integration, datasets remain isolated and underutilized.

Examples shared during the workshop showed the value of centralized dashboards, standardized metadata frameworks, and clear data governance arrangements. These tools can improve institutional efficiency by enabling regulators to identify high-risk areas, monitor trends, and coordinate responses.

In transboundary contexts, such as marine pollution, forest fires, or shared river basins, interoperability becomes even more important. Harmonized methodologies and shared data platforms help economies align monitoring efforts, improve comparability, and reduce duplication.

For APEC, voluntary convergence around technical standards for emissions measurement, satellite interpretation, and traceability could strengthen regional =cooperation.

7.3 Digitalization and Environmental Management

Discussions on climate mitigation and resilience underscored the growing link between digital systems and climate commitments. AI-assisted energy models, satellite-based land-use tracking, and digital emissions monitoring platforms were presented as tools that can improve the accuracy of greenhouse-gas inventories and support near real-time progress assessments.

Participants noted that the credibility of climate policies increasingly depends on reliable monitoring, reporting, and verification systems. Digital platforms that integrate data on

energy consumption, industrial emissions, and land-use change can help governments identify gaps, evaluate policy effectiveness, and adjust strategies when necessary.

The workshop emphasized that environmental digitalization strategies should be aligned with economy-level frameworks rather than developed inisolation.

7.4 Circular Economy Governance and Digital Traceability

Case studies on circular economy initiatives illustrated how digital tools support material- flow analysis, waste reduction, and supply-chain accountability. AI-driven systems can optimize logistics and production processes, while blockchain-based platforms and digital product passports can verify responsible sourcing, track lifecycle impacts, and strengthen compliance with standards.

However, speakers cautioned that digital traceability systems require regulatory recognition to reach scale. Without integration into procurement rules, industrial regulations, or trade policies, these systems risk remaining voluntary or limited to pilot phases.

Coordination across ministries, including environment, industry, and trade, was identified as essential for ensuring that digital circular economy tools reinforce broader goals.

7.5 Disaster Risk Reduction and Predictive Governance

Presentations on disaster risk reduction highlighted how predictive models and early- warning systems can improve emergency preparedness. Participants shared examples of machine learning algorithms used to anticipate floods, storms, or landslides, and systems that integrate hydrological and meteorological data for risk communication.

However, the effectiveness of these tools depends on clear institutional procedures. Alerts must be connected to established emergency-response protocols, communication strategies, and decision-making processes. Interoperability between scientific institutions and disaster-response authorities was highlighted as a key factor in transforming digital signals into effective public safetymeasures.

7.6 Financing, Sustainability, and Long-Term Maintenance

Participants raised concerns regarding the long-term sustainability of digital systems. While pilot projects often receive initial funding, maintaining digital platforms requires resources for updates, cybersecurity, data storage, and technical personnel.
Speakers emphasized the importance of integrating digital systems into medium-term budget cycles and demonstrating their cost-effectiveness through improved compliance outcomes, reduced environmental damage, and enhanced institutional efficiency.

Public–private partnerships were discussed as complementary financing options, particularly for traceability platforms and digital circular economy tools. However, participants noted the need to safeguard regulatory independence and public accountability in such arrangements.

7.7 Governance Principles for a Digital Environmental Future

Drawing on the lessons and examples shared throughout the workshop, several governance principles emerged as essential for integrating digital solutions into environmental policy frameworks. These include:

- Aligning digital systems with clear environmental objectives;
- ensuring interoperability and institutional coordination;
- investing in technical capacity and data governance;
- maintaining transparency and ethical safeguards; and
- securing long-term financing and political support.

For APEC economies, these principles provide a foundation for scaling digital tools in a manner that strengthens environmental management, improves outcomes, and supports regional cooperation.

8 Actionable Policy Recommendations for APEC Economies

The workshop concluded with a set of forward-looking discussions that synthesized the main strategic actions APEC economies can take to advance the use of digital tools for addressing environmental challenges and circular economy implementation. These recommendations stem from the experiences shared across economies and the institutional lessons highlighted throughout the workshop.

A first area of action relates to the development of comprehensive economy-level strategies for environmental digitalization. Participants emphasized that digital tools are most effective when aligned with long-term policy priorities, supported by stable institutional mandates, and backed by predictable investment. Such strategies should outline data governance arrangements, interoperability requirements, and clear objectives for digital adoption across environmental agencies. They should also articulate how digital innovation will support climate commitments, biodiversity conservation, pollution control, and resource-efficiency goals.

A second recommendation is the establishment of a voluntary APEC platform dedicated to digital environmental cooperation. Under the Digital Economy Steering Group (DESG), this platform could support the exchange of methodologies, open-source AI tools, satellite monitoring approaches, and digital traceability standards. Joint initiatives, such as shared data repositories, collaborative pilot projects, or peer-learning mechanisms, could help economies adapt successful models while respecting domestic institutional contexts.

A third recommended action involves scaling circular economy projects that use digital solutions to track materials, verify compliance, and improve resource management. Governments can support pilot initiatives in key sectors such as waste management, forestry, fisheries, or urban planning. Participants highlighted the importance of evaluation frameworks that measure environmental impact, cost-effectiveness, and social acceptance, helping ensure that pilot projects evolve into long-term programs.

Overall, the recommendations underscored a shared understanding that digital transformation should move beyond experimentation toward coordinated regional and economy-level efforts. Strengthening data systems, fostering technical cooperation, and integrating digital tools into policy frameworks were identified as essential steps for achieving more effective and transparent approaches to address environment-related challenges across the APEC region.

9 Conclusion: Toward a Tech-Driven Environmental Agenda for APEC

The workshop reaffirmed that digital transformation is playing an increasingly central role in addressing environment-related challenges across the Asia-Pacific region. Participants emphasized that tools such as artificial intelligence, satellite monitoring, sensor networks, early- warning systems, and digital traceability platforms are becoming essential for improving regulatory oversight, strengthening transparency, and enhancing the capacity of institutions to anticipate and manage environmental risks.

At the same time, the discussions highlighted that technology alone is not sufficient to deliver sustainable outcomes. The effectiveness of digital tools depends on strong institutional foundations, including clear mandates, coherent governance structures, adequate technical capacity, and long-term investment. Participants also stressed the importance of safeguards to ensure ethical use of data, protect privacy, and maintain public trust.

The workshop demonstrated that regional cooperation offers significant opportunities for advancing digital approaches to address environment-related challenges. By sharing methodologies, aligning technical standards, and collaborating on pilot initiatives, APEC economies can accelerate learning and reduce duplication of efforts. Strengthening cooperation under the Digital Economy Steering Group could help economies build on each other's experiences and promote more consistent approaches to digital innovation across the region.

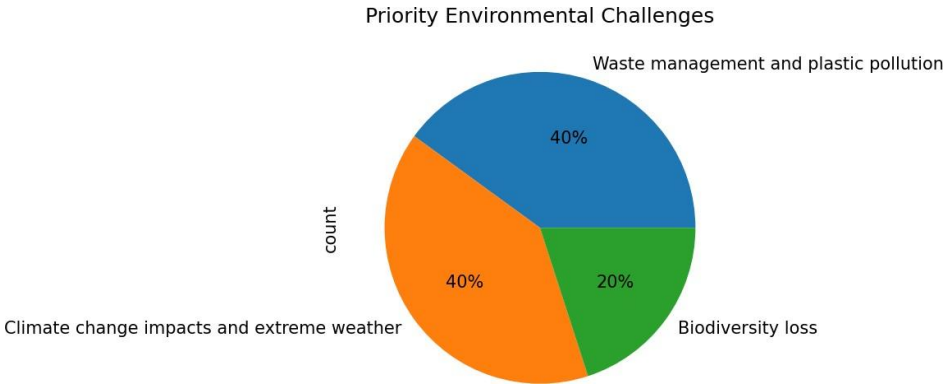
As economies pursue sustainability and resilience objectives, integrating digital tools into environmental policy and regulatory frameworks will be increasingly important. The workshop marked an important step in consolidating knowledge, identifying common challenges, and opening new avenues for collaboration. Moving forward, the key challenge for APEC economies will be to scale and institutionalize these tools in a way that supports long-term environmental protection and regional cooperation.

Annex I - Pre-Workshop Survey Findings

As part of the workshop preparation, a pre-event survey was sent to participants to gather basic information about their priorities and experience with digital tools. Only five people completed the survey, even after reminders. The results provide a general idea rather than a full picture, but the answers still help understand expectations and common needs.

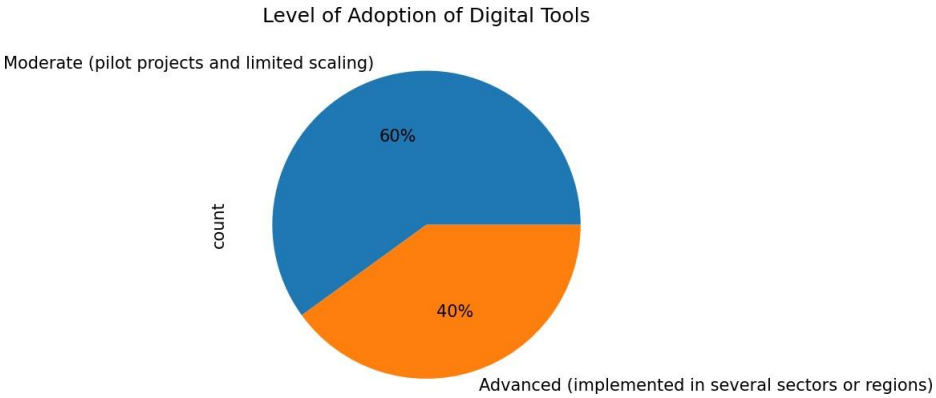
Priority Environmental Challenges

Respondents mentioned different issues affecting their economies. The most common ones were climate impacts, waste management problems, and biodiversity loss. Even though the sample is small, climate and waste issues appeared more than once.



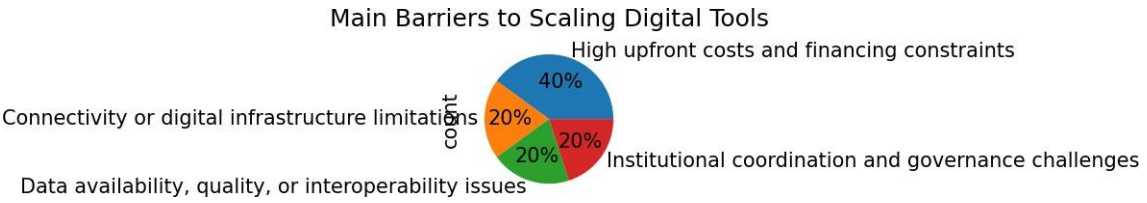
Level of Adoption of Digital Tools

Participants described how far along their institutions were in using digital tools. Some are only starting, while others are already testing a few systems but still on a limited scale. Overall, most institutions seem to be in early or pilot phases.



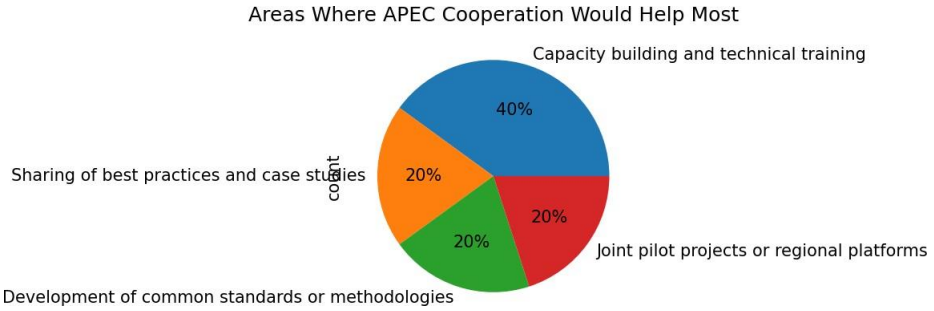
Main Barriers to Scaling Digital Tools

Respondents pointed out several challenges: high costs, infrastructure gaps, problems with data quality or integration, and internal coordination issues. These concerns match the topics discussed during the workshop.



Areas Where APEC Cooperation Would Help Most

Participants mentioned that APEC could help mainly through training, sharing experiences from other economies, common standards or approaches, and joint pilot projects. This shows that many participants see APEC as a useful space to exchange ideas and build practical skills.



Note on the Low Response Rate

Even with reminders, only five responses were collected. This is common when participants work in public institutions and have limited time before events. Still, the answers helped guide the workshop preparation.

Annex II - Final Workshop Agenda

AGENDA

Capacity-Building Workshop on Digital Tools to Address Environment-Related Challenges
Guangzhou, 6-7 February 2026

Organized by the Ministry of Environment of Peru (MINAM), under the APEC Digital Economy Steering Group (DESG)

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6 February 2026 **Digital Tools to Address Environment-Related Challenges**		
Time	**Topic**	**Keynote Speaker**
08:30 - 09:00	Registration process	-
09:00 - 09:15	Welcome and opening	**Ms. Vanessa del Carmen Rivas Plata Saldarriaga**, director of the Directorate of Multilateral Affairs of the Ministry of Foreign Trade and Tourism, Peru **Mr. Wagner del Aguila**, Ministry of Environment, Peru
Session 1: AI and Technology for Smarter Environmental Oversight		
09:15 - 10:00	AI for the Development of Digital Tools to Optimize Environmental Assessment	**Mr. Andric Alejandro Vargas Alarcon,** Technology Management Specialist, National Environmental Certification Service for Sustainable Investments
10:00 – 10:30	Coffee and break	
10:30 - 11:15	From data to deterrence: A playbook for modern responsive environmental enforcement	**Mr. Francisco Donoso**, Head of the Department of Technology, Monitoring and Information of Environmental Superintendence (SMA), Chile
11:15 - 11:30	Family Photo	
11:30 - 13:30	**Lunch**	
Session 2: Data and Cooperation: Technology for Transboundary Environmental Solutions		
13:30 - 14:15	Monitoring land-use and land-cover in Brazil, using Earth observation: from data to policy	**Ms. Lubia Vinhas –** Chief of Staff, National Institute for Space Research (INPE), Brazil
14:15 - 15:00	Digital Tools for Addressing Environmental Challenges in Peru	**Mr. Jose Luis Segovia,** Director of Evaluation and Knowledge Management - CONCYTEC, Peru
15:00 - 15:45	Earthquake Early Warning Using Three Seconds of Single Seismic Station Data Based on Machine Learning	**Mr. Lamberto Adolfo Inza,** Principal Scientific Researcher, Geophysical Institute of Peru
15:45 - 16:00	Closure	

7 February 2026 **Digital Innovation for Circular Economy and Emissions Reduction**		
Time	**Topic**	**Keynote Speaker**
08:30 - 09:00	Registration process	-
09:00 - 09:15	Opening remarks	**Mr. Wagner del Aguila**, Ministry of Environment, Peru
Session 3: Digital Solutions for Circular Economies and Emissions Reduction		
09:15 - 10:00	AI Applications for Sustainable Development: Power Generation, Logistics, Drug Design, and Governance	**Mr. Axel Soto,** Researcher National Scientific and Technical Research Council (CONICET), Argentina
10:00 - 10:45	Data that makes a difference: How Finland uses digital tools for circular and climate action	**Mr. Roberto Requejo** - Trade Commissioner for the Andean Region, Panama & Dominican Republic, Ministry for Foreign Affairs - Finland
10:45 - 11:30	Promoting Coordinated Transformation for Digital and Green Development	**Ms. Yanfei Xu** – Deputy Director of Institution of Informatization, China
11:30 - 11:45	Coffee and break	
11:45 - 12:30	Digital technology innovation to optimize sustainable pathways of traded tropical wood products	**Mr. Tetra Yanuardy**, Project Manager, International Tropical Timber Organization (ITTO
12:30 - 13:15	From data to decision-making: Strengthening environmental management through digital tools in APEC economies.	**Ms. Lisseth Díaz** – Environmental Management and Enforcement Consultant
13:15 - 14:15	Lunch	
Session 4: From Data to Decision: Policy Frameworks		
14:15 - 15:00	Philippine experience	Harold Bryan S. Paler Senior Science Research Specialist, Philippines Ricardo Romeo Naval Trade-Industry Development Analyst, Philippines
15:45 - 16:00	Coffee and break	
16:00 - 16:30	**Networking Session** Exchange of Contacts, establishment of alliances and cooperation among APEC economies.	
16:30 - 16:45	Closure	

Annex III - List of Speakers and Participants Annex

February 6, 2026

Name	Gender	Organization	Position	Economy
Chen Yuanting	Female	1 Panda Consulting	Operation Manager	Non-member
Andric Vargas	Male	SENACE	Technology Management Specialist – Window 1	Peru
Hilda Lisseth Díaz Vargas	Female	International consulting	International consulting	Non-member
Wang Haijing	Female	1 Panda Consulting	General Manager	Non-member
Ricardo Naval	Male	DTI-BITR	Trade-Industry Development Analyst	Philippines
Wagner Del Aguila	Male	Ministry of Environment	Project Cooperation Analyst	Peru
LUBIA VINHAS	Female	NATIONAL INSTITUTE FOR SPACE RESEARCH	RESEARCHER	Non-member
Axel Soto	Male	1 CONICET - Universidad Nacional del Sur	Researcher - Professor	Non-member
Xu Yanfei	Female	China Cyberspace Research Institute	Deputy Director of the Institute of Information Technology	China
Bryan Paler	Male	DOST-ASTI	Senior Science Research Specialist	The Philippines
Zhou Tongyu	Female	Cyberspace Administration of China	Cadre of the International Cooperation Bureau	China
Rodolfo Cardenas	Male	IIAP	Image Processing and Artificial Intelligence Specialist	Peru
TETRA	Male	ITTO	Projects Manager	Non-member
TRINH DUY PHUC	Male	MINISTRY OF INDUSTRY AND TRADE	OFFICIAL	Viet Nam
Ratih Damayanti	Female	BRIN	Director of Environment, Maritime, Natural Resources and Nuclear Policy	Indonesia
Tegar Satrio Dwiputro	Male	MCDA	Analyst	Indonesia
Akhmad Bayhaqi	Male	APEC Secretariat - PSU	Senior Analyst	APEC Secretariat
watriah Dato Paduka Zainidi	Female	Ministry of Foreign Affairs	Second Secretary	Brunei Darussalam
Pg Rooslina Weti Pg Kamaludin	Female	Ministry of Foreign Affairs	Acting Director	Brunei Darussalam
NGUYEN THI THUY GIANG	Female	MINISTRY OF INDUSTRY AND TRADE	OFFICIAL	Viet Nam
Veronica Campos	Female	Environmental Superintendency	Data Scientist	Chile
Anondo Dehan Mukherjee	Male	U.S. Department of State	APEC Policy Officer	United States
Sarah Inagaki	Female	U.S. Department of Commerce	Policy Advisor	United States
Simon YAUKAH	Male	PNG APEC Secretariat, DPM&NEC	Director- BMC	Papua New Guinea
Jukwan LEE	Male	KIEP	Director	Republic of

				Korea
Chelsea Seah Jiaqi	Female	APEC Secretariat - PSU	Researcher	APEC Secretariat
Bunga Insyirah Wijaya	Female	MCDA	Translator	Indonesia
Moshasha	Female	Competition Policy and Evaluation Center of the State Administration for Market Regulation	Director of the Institute of Policy and Regulation	China
Jose Segovia	Male	CONCYTEC	Director, Directorate of Evaluation and Knowledge Management	Peru
ROBERTO REQUEJO	Male	Ministry for Foreign Affairs Finland	Trade Commissioner - Andean Region, Panama & Dominican Republic	Non-member
Francisco Donoso	Male	Environmental Superintendency	Head of the Department of Technology, Monitoring and Information	Chile

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Bryan Paler	Male	DOST-ASTI	Senior Science Research Specialist	The Philippines
Ricardo Naval	Male	DTI-BITR	Trade-Industry Development Analyst	The Philippines
Liz Pancorvo	Female	Ministry of Foreign Trade	Trade in Services Specialist	Peru
TRINH DUY PHUC	Male	MINISTRY OF INDUSTRY AND TRADE	OFFICIAL	Viet Nam
NGUYEN THI THUY GIANG	Female	MINISTRY OF INDUSTRY AND TRADE	OFFICIAL	Viet Nam
Veronica Campos	Female	Environmental Superintendency	Data Scientist	Chile
Francisco Donoso	Male	Environmental Superintendency	Head of the Department of Technology, Monitoring and Information	Chile
Nikolas Zolas	Male	U.S. Consulate Guangzhou	Vice Counsel	United States
Watriah Dato Paduka Zainidi	Female	Ministry of Foreign Affairs	Second Secretary	Brunei Darussalam
Axel Soto	Male	1 CONICET - Universidad	Researcher - Professor	Non-member

		Nacional del Sur		
Janna Yu	Female	U.S. Consulate General Guangzhou	Commercial Assistant	United States
TETRA	Male	ITTO	Projects Manager	Non-member
Damein Hall	Male	Dep of Foreign Affairs & Trade	Director	Australia
Jose Segovia	Male	CONCYTEC	Director, Directorate of Evaluation and Knowledge Management	Peru
Anondo Dehan Mukherjee	Male	U.S. Department of State	APEC Policy Officer	United States
Sarah Inagaki	Female	U.S. Department of Commerce	Policy Advisor	United States
Elizabeth Ward	Female	Dep of Foreign Affairs & Trade	First Assistant Secretary	Australia
Dominic Fischer	Male	Dep of Foreign Affairs & Trade	Policy Officer	Australia
KAEWKAMOL PITAKDUMRONG KIT	Female	PECC	Executive Director	Non-member
Pg Rooslina Weti Pg Kamaludin	Female	Ministry of Foreign Affairs	Acting Director	Brunei Darussalam
Lianne Canarick	Female	Department of State	Foreign Affairs Officer	United States
Kathya Vilchez	Female	Ministry of Foreign Trade	APEC Specialist	Peru