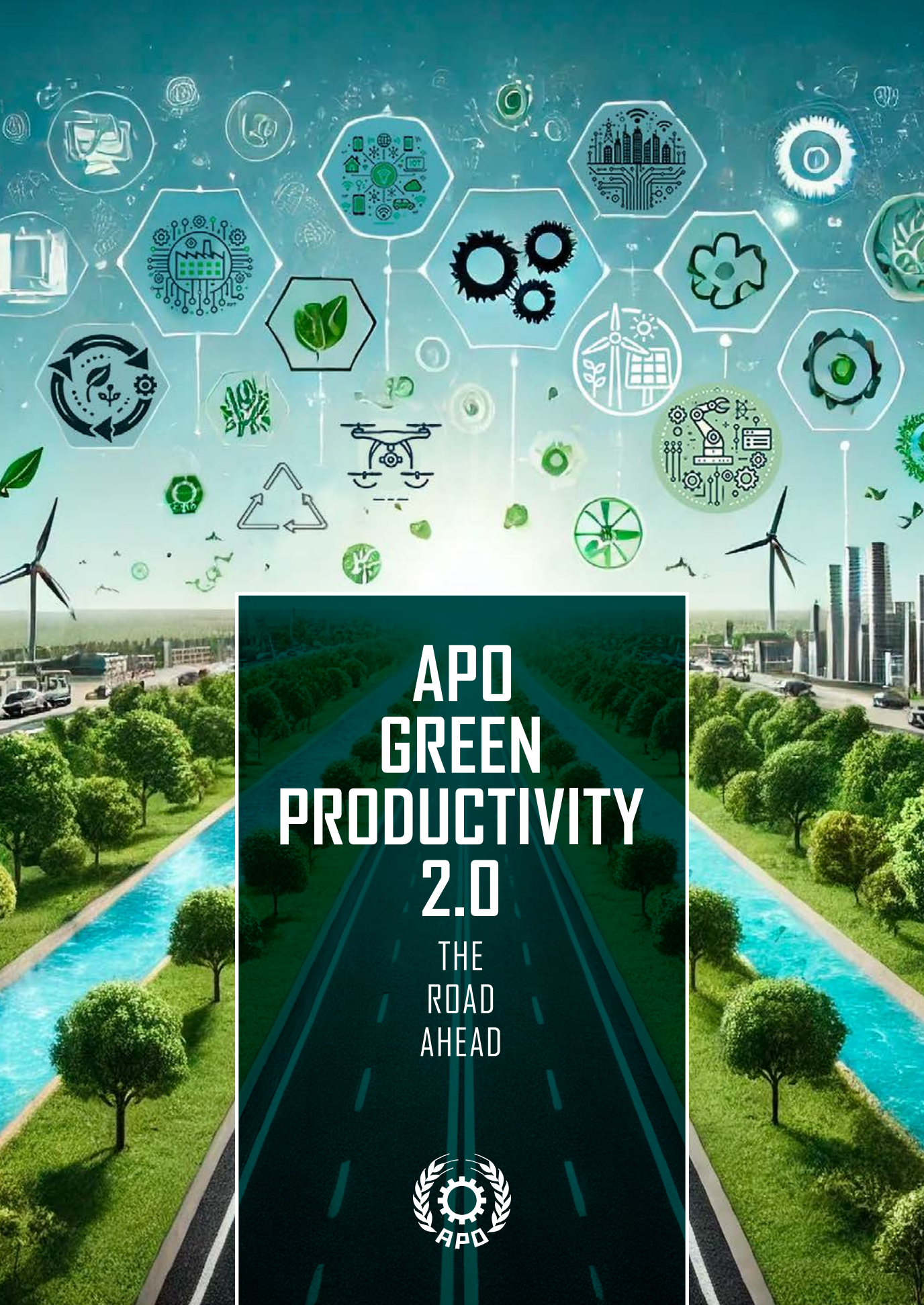

# APO GREEN PRODUCTIVITY 2.0

## THE ROAD AHEAD

The Asian Productivity Organization (APO) is an intergovernmental organization that promotes productivity as a key enabler for socioeconomic development and organizational and enterprise growth. It promotes productivity improvement tools, techniques, and methodologies; supports the National Productivity Organizations of its members; conducts research on productivity trends; and disseminates productivity information, analyses, and data. The APO was established in 1961 and comprises 21 members.

APO Members
Bangladesh, Cambodia, Republic of China, Fiji, Hong Kong, India, Indonesia, Islamic Republic of Iran, Japan, Republic of Korea, Lao PDR, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Turkiye, and Vietnam.

# APO GREEN PRODUCTIVITY 2.0

## The Road Ahead

OCTOBER 2024 | ASIAN PRODUCTIVITY ORGANIZATION

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Dr. Chun-Hsu Lin, Chair – Technical Working Group on Green Productivity 2.0, served as the volume editor.

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1-24-1 Hongo, Bunkyo-ku
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# FOREWORD

The Asian Productivity Organization (APO) launched the Green Productivity (GP) concept in 1994 under a special cash grant from the Government of Japan. GP development was inspired by the 1992 Earth Summit in Rio de Janeiro and Agenda 21. For three decades, GP has guided APO member economies in enhancing economic prosperity, productivity growth, and environmental performance. A training course on GP held since 2001 in Vietnam has developed a critical mass of GP specialists to act as trainers, consultants, and practitioners for enterprises across the Asia-Pacific. The accreditation of certification bodies on GP in Indonesia in 2023 and in Singapore and Thailand in 2024 reaffirmed the role of the APO as an institution builder and clearinghouse for productivity information at the regional level.

Sustainability is a worldwide goal. Global sustainability initiatives such the UN Millennium Development Goals in 2000, Sustainable Development Goals in 2015, and Paris Climate Agreement in 2015 to limit the temperature increase to 1.5°C above preindustrial levels and achieve net-zero emissions call for evolution in terms of focuses, approaches, and targets. The APO, as part of its mission to contribute to the sustainable socioeconomic development of Asia and the Pacific and under its 2025 vision of "Inclusive, innovation-led productivity growth in the Asia-Pacific," developed a roadmap to expand and deepen the GP concept under another special cash grant from the Government of Japan.

The publication, *APO Green Productivity 2.0: The Road Ahead,* reports activities carried out in developing the GP 2.0 Roadmap for future APO activities and initiatives. The identification of 30 key approaches with corresponding enablers and technologies; creation of a Project Bank covering the agriculture, consumption, manufacturing, and service sectors; and development of the GP 2.0 ecosystem will equip policymakers with informed decision-making tools. Implementation of activities under GP 2.0 Roadmap will also build capacity at individual level, strengthen triple bottom lines at organizational level, and facilitate informed decision-making at policy level through the development of systems, schemes, digital tools, and databanks with the involvement of sector-specific technical experts, government institutions, academia, and think tanks.

The contributions of all members of the APO GP Advisory (GPA) Council, including Prof. Emeritus Ryoichi Yamamoto, The University of Tokyo, and Chairperson of the Board of Trustees, Tokyo Metropolitan Public University Corporation, Japan, as GPA Council Chair; Dr. Chun-Hsu Lin, Director and Research Fellow, Center for Green Economy, Chung-Hua Institution for Economic Research, ROC, as Technical Working Group (TWG) Chair; and the TWG, were critical in developing a comprehensive roadmap for GP 2.0. With the collective efforts of these dedicated experts, GP 2.0 is now a fundamental approach to sustainability for APO members and beyond in the decades ahead.

Dr. Indra Pradana Singawinata
Secretary-General
Asian Productivity Organization
Tokyo

# INTRODUCTION

The development of Green Productivity (GP) 2.0 is crucial to setting the APO's GP initiative on a new trajectory aligned with the increasing global awareness and actions to achieve sustainability. This endeavor requires confronting the complexities presented by contemporary sustainability frameworks such as net-zero emission policies and the UN SDGs, making the project inherently challenging.

GP plays a vital role in achieving sustainability, a shared global goal. Following more than a year of extensive discussions and brainstorming, GP 2.0 has been successfully conceptualized as an ecosystem with clearly defined focuses, projects, approaches, enablers, methodologies, and timelines.

Between late 2022 and early 2024, the TWG, comprising members from the Republic of China (ROC), the Islamic Republic of Iran (I.R. Iran), Malaysia, Pakistan, the Philippines, Thailand, and Vietnam, was commissioned to develop GP2.0 approaches and a roadmap. The TWG collaborated with GP experts to identify approaches, with corresponding enablers, technologies, and methodologies, for developing a roadmap of activities. This roadmap will serve as a reference for APO activities in the coming decades in endeavors to achieve overall socioeconomic growth at the regional level. The GPA Council Chaired by Prof. Emeritus Ryoichi Yamamoto, The University of Tokyo, Japan and members from Indonesia, Japan, Singapore and Thailand technically reviewed the work of the TWG and provided crucial guidance and strategic recommendations on overall development of the projects and activities for further implementation. GP 2.0 represents an evolution from previous GP initiatives, responding to global sustainability trends since the launch of GP.

Notably, GP 2.0 introduces sector-specific elements, encompassing consumption aspects for all the APO members and forming a comprehensive GP 2.0 ecosystem based on updated guidance derived from substantial research activities conducted by the APO.

Another outcome of the GP 2.0 Roadmap development was the identification of 30 key approaches, with each assigned weight and priority, and categorized

under three pillars of regulations and programs, financial mechanisms, and technology upgrades. Enablers, methodologies, and timelines were identified for these approaches. These efforts culminated in creating a Project Bank under GP 2.0, featuring 29 concrete projects across various economic sectors.

These projects, including research, multi-country observational study missions, workshops, demonstration projects, and conferences, are poised for immediate implementation by the APO, marking the initial phase of GP 2.0 activities. In addition to the up-to-date Project Bank, more schemes may be developed and implemented to boost sustainability across the APO region in the GP 2.0 era.

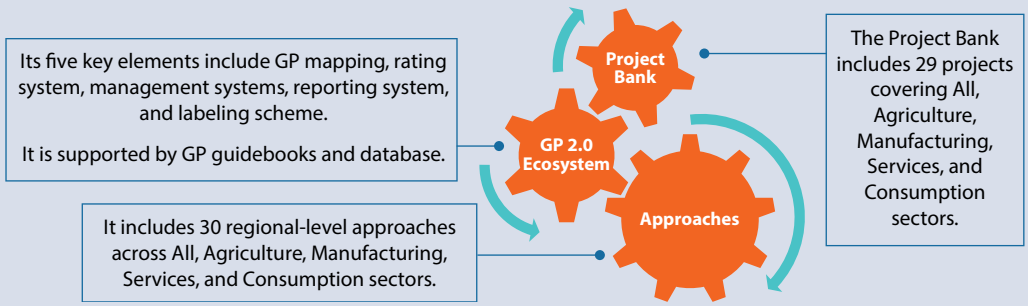
GP 2.0 marks a new phase in Green Productivity initiatives, expanding and deepening the original concept. It includes the GP 2.0 ecosystem and a Project Bank based on the approaches identified by the TWG. The GP 2.0 Roadmap retains the core principles of its predecessor while adding new dimensions to the activities carried out since GP 1.0, which began in 1994. The key elements of the GP 2.0 Roadmap, namely approaches, ecosystem, and project bank, extend beyond manufacturing to include services, agriculture, and consumption sectors. These additions provide enterprises with enhanced tools and methods to strengthen their triple bottom line, equip APO GP specialists to address emerging needs and challenges, support climate change mitigation and adaptation efforts, and assist policymakers in making informed decisions for overall socioeconomic development.

Figure 1 below illustrates GP 2.0, which expands and deepens the concept of GP.

**FIGURE 1**

**WHAT IS GP 2.0?**

**GP 2.0 expands the GP concept to sectors beyond manufacturing and deepens the GP concept through the development of a GP 2.0 ecosystem and the implementation of projects under a Project Bank.**



# GREEN PRODUCTIVITY 1.0

## The Evolution of Green Productivity and GP 1.0

GP is a strategy for enhancing productivity and environmental performance to promote overall socioeconomic development. In 1994, the APO launched GP as a new approach to sustainable development in response to the 1992 Rio Earth Summit, with the aim of contributing to sustainability.

The APO describes GP as a pathway leading to sustained improvement in the quality of human life. GP involves applying appropriate productivity and management tools, techniques, and technologies to reduce the environmental impact of an organization's activities, products, and services while enhancing profitability and competitive advantage.

The following are the key aspects of the GP 1.0 era, from 1994 to the present, on which the APO's initiatives were based and implemented.

- **Resource Efficiency:** One of GP's fundamental pillars was optimizing resource utilization. This involved minimizing waste, reducing energy consumption, and enhancing overall production process efficiency.
- **Environmental Management Systems:** A critical element of GP was adopting Environmental Management Systems (EMS), including policies, practices, and procedures to identify, manage, monitor, and improve an organization's environmental performance.
- **Training and Capacity Building:** Recognizing the need for a paradigm shift in organizational mindsets, the APO emphasized training and capacity building in 1994. This involved educating businesses, industries, and professionals on the principles and practices of GP. In 2019, the APO issued the APO-GPS 201 Certification Scheme and Competency Standard for Green Productivity Specialists to certify individuals who can act as trainers, consultants, promoters, and researchers in GP. The scheme was later upgraded in 2023 (APO, 2023).
- **Cleaner Production Techniques:** GP promoted the adoption of cleaner production techniques, encouraging businesses to explore and implement technologies and processes that minimize environmental impact.

- **Cross-sectoral Integration:** The APO advocated for cross-sectoral integration of GP principles. This involved engaging businesses across various industries to share best practices and collaborate in implementing environmentally sustainable strategies.

- **Government Collaboration:** The initiative encouraged collaboration between the private sector and government bodies to create supportive policies and regulatory frameworks that incentivize and promote GP practices.

- **Promotion of Eco-friendly Technologies:** The focus was on promoting and adopting eco-friendly technologies that contributed to productivity gains and environmental conservation. Examples include conducting the Eco-Products International Fairs and publishing the *Eco-products Directory* (APO, n.d.).

## Studies and Issues for GP 1.0

Since 1994, the concept of GP has evolved, with subsequent studies and initiatives building upon the foundation laid by the APO. Integrating environmental sustainability into productivity improvement strategies continues to be a global imperative, with the early efforts of organizations like the APO playing a crucial role in shaping the discourse and practices surrounding GP. In 2002, the APO published the *Green Productivity Trainer's Resource Manual* on practical industry approaches to address productivity and environmental protection (APO, 2002).

During the World Summit on Sustainable Development in 2002 in Johannesburg, also known as Rio+10, the APO presented a special publication *Green Productivity: An Approach to Sustainable Development* (APO, 2002) highlighting GP as a practical approach to sustainable development and addressing global environmental issues.

The APO has actively promoted ecoproducts under its GP Program through initiatives such as the annual Eco-products International Fair (EPIF) and the development of the APO Eco-products Directory and Eco-products Database. These efforts were carried out with the cooperation of the GP Advisory Committee (GPAC), comprising representatives from more than

60 Japanese corporations with extensive experience in managing environmental issues.

The EPIF was held 11 times between 2004 and 2017 across APO member economies, serving as a platform to raise environmental awareness, encourage the greening of supply chains, support the growth of green markets, and involve the public in fostering a better environment through the use of ecoproducts, ecotechnologies, and ecoservices. This initiative inspired the development of the Green Factory Scheme in Indonesia and the Green Labeling Scheme in the Philippines. Eco-products exhibitions were also launched in Malaysia and the Philippines to promote relevant environmental technologies and solutions.

The *Eco-products Directory* was published eight times from 2004 to 2012 (APO, n.d.) and featured environmentally friendly products and services from companies and organizations across the Asia-Pacific region. In 2010, the Eco-products Database was launched as an online portal listing products and services developed within the Asia-Pacific region that aimed to minimize environmental impacts and mitigate the effects of global warming. It provided access to information on these eco-friendly products and services, which were also featured in the *Eco-products Directory*. The final version of the Eco-products Database, containing products listed in the 2014 *Eco-products Directory*, marked the end of this initiative.

In 2006, the *Handbook on Green Productivity* was developed based on the "success in six" model of getting started, planning, generating, and evaluating GP options, implementing GP options, monitoring and reviewing, and sustaining GP (Johannson, 2006). It primarily targeted small and medium enterprises (SMEs) in the manufacturing sector and was designed as a learning tool to strengthen their triple bottom line of productivity, social well-being, and environmental performance.

The tools, techniques, methodologies, and approaches shared in these two publications remain highly relevant in the present context. Moreover, the technological advances in the last two decades have expanded the applicability of GP tools, especially in the wake of recent climate-related calamities (APO, 2002).

In 2013, the APO approved the establishment of the Center of Excellence on Green Productivity (APO COE on GP) in the ROC to strengthen the promotion of GP practices. The foundation of the APO COE on GP was inspired by activities carried out on a platform similar to GPAC in the ROC. The APO conducted reviews through surveys and expert meetings to chart new directions for GP in the coming decades.

In 2020, a study was conducted on *Green Productivity for SDGs: Review of Emerging and Priority Needs*. It focused on fostering sustainability and aligning with the UN sustainability efforts (Lin & Bhardwaj, 2020). The study provided crucial insights into the promotion needs of GP in member countries, such as the demand for certification programs, frameworks, public awareness campaigns, and the implementation of green supply chain management practices. Key areas of focus identified in the study included energy management, audits, and efficiency. It also emphasized the importance of addressing waste management and recycling and adopting Material Flow Cost Accounting (MFCA).

By addressing these critical areas, the APO members can enhance sustainable development, meet the SDGs, and pave the way for a more environmentally conscious and productive future (Lin & Bhardwaj, 2020).

In 2021, the APO conducted a comprehensive study, *Green Productivity and Circular Economy: Complementary Approaches to Sustainable Development*, exploring the synergies between GP and the circular economy as complementary approaches to sustainable development (Lin, 2022). This research examined the impact of GP and Circular Economy (CE) policies on business performance at the corporate level, focusing on both private and public enterprises.

The study received 1,144 valid responses from enterprises across 12 APO member economies. Twelve national experts helped in secondary data collection and analyses, contributing to a comprehensive evaluation. The study revealed several key findings that offered valuable insights into the current state of GP and the circular economy within the APO member economies (Lin, 2022).

- **Recognition of Initiatives:** The UN SDGs and Environmental, Social, and Governance (ESG) initiatives were the most widely recognized efforts among all stakeholders.

- **Acceptance of GP:** The GP concept was more widely accepted than the circular economy, with the focus on energy efficiency gaining significant attention.

- **Limited Focus on Circular Economy Aspects:** Enterprises demonstrated limited concern for circular economy aspects beyond manufacturing, such as consumption, logistics, commerce, and the final disposal of products. A notable lack of Innovative circular economy business models was observed.

- **Assistance Desired:** Workforce training and technology transfer emerged as the top priorities for assistance, indicating a clear need for capacity building. However, enterprises reported a lack of guidance, tools, training, and innovative business models tailored for circular economy practices.

- **Sectoral Priorities:** Green finance and networking emerged as key priorities for green transformation in the service sector, while the industry and agriculture sectors lagged in these aspects.

The findings from the GP and Circular Economy study underscored the need for targeted support in training, technology transfer, and the development of innovative business models to drive the adoption of CE practices.

The following conclusions can be drawn based on the previous studies and the observations of GP 1.0 projects.

- GP 1.0 emphasized the manufacturing sector more than the agriculture and service sectors.

- GP 1.0 focused primarily on strengthening resource utilization and pollution control.

- Climate change issues were not clearly addressed.

- Private enterprises were subjected to more sustainability targets than government entities or the general public.

As we divide economic activities into production and consumption, there were notable differences on both sides during the GP 1.0 era (Table 1).

**TABLE 1**

**KEY OBSERVATIONS AND ISSUES IN PRODUCTION AND CONSUMPTION UNDER GP 1.0.**

| Aspects of Economy | Production | Consumption |
|---|---|---|
| Observations and issues about GP | • Service-sector regulatory frameworks are in the early stages.<br>• The scope of capacity building, especially in developing economies, must be addressed. | • Behavioral changes related to regulations require more focus.<br>• Fostering green procurement requires a shift from voluntary to needed certification. |
| Observations and issues about GP | • Regulations in almost all the APO members are either in place or being developed.<br>• Financial mechanisms, especially in the service sector, need further development.<br>• The agriculture sector must strengthen regulations, financial mechanisms, and technology upgrades, especially in developing economies. | • In addition to the transportation and building sectors, dining (food) and clothing (textiles) require more attention. |

# STRATEGIC MAPPING AND DEVELOPMENT OF GP 2.0

In response to current global sustainability initiatives to align the principles of GP, the APO initiated a project under a Special Cash Grant from the Government of Japan to develop GP 2.0. It required setting up of the GPA Council, chaired by Prof. Emeritus Ryoichi Yamamoto of the University of Tokyo, for strategic advice. A TWG was also set up to provide technical inputs with the following objectives:

- Map GP initiatives across the APO member economies.
- Identify opportunities for GP applications in response to current issues, global trends, and initiatives.
- Analyze GP tools, techniques, and methodologies to identify new enablers and technologies to support GP applications.
- Develop the GP 2.0 Roadmap and identify corresponding action plans, methodologies, projects, and Key Performance Indicators (KPIs).
- Provide the above outputs and technical feedback to the GPA Council for review and strategy formulation.

Since its inception, the TWG has been actively engaged in formulating the GP 2.0 Roadmap, holding online discussions and face-to-face meetings. Some GP experts outside of the TWG also provided specific inputs. Their reports included mapping GP 2.0 initiatives to identify hotspots and current trends, prioritizing approaches to address the gaps, and corresponding enablers, technologies, and methodologies for developing action plans.

## GP 2.0 Structure and Basis

Based on prior studies, investigations, and an analysis of emerging global trends in sustainability, the proposed directions of GP 2.0 were outlined. These are as follows:

- **Comprehensive Coverage:** GP 2.0 is envisioned to encompass all economic activities before and after the manufacturing or production stage.

- **Sequential Extension:** The facets of GP will initially extend to CE, emphasizing the efficiency of energy, materials, and water. Subsequently, with a more holistic view of resource management, GP 2.0 will incorporate ESG aspects and the SDGs.

- **Sector-specific Focus:** Recognizing the diverse needs across sectors, specific focus areas and requirements for the agriculture, industry, and service sectors should be established.

- **Continuous Support for Business Entities:** GP 2.0 should consistently support business entities through workforce training, technology transfer, and networking initiatives.

- **Supplementary Program Development:** Member countries are encouraged to develop supplementary programs alongside GP, including policies, standards, certification systems, auditing, green finance, and international cooperation mechanisms.

- **Deepen Collaboration:** The success of GP 2.0 will rely on collaboration with relevant organizations, such as science and technology institutes, new energy and technology organizations, and the private sector. In addition, regular awareness and dissemination activities will demonstrate positive outcomes.

The TWG proposed the GP 2.0 framework, as shown in Table 2, aligned with the outlined directions of GP 2.0.

**TABLE 2**

**CORE FRAMEWORK FOR GP 2.0 PROPOSED BY THE TWG.**

| Vision |
|---|
| **Net-zero Emission**<br>• A commitment to achieving a balance between greenhouse gas emitted into the atmosphere and the amount removed, resulting in no net increase in emissions. |

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| Vision |
|---|
| **UN SDGs (decoupling socioeconomic growth from environmental degradation)**<br>• Aligning with the UN SDGs to balance socioeconomic progress with environmental sustainability. |
| **Main Stakeholders** |
| **Producers**<br>• Manufacturing sector<br>• Service sector<br>• Agriculture sector<br>• Government (regulation and guidance providers)<br>• Academia and NGOs (knowledge and technology providers)<br>**Consumers** |
| **Focus Area** |
| **Regulations and Programs**<br>• Implementing effective rules, guidelines, and strategic initiatives to promote sustainable practices. |
| **Financial Mechanisms**<br>• Developing and applying financial tools and incentives to support sustainable practices, contributing to achieving the initiative's goals. |
| **Operation and Technology Upgrades Mitigating Climate Change and Enhancing Productivity**<br>• Enhancing operational processes and adopting advanced technologies to mitigate climate change and boost productivity. |
| **Collaboration**<br>• Fostering collaboration among think tanks, technology, new energy research institutes, and the private sector. |

The components in Table 2 collectively establish a comprehensive framework for addressing sustainability challenges while fostering a balanced approach to economic growth and environmental considerations.

## The Process of Study: Delphi Method

The TWG comprised of seven experts, one each from the ROC, I.R. Iran, Malaysia, Pakistan, the Philippines, Thailand, and Vietnam. They employed principles of the Delphi method for mapping GP initiatives across 20 APO member economies. The Delphi method is a structured approach to gathering information and reaching a consensus among experts using the following steps.

**Round 1:** Individual evaluation by TWG members.

**Round 2:** Feedback and iteration to summarize the responses from the first round.

**Round 3 and Beyond (if required):** Repeat the feedback and iteration process until a consensus or convergence of opinions is achieved.

TWG members collected national and sectoral data on regulations and programs, financial mechanisms, and operational and technological upgrades across economic production and consumption sectors. The production data was categorized into manufacturing, agriculture, services, the public sector, government, and think tanks. On the consumption side, the data covered the operation of buildings and offices, dining, clothing, transport, education, sports and recreation, medical services, and other activities.

## Gap Analysis: Identifying Hotspots

TWG experts began by identifying hotspots in each APO member economy, focusing on implementing national sustainability and net-zero emission policies across economic sectors (manufacturing, agriculture, services) and consumption activities. They initially assigned scores based on their assessments of each member economy's current status and urgency.

To assess the current status, it was recommended to assign scores to each element of the matrix using the following scale:

3: Developed
2: In progress
1: Starting
0: Lacking

To evaluate urgency, scores were assigned to each element of the matrix based on the following principles:

3: Urgent measures required (0–5 years)
2: Short-term measures required (5–10 years)
1: Long-term measures required (10–20 years)
0: No need

The discrepancy between the current status and urgency was used to determine the gap. Subsequently, hotspots were identified by focusing on elements with higher gap scores for each APO member, as illustrated in Figure 2.

**FIGURE 2**

**GAP ANALYSIS EXAMPLE: ASSESSING SUSTAINABILITY INITIATIVES AMONG THE APO MEMBERS.**

**Current Status**

| Production | | | | | | |
|---|---|---|---|---|---|---|
| | Industry | | | | Government | Think Tanks |
| | Manufacturing | Agriculture | Service | Public Sector | | |
| Regulations and programs | 1 | 1 | 1 | 0 | 2 | 0 |
| Financial mechanisms | 2 | 1 | 1 | 2 | 2 | 2 |
| Operation and technology upgrades | 1 | 0 | 1 | 1 | 1 | 1 |

| Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Operation of Buildings and Offices | Dining | Clothing | Transport | Education | Sports and Recreations | Medical Services | Other Activities |
| Regulations and programs | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| Financial mechanisms | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |
| Operation and technology upgrades | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

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| Urgency | | | | | | |
|---|---|---|---|---|---|---|
| Production | | | | | | |
| | Industry | | | | Government | Think Tanks |
| | Manufacturing | Agriculture | Service | Public Sector | | |
| Regulations and programs | 3 | 3 | 3 | 0 | 3 | 0 |
| Financial mechanisms | 3 | 3 | 3 | 2 | 2 | 0 |
| Operation and technology upgrades | 3 | 3 | 3 | 2 | 2 | 2 |

| Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Operation of Buildings and Offices | Dining | Clothing | Transport | Education | Sports and Recreations | Medical Services | Other Activities |
| Regulations and programs | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 0 |
| Financial mechanisms | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 0 |
| Operation and technology upgrades | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 0 |

(Continued on next page)

The inference from the gap scores is as follows: a score of 0 indicates that no further effort is needed, a score of 1 suggests that long-term efforts are required, a score of 2 reflects the need for further improvement, and a score of 3 signifies that significant and immediate efforts are necessary.

## Identifying Approaches and Enablers

After conducting the gap analysis for each member economy and synthesizing the scores for all 20 members, the TWG members were guided to identify and suggest approaches based on the combined analysis results. These approaches aimed to bridge the gap between GP 1.0 and GP 2.0 for each "hotspot" and were determined through a two-layer approach of weighing and prioritizing questionnaires in the TWG meetings and workshops.

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**Gap**

| Production | | | | | | |
|---|---|---|---|---|---|---|
| | Industry | | | | Government | Think Tanks |
| | Manufacturing | Agriculture | Service | Public Sector | | |
| Regulations and programs | 2 | 2 | 2 | 0 | 1 | 0 |
| Financial mechanisms | 1 | 2 | 2 | 0 | 0 | 2 |
| Operation and technology upgrades | 2 | 2 | 2 | 1 | 1 | 1 |

| Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Operation of Buildings and Offices | Dining | Clothing | Transport | Education | Sports and Recreations | Medical Services | Other Activities |
| Regulations and programs | 2 | 2 | 0 | 2 | 1 | 1 | 1 | 0 |
| Financial mechanisms | 3 | 2 | 0 | 0 | 1 | 1 | 1 | 0 |
| Operation and technology upgrades | 3 | 2 | 0 | 3 | 2 | 1 | 1 | 0 |

## Determining Priority and Time Frames

After identifying the approaches, the priorities and implementation timeframes for various approaches were determined using the Delphi method. In addition to the TWG members, experts in GP were included in the consultation process to provide insights into the key items and priorities of GP 2.0.

## Establishing the GP 2.0 Ecosystem

In addition to the gap analysis and approach identification, an auxiliary ecosystem of GP 2.0 was designed to create an environment that supports the transition to and facilitation of GP implementation. The GP 2.0 ecosystem comprises five key elements: mapping, rating, management systems, reporting,

and labeling. Two supporting elements, guidebooks and a database, complement these core components.

Together, these seven elements address the identified approaches, facilitate the adoption of technologies, deepen collaboration, engage relevant stakeholders, promote carbon-neutral and carbon-positive products, technologies, and services, and link the APO activities to serve its members better. The ecosystem is intended to expand GP applications, provide practical tools for policymakers, industries, and professionals working toward environment-friendly business growth, and strengthen the APO certification schemes for developing GP specialists.

In addition, the GP 2.0 ecosystem enhances the APO's role in providing solutions for overall socioeconomic development at the regional level, with productivity enhancement at the core and facilitating the decoupling of industrial development from environmental degradation.

# STUDY RESULTS

## Summary of the Gap Analysis Results

During the initial phase of the GP 2.0 development project, TWG members conducted a comprehensive gap analysis of regulations, financial mechanisms, and technological capabilities related to sustainability initiatives across 20 APO members. Each member exhibited unique strengths and required specific upgrades to meet evolving global advocacy requirements. Therefore, discussions on sustainability issues for any particular economy were to consider its circumstances. The TWG's synthesis of individual member assessments revealed the following trends and issues.

- Overall, the regulations supporting sustainability from the production perspective are either already in place or progressing for all members. However, the regulatory framework for the service sector remains in its early stages.

- Over the past decades, manufacturing has focused significantly on technological and solution upgrades. However, some countries, such as the I.R. Iran and Fiji, still require capacity building in operational processes.

- The manufacturing sectors of the I.R. Iran, Mongolia, and Sri Lanka need further development of financial mechanisms. Similarly, financial mechanisms are necessary for the service sector in Cambodia, the ROC, I.R. Iran, Lao PDR, Malaysia, Pakistan, the Philippines, Sri Lanka, Thailand, and Vietnam.

- In the underemphasized agriculture sector, Bangladesh, India, the I.R. Iran, Pakistan, and the Philippines require strengthening all three pillars of regulation, financial mechanisms, and technology upgrades. Mongolia needs more assistance establishing financial mechanisms, while the Republic of Korea (ROK) requires additional regulatory measures.

- From the consumption perspective, unlike production activities, the past decades have seen fewer initiatives on behavioral changes related

to consumption or demand, particularly at the regulatory level. Initiatives in transportation, buildings, and offices have gained traction, often promoted voluntarily or through financial mechanisms like subsidies.

- Several APO members have implemented certification systems for green buildings, fostering green procurement and other sustainability measures. Apart from buildings, offices, and transportation, dining and clothing are expected to receive increased attention for sustainability in the future.

The TWG's activities began by mapping GP initiatives across all 20 APO members using the Delphi method. The observations related to the production aspect can be summarized as follows.

- Service-sector regulatory frameworks are still in their early stages.
- The scope of capacity building, especially in developing economies, must be addressed.
- Regulations in almost all the APO members are either already in place or currently being developed.
- Financial mechanisms, especially in the service sector, require further development.
- The agriculture sector in developing economies requires strengthening regulations, financial mechanisms, and technology upgrades.

The observations related to the consumption aspect can be summarized as follows.

- Behavioral changes related to regulation need more focus.
- Fostering green procurement requires a shift from voluntary to required certification.
- Besides the transportation and building sectors, the dining (food) and clothing (textiles) sectors require more attention.

Hotspots from all the APO members have been consolidated into comprehensive tables for production (Figure 3) and consumption (Figure 4), serving as a basis for further analysis and consideration.

**FIGURE 3**

**PRODUCTION HOTSPOTS OF APO MEMBERS FOR GP 2.0.**

| | Manufacturing | Agriculture | Service | Public Sector | Government | Think Tanks |
|---|---|---|---|---|---|---|
| Regulations and Programs | 25 | 32 | 35 | 21 | 21 | 24 |
| Financial Mechanisms | 32 | 30 | 43 | 16 | 21 | 22 |
| Operational and Technology Upgrades | 30 | 31 | 35 | 25 | 25 | 30 |

**FIGURE 4**

**CONSUMPTION HOTSPOTS OF APO MEMBERS FOR GP 2.0.**

| | Operation of Buildings and Offices | Dining | Clothing | Transport | Education | Sports and Recreation | Medical Services | Other Activities |
|---|---|---|---|---|---|---|---|---|
| Regulations and Programs | 26 | 23 | 18 | 34 | 29 | 25 | 22 | 16 |
| Financial Mechanisms | 35 | 19 | 18 | 27 | 21 | 21 | 18 | 15 |
| Operational and Technology Upgrades | 37 | 25 | 21 | 39 | 26 | 20 | 22 | 15 |

The hotspot outcomes from Figures 3 and 4 have been reorganized and summarized in Table 3 to represent different sectors.

**TABLE 3**

**HOTSPOTS FOR GP 2.0 ACROSS DIFFERENT SECTORS.**

| Pillars | Regulations and Programs | Financial Mechanisms | Operation and Technology Upgrades |
|---|---|---|---|
| Agriculture | ✓ | | ✓ |
| Manufacturing | | ✓ | ✓ |

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| Pillars | Regulations and Programs | Financial Mechanisms | Operation and Technology Upgrades |
|---|---|---|---|
| Services | | ✓ | |
| Buildings | ✓ | ✓ | ✓ |
| Transportation | ✓ | | ✓ |

## Determination of Approaches

TWG members determined the strategies for the initial phase of GP 2.0 based on the outcomes of the previous gap analysis and a weighting system, as outlined in Table 4. The approaches aimed at bridging the gaps across various sectors and pillars, on which the current status rating and gap analysis were based, are summarized.

**TABLE 4**

**APPROACHES IDENTIFIED FOR GP 2.0 IMPLEMENTATION.**

| Sector | Approaches |
|---|---|
| Manufacturing | **Government schemes**<br>• Government grants for capacity building, incubator setting, manufacturing upgrades, and energy efficiency<br>• Tax incentives<br>**Green financial markets and mechanisms**<br>• Carbon trading and offsets<br>• Green bonds and other financial products<br>• Standards for financing (environmental taxonomy)<br>**Improvement of products and physical facilities**<br>• Ecodesign<br>• Life Cycle Assessment (LCA)<br>**Improvement of processes and management**<br>• Industry 4.0<br>◦ Green supply chains<br>◦ Clean production<br>• Greenhouse Gases (GHG) inventory<br>• CE promotion<br>**Assisting mechanisms**<br>• GP management systems<br>• Green certification and standards |

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| Sector | Approaches |
|---|---|
| **Agriculture** | **Regulations and programs**<br>• Water use regulations<br>**Smart, sustainable agriculture operations**<br>• Precision farming and use of drone applications<br>• Indigenous species plantation, land management, and ecosystem-based agriculture<br>• Sustainable irrigation and rainwater utilization<br>• Adaptation to climate change in farming<br>**Circular economy practices**<br>• Organic fertilizer and agriculture waste to energy<br>**Renewable energy utilization and applications**<br>• Renewable energy uses<br>• Agrivoltaics and aquavoltaics |
| **Services** | **Government schemes**<br>• Grants for innovation projects and energy efficiency<br>• Tax incentives for innovation projects and energy efficiency<br>**Financial mechanisms**<br>• Green finance for the service sector<br>• Green procurement for the service sector |
| **Consumption (buildings, offices, and transportation)** | **Buildings and Offices**<br>• Leadership in Energy and Environment Design (LEED) and Green Building Index<br>• Trash sorting regulations and infrastructure<br>• Shared working spaces and flexible working hours/locations<br>• Incentives for:<br>◦ Renewable energy use<br>◦ Retrofitting and use of local materials, renewable materials, recycled construction waste, etc.<br>◦ Green building loans<br>◦ Encouraging ecodesign of buildings<br>**Transport**<br>• Incentives and regulations<br>◦ Incentives for the transition from Internal Combustion Engines (ICE) to Electric Vehicles (EV)<br>• System design and optimization<br>◦ Sustainable mobility: public transport, cycling infrastructure, carpooling and ride-sharing<br>• Efficiency and optimization in transport systems |

The TWG experts assigned two-layer weighting percentages to the approaches to establish the relative importance of each approach within individual sectors. These approaches were subsequently categorized into three groups: Behavior Change, Management Systems, and Tools and Techniques. Based on the weighting results, TWG members selected 14 pivotal approaches (Table 5) for concentrated attention. To refine the initial approaches identified, it was essential to define the critical elements of GP 1.0 and understand any similarities in approaches that remain relevant under the current circumstances. Referring to the *APO Handbook and Training Manual on GP*, the critical elements of GP 1.0 were classified, as shown in Table 6, along with the approaches for GP 2.0.

**TABLE 5**

**CRITICAL APPROACHES FOR GP 2.0 VS. TYPICAL APPROACHES IN GP 1.0.**

| Classification | Focused Approaches | |
|---|---|---|
| | GP 2.0 | GP 1.0 |
| **Behavior Change** | • Regulations and financial incentives for production sectors<br>• Regulations and financial incentives for consumers | • Environmental awareness<br>• Social engagement<br>• Sustainable commutation, dining, and office operations |
| **Management Systems** | • Carbon trading and offsets<br>• Industry 4.0<br>• GP Management Systems (GPMS)<br>• Agricultural regulations and planning<br>• Green procurement | • EMS<br>• Green procurement<br>• Supply chain management<br>• Measurement, reporting, regulations, and compliance |
| **Tools and Techniques** | • Ecodesign<br>• Adaptation in industry (manufacturing)<br>• Agricultural circular economy practices<br>• Agricultural renewable energy uses and generation<br>• Adaptation in agriculture<br>• Green finance tools and standards<br>• Transportation system optimization | • LCA<br>• Energy saving and renewable energy<br>• Waste minimization and resource efficiency<br>• Cleaner production and green technology innovation<br>• Ecodesign or design for the environment<br>• Carbon footprint reduction<br>• Green buildings and infra-structure |

Supplementing the conclusions drawn from the TWG meeting using the Delphi method, additional inputs from the GPA Council Chair and the non-TWG GP experts were incorporated through two consultation meetings. The revised results are outlined by the characteristics of the approaches in Table 6.

**TABLE 6**

**GP 2.0 APPROACHES CLASSIFIED BY ATTRIBUTES.**

| Classification | Focus Approaches |
|---|---|
| **Behavior Change** | • Happiness economy<br>• Society 5.0<br>• Resource-minded economic development<br>• Bioeconomy |
| **Management Systems** | **Agriculture**<br>• Regulations on water, digitalization, and tools<br>• Adaptation to climate change in agriculture<br>• Land management like precision farming, eco-based agriculture, and biodiversity<br>**Manufacturing**<br>• Regulations and financial incentives<br>• Adaptation to climate change<br>• Carbon trading and offsets<br>• Industry 4.0<br>• GP management systems<br>**Services**<br>• Green finance tools and standards<br>• Smart building management<br>• Facility management<br>• Sustainable supply chain management<br>**Consumption**<br>• Regulations and financial incentives for consumption |

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| Classification | Focus Approaches |
|---|---|
| Tools and Techniques | **Agriculture**<br>• Practice improvement<br>• Circular economy practices<br>• Energy-related approaches<br>**Manufacturing**<br>• Four-stage model of ecoinnovation<br>• Ecomaterials, ecoproducts, product–service system<br>• Eco and green labeling<br>• Company and product information disclosure<br>**Services**<br>• Digital technologies<br>**Consumption**<br>• Green procurement<br>• Ethical consumption |

## Prioritizing Approaches and Its Linkages to Segments of Sustainability

Drawing on inputs from the GPA Council Chair and other GP experts, TWG members were asked to complete a questionnaire, assign weights to the finalized approaches, and define the implementation timeline based on urgency. The timeline was divided into three stages: initiatives to be completed by 2030 for short-term goals, 2030–40 for mid-term goals, and 2040–50 for long-term goals. The finalized list, including 30 approaches, and the targeted time frames for implementation, is presented in Table 7.

**TABLE 7**

**FINAL GP 2.0 APPROACHES WITH RELATIVE PRIORITIES AND TARGETED TIME FRAMES.**

| Sector | Approach | Priority | P1 | P2 | P3 |
|---|---|---|---|---|---|
| All Sectors | SDGs | 1 | * | | |
| | Sufficiency-based circular economy | 2 | * | * | * |
| | Bioeconomy | 3 | * | * | |
| | Society 5.0 | 4 | * | * | |
| | ESG initiatives | 5 | * | * | |
| | Happiness economy | 6 | * | | |
| Agriculture | Regulations on water, digitalization, and tools | 1 | * | * | |
| | Adaptation to climate change | 2 | * | * | * |
| | Practice improvement | 3 | * | * | |
| | Land management | 4 | * | | |
| | Circular economy practices | 5 | * | | |
| | Energy-related approaches | 6 | * | | |
| Manufacturing | GP management systems, standards, and certification | 1 | * | * | * |
| | Adaptation to climate change | 2 | * | * | * |
| | Regulations and financial incentives | 3 | * | * | |
| | Eco and green labeling | 4 | * | * | |

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| Sector | Approach | Priority | P1 | P2 | P3 |
|---|---|---|---|---|---|
| Manufacturing | Industry 4.0 | 5 | * | | |
| | Carbon trading and offsets | 6 | * | | |
| | Four-stage model of ecoinnovation | 7 | * | | |
| | Ecomaterials, ecoproducts, and product–service systems | 8 | * | | |
| | Company and product information disclosure | 9 | | * | |
| Services | Digital technologies | 1 | * | * | * |
| | Green finance tools and standards | 2 | * | * | |
| | Sustainable supply chain management | 3 | * | * | * |
| | Smart building management | 4 | * | * | * |
| | Facility management | 5 | * | * | * |
| | Green tourism | 6 | * | * | * |
| Consumption | Regulations and financial incentives for consumption | 1 | * | * | |
| | Green procurement | 2 | * | * | * |
| | Ethical consumption | 3 | * | * | * |

**Note:** P1, P2, and P3 indicate the time frame, where P1: before 2030; P2: 2030–40; and P3: 2040–50.

The approaches complement the key segments of sustainability while keeping the GP concept at its core, specifically focusing on strengthening the triple bottom line. The linkages between the approaches and various segments of sustainability, i.e., social, economic, and environment bottom lines, are shown in Figure 5.

**FIGURE 5**

**LINKING GP 2.0 APPROACHES TO SEGMENTS OF SUSTAINABILITY.**

## Identifying Enablers and Technologies

After extensive discussions within the TWG and during consultation meetings, a consensus was reached on the enablers and technologies that complement the GP approaches. These were agreed upon, with potential for further refinement, as detailed in Table 8.

**TABLE 8**

**INITIAL ENABLERS AND TECHNOLOGIES AGREED UPON BY TWG MEMBERS.**

| All Sectors |
|---|
| • Sustainable business models |
| • Green job creation |
| • Green finance and ESG rating |
| • Transition cost assessment |
| • True-cost accounting |
| **Agriculture/Food/Forestry** |
| • Financial support schemes like insurance, investment, loans, and subsidies |
| • Training and capacity development |
| • Technologies, including digital technologies and apps, breeding, renewable energy use, agrivoltaics and aquavoltaics, and new production technologies |
| • Market information |
| • Infrastructure like gardening with blue-green infrastructure |
| • Regulatory structure |
| • Precision farming |
| • Bio-based products, including bioplastics and biodegradable clothing |
| • Sustainable stormwater management programs |
| • Nature-based solutions like indigenous species, genetic and local resource plantations, and eco-based biodiverse agriculture |
| • Soil health monitoring and maintenance |
| • Agroforestry development |
| • Sustainable irrigation and rainwater utilization |
| • Reduction of food loss |

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**Agriculture/Food/Forestry**

- Farm material recycling
- Organic fertilizers
- Bioenergy from organic waste and plants
- Composting, biogas, and waste-to-energy programs
- Crop rotation and diversification

**Manufacturing and Industry**

- Existing GP 1.0 technologies
  - Hazardous substance management
  - Health and Safety Environment Security (HSES)
  - LCA and social LCA
  - MFCA
  - Eco and green labeling
- Ecoefficiency and material efficiency strategies
- Design for system innovation and transitions
- Nature-based solutions
- Sustainable business models
- GP for kids and SMEs
- Access to finance mechanisms, such as green bonds
- Utilizing treated wastewater instead of disposal under circular economy principles and retrofitting for green buildings
- Utilization of nanocoating technologies for insulation or waterproofing
- Four-stage model of ecoinnovation
- Ecomaterials, ecoproducts, and product–service systems
- Environmental information disclosures for companies and products

**Services**

- Society 5.0 technology
  - Internet of Things (IoT) sensors and data analytics

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| |
|---|
| **Services** |
| ◦ Artificial Intelligence (AI)-powered customer insight |
| ◦ Digital twin technology |
| ◦ Blockchain |
| • Government support and incentives |
| • Public-private financing |
| • Regional transaction carbon market development |
| • Integrated transportation systems |
| **Consumption** |
| • Programs and incentives for consumers |
| • Green procurement policies |
| • Ethical consumption guidelines |
| • Mobile apps for green products, services, and other consumption resources |

The following methodologies were also collectively endorsed, providing additional opportunities for refinement. The proposed methodologies were designed with the APO mission, resources, and mandate in view.

- GP demonstration projects
- GP adaptations for SMEs
- Tool and technology packages
- GP visualization
- Green clusters
- Economic and environmental Return on Investment (RoI) or cost-benefit analysis
- Capacity building, training, and workshops
- Networking

- Technology transfer and development
- Data collection via sensors and big data analytics
- GP for kids
- Professional GP education in schools and universities

Utilizing the outcomes from Table 8 and the agreed-upon methodologies, the approaches, enablers, associated weights, and methodologies have been consolidated and summarized across various sectors in Table 9.

**TABLE 9**

**CONSOLIDATED APPROACHES, ENABLERS, TECHNOLOGIES AND METHODOLOGIES.**

| Sector | Approach | Enabler and Technology | Methodology |
|---|---|---|---|
| All Sectors | SDGs<br>Sufficiency-based circular economy<br>Bioeconomy<br>Society 5.0<br>ESG initiatives<br>Happiness economy | • Sustainable business models<br>• Creation of green jobs and jobs for nature<br>• Green finance and ESG rating<br>• Transition cost assessment<br>• True-cost accounting<br>• Green consumption market<br>• Green technologies<br>• Standards of CE, Society 5.0, related conformity assessment guides<br>• Green products and services<br>• Green award systems<br>◦ Fair working environment<br>◦ Corporate Social Responsibility (CSR), ESG, GP | • GP demo projects<br>• GP visualization<br>• Green clusters<br>• Economic and environmental RoI or cost-benefit analysis<br>• Education<br>◦ GP for kids<br>◦ Professional GP education in schools and universities |
| Agriculture | Regulations on water, digitalization, and tools<br>Adaptation to climate change | • Financial support schemes like insurance, investment, loans, and subsidies<br>• Training and capacity development<br>• Technologies (digital technologies and apps, breeding, renewable energy use, agrivoltaics and aquavoltaics, and new production technologies) | • Demo projects<br>• GP modulations for SMEs<br>• Tool and technology packages<br>• Green clusters |

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| Sector | Approach | Enabler and Technology | Methodology |
|---|---|---|---|
| **Agriculture** | Practice improvement<br>Land management<br>CE practices<br>Energy-related approaches | • Market information and support in the exchange of green products and services<br>• Infrastructure (gray infrastructure and gardening with blue-green infrastructure)<br>• Regulatory structure<br>• Precision farming and drones<br>• Bioeconomy with bio-based products, including bioplastics (not competing with food), biodegradable clothing, upcycled agricultural-waste products<br>• Sustainable stormwater management programs, including rainwater utilization<br>• Nature-based solutions (indigenous species and genetic, local resource plantations, and eco-based agriculture with biodiversity)<br>• Soil health monitoring and maintenance<br>• Agroforest development<br>• Sustainable irrigation<br>• Reduction of food loss<br>• Organic fertilizers, including compost, animal manure, sewage sludge, and other biowaste<br>• Bioenergy from organic waste and plants, including biogas and waste-to-energy technologies<br>• Crop rotation and diversification<br>• Ecosystem-based services<br>• Standards of smart green agriculture, sustainable development and management of water, soil, forests, and related conformity assessment guides<br>• Tree plantations for biomass used for energy generation and green charcoal | • Economic and environmental RoI or cost-benefit analysis capacity building, training, workshops<br>• Networking<br>• Technology transfer and development<br>• Data collection via sensors and analysis of big data |
| **Manufacturing** | GP management systems, standards, and certification | • Existing GP 1.0 technologies<br>◦ Hazardous substance management<br>◦ HSES<br>◦ LCA and social LCA<br>◦ MFCA | • Demo projects<br>• GP modulations for SMEs |

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| Sector | Approach | Enabler and Technology | Methodology |
|---|---|---|---|
| Manufacturing | Adaptation to climate change<br>Regulations and financial incentives<br>Eco and green labeling<br>Industry 4.0<br>Carbon trading and offsets<br>Four-stage model of eco-innovation<br>Ecomaterials, ecoproducts, product-service systems<br>Company and product information disclosure | ◦ Eco and green labeling<br>• Ecoefficiency and material efficiency strategies<br>• Design for system innovation and transitions<br>• Nature-based solutions<br>• Sustainable business models<br>• GP for SMEs<br>• Access to finance mechanisms, such as green bonds<br>• Utilizing treated wastewater instead of disposal under the CE principle<br>• Retrofit for green buildings<br>• Utilization of nanocoating technologies for insulation or waterproofing<br>• Four-stage model of eco-innovation<br>• Ecomaterials, ecoproducts, product-service system<br>• Company and product environmental info disclosure<br>• Standards of carbon footprints, accounting, eco and green products, advanced quality and safety assurance management systems, and certification models | • Tool and technology packages<br>• GP visualization<br>• Green clusters<br>• Economic and environmental RoI or cost-benefit analysis<br>• Capacity building, training, and workshops<br>• Networking<br>• Technology transfer and development<br>• Research on development of GP management system standards<br>• Research and development of GPO for SMEs |
| Services | Digital technologies<br>Green finance tools and standards<br>Sustainable supply chain management<br>Smart building management | • Society 5.0 technology<br>◦ IoT sensors and data analytics<br>◦ AI-powered customer insight<br>◦ Digital twin technology<br>◦ Blockchain<br>• Government support and incentives<br>• Public-private financing<br>• Regional transaction<br>• Carbon market development<br>• Integrated transportation system | • Demo projects<br>• GP modulations for SMEs<br>• Tool and technology packages<br>• GP visualization<br>• Green clusters<br>• Economic and environmental RoI or cost-benefit analysis |

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| Sector | Approach | Enabler and Technology | Methodology |
|---|---|---|---|
| **Services** | Facility management<br>Green tourism | • Green financing mechanism<br>• Standards for smart building materials, construction structures, architects, eco and green tourism models with related measurement methods and certification | • Capacity building, training, workshops<br>• Networking |
| **Consumption** | Regulations and financial incentives for consumption<br>Green procurement<br>Ethical consumption | • Programs and incentives for consumers<br>• Green procurement policies<br>• Ethical consumption guidelines<br>• Mobile apps for green products, services, and other resources | • Demo projects<br>• GP visualization |

# THE GP 2.0 AND ROADMAP

The approaches, enablers, and methodologies outlined in Table 9 for GP 2.0 are tailored to specific sectors, featuring distinct time frames and weights for each approach. This delineation is crucial for addressing prioritization and resource allocation challenges. The activities presented in Table 9 are recommended for the APO members to advance GP in the coming decades. However, these proposed activities and training initiatives necessitate further updates through fundamental research, investigations, and planning to serve as guiding tools and backups. A comprehensive GP 2.0 ecosystem can be systematically developed to create positive feedback loops.

While proposing the following key aspects of the roadmap, namely the future action plans, TWG members considered the APO mandate and developed the activities at broader and individual approach levels. This included developing the GP 2.0 ecosystem and creating the Project Bank. The vital inputs and recommendations from the GPA Council were crucial in fundamentally defining the activities under GP 2.0 Roadmap.

Besides the effective implementation of the activities proposed under the GP 2.0 Roadmap, the overall success of expanding the GP requires increased awareness and dissemination of the initiatives implemented under GP 2.0. This awareness and dissemination effort calls for the involvement of relevant stakeholders, including the APO Secretariat, senior staff of National Productivity Organizations, and policymakers from various APO members, to share positive outcomes, learnings, challenges, and best practices during an international conference, ideally every three years.

GP 2.0, which includes the GP 2.0 ecosystem and a Project Bank, expands the applicability of the GP concept beyond manufacturing to services, consumption, and agriculture sectors. It also deepens the concept by providing additional tools and pathways to achieve overall socioeconomic development. The primary aim of GP 2.0 is to build capacity at the individual level, strengthen triple bottom lines at the organizational level, and facilitate informed decision-making at the policy level through the development of systems, schemes, digital tools,

and databanks. This will be achieved through the involvement of sector-specific technical experts, government institutions, academia, and think tanks.

## Development of the GP 2.0 Ecosystem

The GP 2.0 ecosystem is aligned with the approaches and enablers identified at a broader level. The key elements proposed for implementation include the development of GP mapping, GP rating, GP management systems, GP manuals and guidebooks, GP databases, GP reporting systems, and GP labeling. All these elements complement each other and will strengthen the existing APO Certification Scheme for Development of GP Specialists. They also enhance the role of the APO in providing solutions for overall socioeconomic development at the regional level, with productivity enhancement at its core while facilitating the decoupling of industrial development from environmental degradation.

To establish a complete GP ecosystem, specific research activities must be undertaken within the APO Secretariat for future use by all members. Areas for further research include, but are not limited to, the following.

### GP Mapping

**Definition:** Accurate visualization of the existing status of policies and efforts related to GP, including variations in environmental degradation, resource exploitation, GDP, GHG emissions, employment, and social justice compared to productivity.

**Requirement:** Establish key data points and parameters for data collection, visualization, and analysis to gain insights into the implications of efforts and linkages with net-zero emission targets.

**Proposed Implementation Time Frame:** 2025–26 (12 months).

**Target:** Policymakers.

**Deliverable:** An online APO GP map.

**Benefits:** It will help policymakers make informed decisions on productivity enhancement, environmental protection, human resources development, and

economic prosperity at the national level. It will also allow them to learn about initiatives among other APO members, providing policy draft benchmarks.

### GP Rating System

**Definition:** A tool designed to assess the overall GP performance of organizations.

**Requirement:** Define KPIs using measurable, reliable data inputs.

**Proposed Implementation Time Frame:** 2025–26 (12 months).

**Target:** SMEs.

**Deliverable:** The APO GP Rating tool.

**Benefits:** APO GP Specialists can act as consultants to rate the existing performance of SMEs. They will be able to determine their existing baseline performance and work to identify gaps for improving their ratings. The database of participating enterprises across APO members will allow benchmarking among SMEs at the regional level and serve as a basis for the APO to develop demonstration and Technical Expert Services (TES) projects.

### GP Database

**Content:** A database on nature-based, carbon-neutral, carbon-positive, and environment-friendly products, services, and technologies.

**Requirement:** Establish a convenient database to enhance enterprises' performance and assist APO Certified GP Specialists in identifying relevant options for implementation at the ground level.

**Proposed Implementation Time Frame:** 2025–26 (12 months).

**Deliverables:** A database published biennially.

**Benefits:** APO members Japan, the ROC, the ROK, and Singapore utilize many products, services, and technologies that contribute to decoupling industrialization

from environmental degradation. This database will facilitate the transfer of technologies and service delivery methods and the adoption of nature-based, carbon-neutral, and carbon-positive products across APO member societies.

### GP Guidebooks

**Objective:** Tailoring GP 2.0 methods for different industries needed to develop industry-specific manuals and guidebooks.

**Proposed Implementation Time Frame:** 2025–27 (24 months).

**Target:** Professionals working on environmentally friendly business growth and APO Certified GP Specialists.

**Deliverables:** A set of comprehensive references on GP frameworks for various industrial sectors.

**Benefits:** Similar to the APO training manuals and handbook on GP 1.0, these guidebooks will serve as an information bank on GP and enhance the capacity of GP specialists seeking certification. The APO could further implement multi-country projects to develop and enhance the capacity of participants working on climate change mitigation across APO member countries.

### GP Management Systems

**Definition:** Protocols for organizations to follow, comprehend, document, become certified in, and improve their performance in GP.

**Principle:** Emphasizes continuous improvement, with clear statements and status reports as essential components.

**Proposed Implementation Time Frame:** 2026–28 (24 months).

**Target:** SMEs.

**Deliverables:** A guide and manual on GPMS and their implementation.

**Benefits:** GP specialists can act as consultants to implement the management systems. For SMEs, it will help bridge the gaps identified in GP ratings, thereby

strengthening their triple bottom lines. The APO could implement demonstration projects to showcase the positive outcomes of successfully implementing GPMS.

### GP Reporting System

**Definition:** A reporting system for enterprises to use when disclosing information on projects, outcomes, and financial expenditures, focusing on productivity and quality enhancement, human resources well-being, and safety improvement in environmental performance.

**Requirement:** Establish key measurable parameters for disclosure based on pillars of the GP concept.

**Proposed Implementation Time Frame:** 2026–28 (24 months).

**Target:** SMEs.

**Deliverables:** A handbook and training manual on the GP reporting system.

**Benefits:** GP specialists can act as consultants to help businesses prepare reports. SMEs can use disclosure reports to establish themselves as productive and environmentally responsible organizations, gaining access to financing for further business growth. The APO can implement various demonstration projects among members to showcase the implementation procedures and positive outcomes. Other projects, such as Bilateral Cooperation between NPOs (BCN) and Individual-country Observational Study Mission (IOSM), could also be offered to facilitate the sharing best practices among the APO members. This would foster the adoption of green, carbon-neutral, and carbon-positive products, services, and technologies in society across the APO members.

### GP Labeling Scheme

**Definition:** A GP label to certify that a product, service, or technology adheres to the principles of GP.

**Requirement:** Establish KPIs and measurable parameters to rate performance.

**Proposed Implementation Time Frame:** 2027–28 (12 months).

**Deliverable:** A manual on the GP labeling scheme.

**Benefits:** The GP label will encourage the development of green supply chains. It will also empower consumers and end-users by promoting ethical consumption through informed decision-making when procuring products or services. Enterprises can use the GP label as a unique selling point to differentiate their products, services, or technologies. The APO could implement demonstration and TES projects related to the labeling scheme, followed by IOSM and BCN projects to facilitate sharing best practices. This would foster the adoption of green, carbon-neutral, and carbon-positive products, services, and technologies across the APO member societies.

Organizations can be engaged to determine the budget implications and time frames required based on discussions with experts. It is suggested that GP mapping be initiated first, followed by the development of guidebooks, rating systems, and databases. Management systems, reporting, and labeling should be further developed. Figure 6 summarizes all the key elements of the GP 2.0 ecosystem, including the proposed development timeline for each element, and illustrates the inter-linkages between them.

In addition, the GP rating system should be developed for businesses, especially SMEs in the manufacturing sector, and subsequently for the service and agriculture sectors. This would allow for the effective mobilization of financial and human

**FIGURE 6**
**THE GP 2.0 ECOSYSTEM.**

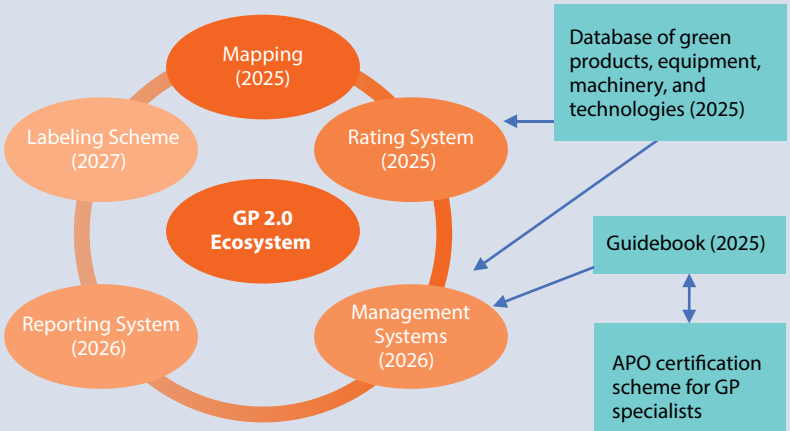

**TABLE 10**

**THE OUTLOOK OF THE GP 2.0 ECOSYSTEM.**

| | GP 2.0 Ecosystem | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Mapping** | **Guidebooks** | **Rating System** | **Database** | **Management Systems** | **Reporting System** | **Labeling Scheme** |
| Definition | Visualization of policies and efforts at national level on GP | Tailoring GP 2.0 methods for different industries | Assessing the overall green productivity performance of organizations | Database on ecoproducts, services, and technologies | Protocols for organizational-level GP performance enhancement | A reporting system for enterprises to disclose related information | A labeling system for GP confirmation |
| Proposed Time Frame | 2025–26 (12 months) | 2025–27 (24 months) | 2025–26 (12 months) | 2025–26 (12 months) | 2026–28 (24 months) | 2026–28 (24 months) | 2027–28 (12 months) |
| Target | Policymakers | Professionals across the APO members | SMEs across the APO members | SMEs across the APO members | SMEs across the APO members | SMEs across the APO members | SMEs across the APO members |
| Deliverable | An online GP Map | Industry-specific comprehensive material on the GP framework | APO GP Rating tool | A database book published on a biennium basis | A guide and manual on GP Management Systems | A handbook and training manual on the GP Reporting System | A manual on GP labeling scheme |

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| GP 2.0 Ecosystem | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Mapping** | **Guidebooks** | **Rating System** | **Database** | **Management Systems** | **Reporting System** | **Labeling Scheme** |
| Benefits | Assisting policymakers in informed decision-making. | Providing an information bank on GP for the APO GP Specialists | • Ascertaining enterprises' existing baseline performance and the gaps to improve<br>• Providing a base for demonstration and TES projects | • Transferring and adopting green or ecoproducts, technologies, and services for sustainability | A ready reckoner for the APO GP Specialists in improving enterprise-level triple bottom line. | Leveraging the disclosure report to gain access to finances for SMEs | • Fostering green supply chain development<br>• Promoting ethical consumption<br>• Providing a selling point for enterprises |

resources. Moreover, as GP 1.0 primarily focuses on manufacturing, existing GP tools and techniques can be referenced while developing the GP rating system for manufacturing SMEs. Similarly, the development of GPMS could be initiated for the manufacturing sector and later expanded to the agriculture and service sectors.

## Project Bank Under GP 2.0

Based upon the approaches identified, the TWG members proposed 29 projects as the initial Project Bank, as summarized in Table 11. Further the 30 approaches and their corresponding enablers, technologies, and methodologies provide an ideal basis for the APO Secretariat to develop additional projects beyond the initial list.

The Project Bank has been created to address the gaps identified at the corporate and regional levels. Country-specific projects may be devised to meet the needs at the individual country level.

**TABLE 11**

**POTENTIAL PROJECT LIST.**

| No. | Sector | Title | Approach | Type of Project |
|---|---|---|---|---|
| 1 | All | Principles and Best Practices of the Sufficiency-based CE | Sufficiency-based CE | Multicountry Observational Study Mission |
| 2 | | Linking ESG with the SDGs by Innovative Business Models | ESG | Multicountry Observational Study Mission |
| 3 | | Bioeconomy Solutions and Technology Demonstrations | Bioeconomy | Multicountry Observational Study Mission |
| 4 | | APO Green Productivity Awards | Happiness Economy | Research and Demonstration |
| 5 | | Society 5.0 for Net-zero Emissions and Sustainability | Society 5.0 | Individual-country Observational Study Mission |

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| No. | Sector | Title | Approach | Type of Project |
|---|---|---|---|---|
| 6 | All | Leveraging GP to Help Youth Accelerate the Emergence of a Green, Sustainable Economy Aligned with the SDGs | SDGs | Research |
| 7 | | Better Business: Leveraging ESG to Enhance Green, Sustainable Finance Opportunities | ESG | Research and Multicountry |
| 8 | | Solid Waste Exchange for the Environmental Progress (SWEEP) Project | Sufficiency-based CE | Research and Demonstration |
| 9 | | Upscaling Plastic Waste | Sufficiency-based Circular Economy | Demonstration |
| 10 | | Turning Compostable Waste into Bioorganic Fertilizer | Bioeconomy | Research and Demonstration |
| 11 | Manufacturing | Research on Developing Green Productivity Management Systems | GPMS | Research |
| 12 | | Workshop on Enhancing Access to Finance for MSMEs for Technological Upgrading and Resource Efficiency | Regulations and Financial Incentives | Multicountry (Workshop) |

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| No. | Sector | Title | Approach | Type of Project |
|---|---|---|---|---|
| 13 | Manufacturing | Research on Adaptation Policies, Strategies, and Measures for Climate-resilient Industries | Adaptation to Climate Change | Research |
| 14 | | Stock-taking Research on National Ecolabelling Schemes and Green Public Procurement in APO Members | Eco/Green Labeling | Research |
| 15 | | Sectoral Research on Application and Adoption of Industry 4.0 in Manufacturing Sectors | Industry 4.0 | Research |
| 16 | | A Systems Approach to Better Small Business: How a Green Productivity Management Systems Can Enhance Prosperity | GPMS | Research |
| 17 | Agriculture | Study on Regulation of Smart Agricultural Digitalization and Tools in APO Members | Regulations on Water, Digitalization, and Tools | Research |
| 18 | | Conference on Reduction of Food Loss and Waste for Sustainable Food Systems | Circular Economy Practices | Multicountry (Conference) |

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| No. | Sector | Title | Approach | Type of Project |
|---|---|---|---|---|
| 19 | Agriculture | Study on Agriculture Waste Management and the Circular Economy | Circular Economy Practices | Research |
| 20 | | Study on Water Regulations and Governance for Enhancing Water Security in APO Members | Regulations on Water, Digitalization and Tools | Research |
| 21 | | Roadmap for Achieving Net-zero Emissions in APO Members by 2050 | Adaptation to Climate Change | Research |
| 22 | Services | Development of a Roadmap for Sustainable Supply Chains | Sustainable Supply Chain Management | Research |
| 23 | | Developing Sustainable Practices for Green Tourism | Green Tourism | Multicountry Observational Study Mission |
| 24 | | Assessing the State of Digital Maturity | Digital Technologies | Research |
| 25 | | Examining the Efficacy of Ecocapital in Standardizing Green Finance | Green Finance Tools and Standards | Research |
| 26 | | Appraising the Contributions of Smart Building Solutions to Sustainable Productivity Outcomes | Smart Building Management | Multicountry |

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| No. | Sector | Title | Approach | Type of Project |
|---|---|---|---|---|
| 27 | Services | Leveraging Blended Finance to Accelerate Innovation in SMEs to Meet the UN SDGs | Green Finance Tools and Standards | Research and Multicountry (Conference) |
| 28 | Consumption | Guidance and Best Practices on Green Procurement for SMEs | Green Procurement | Research |
| 29 | | The Art and Science of Ethical Purchasing for a Better, Greener World | Ethical Consumption | Research and Multicountry (Workshop) |

The future projects under GP 2.0 may not be limited to those listed in Table 11. After deliberations and discussions with relevant stakeholders, and based on the needs of the APO members, additional projects could emerge.

All the activities envisaged under the GP 2.0 ecosystem and projects can be targeted to be complete by 2030. However, the implementation timeline, including the year and the duration of the elements under the GP 2.0 ecosystem and projects are subject to change depending upon the emerging trends within the sustainability landscape, APO's internal approval procedures, KPIs that require more focus as outlined in the APO Vision, budget and resource availability, and standard operating procedures followed while planning and implementing the activities and projects.

# THE WAY FORWARD

The study process has made significant strides in understanding and advancing GP across various sectors. A comprehensive gap analysis was conducted focusing on green productivity across 20 APO member countries. This analysis identified critical areas for improvement and established a baseline for future progress. In addition to the gap analysis, the study outlined 30 approaches for GP 2.0, tailored specifically to the agriculture, manufacturing, services, and consumption sectors. These approaches include key enablers and technologies necessary for implementation, detailed timeframes for execution, and methodologies for conducting the initiatives.

Furthermore, a Project Bank was created, featuring 29 initial projects that exemplify these approaches. The study also introduced the GP 2.0 ecosystem, a comprehensive framework for integrating green productivity initiatives alongside supplementary schemes supporting the ecosystem's development and sustainability.

**FIGURE 7**

**FUTURE OUTLOOK FOR THE GP 2.0 INITIATIVE.**

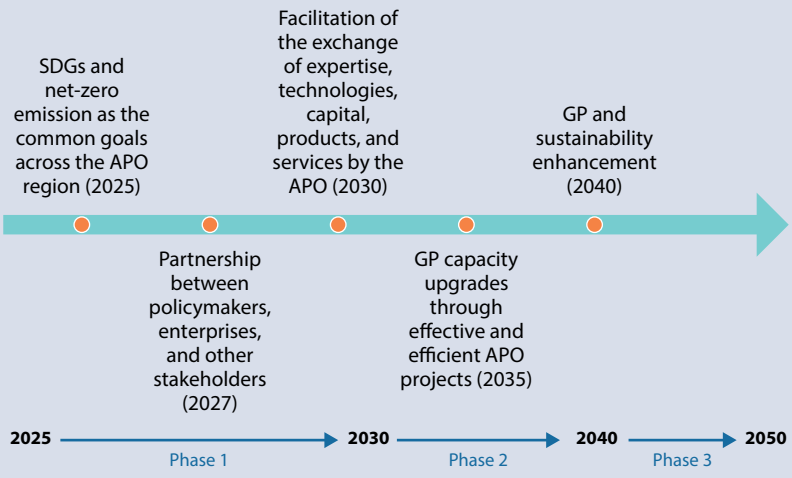

Figure 7 illustrates the strategic design of GP 2.0, a comprehensive protocol designed to guide sustainability efforts across all APO member countries over the next three decades. The protocol's initial goal is to achieve a uniform level of sustainability among member nations by 2025. This milestone will be marked by establishing robust partnerships between the public and private sectors, fostering collaboration and shared responsibility.

Looking ahead, the protocol aims to deepen the exchange of expertise, technologies, and capital, ensuring these resources are more readily available and effectively utilized by 2030. This maturation of knowledge and resource exchange aims to facilitate significant capacity upgrades across sectors, enabling member countries to elevate their sustainability practices to the next level with greater efficiency and impact.

# REFERENCES


APO. (n.d.). *Eco-products Directory.* APO. https://www.apo-tokyo.org/?s=eco+products&post_type=publications

APO. (2002). Green Productivity: An Approach to Sustainable Development. https://www.apo-tokyo.org/wp-content/uploads/2014/07/ind_gp_aasd-2002.pdf

APO. (2002). *Green Productivity Trainer's Resource Manual*. https://www.apo-tokyo.org/publications/green-productivity-training-manual-pdf-2-8mb/

APO. (2023). *Requirement for Green Productivity Specialists APO-GPS201*: 2023. https://www.apo-tokyo.org/wp-content/uploads/2024/02/APO-GPS-201_2023-Requirements-for-Green-Productivity-Specialists.pdf

Johannson, L. (2006). *Handbook on Green Productivity*. APO. https://www.apo-tokyo.org/publications/apo-handbook-on-green-productivity-pdf-7-6mb/

Lin, C. -H. (Ed.) (2022). *Green Productivity and Circular Economy: Complementary Approaches to Sustainable Development*. APO. https://doi.org/10.61145/TVMT3914

Lin, C. -H. & Bhardwaj K. D. (2020). *Green Productivity for the SDGs: Review of Emerging and Priority Needs.* APO. https://doi.org/10.61145/MMLU9967

# LIST OF ABBREVIATIONS

| | |
|---|---|
| AI | Artificial Intelligence |
| BCN | Bilateral Cooperation between NPOs |
| CE | Circular Economy |
| COE | Center of Excellence |
| CSR | Corporate Social Responsibility |
| EMS | Environmental Management Systems |
| EPIF | Eco-products International Fair |
| ESG | Environmental, Social, and Governance |
| GHG | Greenhouse Gases |
| GP | Green Productivity |
| GPA Council | Green Productivity Advisory Council |
| GPAC | Green Productivity Advisory Committee |
| GPMS | GP Management Systems |
| HSES | Health and Safety Environment Security |
| I.R. Iran | Islamic Republic of Iran |
| IOSM | Individual-country Observational Study Mission |
| IoT | Internet of Things |
| KPI | Key Performance Indicators |
| LCA | Life Cycle Assessment |
| MFCA | Material Flow Cost Accounting |
| ROC | Republic of China |
| RoI | Return on Investment |
| ROK | Republic of Korea |
| SME | Small and Medium Enterprise |
| SWEEP | Solid Waste Exchange for the Environmental Progress |
| TES | Technical Expert Services |
| TWG | Technical Working Group |

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## GREEN PRODUCTIVITY ADVISORY COUNCIL

### CHAIR

**Prof. Ryoichi Yamamoto**
*Emeritus Professor*
*The University of Tokyo, and*
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*Thailand*

**Dr. Indra Pradana Singawinata**
*Secretary-General*
*Asian Productivity Organization*

## GREEN PRODUCTIVITY 2.0 TECHNICAL WORKING GROUP

### CHAIR

**Dr. Chun-Hsu Lin**
*Director and Research Fellow*
*Center for Green Economy*
*Chung-Hua Institution for Economic Research*
*Republic of China*

### MEMBERS

**Prof. Esmaeil Fatehifar**
*Faculty Member and President*
*Sahand University of Technology*
*I.R. Iran*

**Alex Yap Yun Fung**
*Director*
*EcoLean Consultancy Sdn. Bhd.*
*Malaysia*

**Aftab Khan Masood**
*Deputy General Manager*
*Projects and Operations/Business Development Services*
*National Productivity Organization*
*Pakistan*

**Eric A. Raymundo**
*Environmental Practitioner*
*Raymundo Environmental Consultancy*
*Philippines*

**Dr. Athisarn Wayuparb**
*Assistant Prof. and Vice President*
*Mahidol University*
*Thailand*

**Dr. Ha Minh Hiep**
*APO Director for Vietnam and*
*Acting Director General*
*Commission for Standards, Metrology and Quality*
*Vietnam*

## GREEN PRODUCTIVITY EXPERTS

**Dr. Shaikh Tanveer Hossain**
*Director*
*Policy & Strategy*
*IFOAM-Organics Asia*
*Bangladesh*

**Lynn E. Johannson**
*President*
*E2 Management Corporation*
*Canada*

**K. D. Bhardwaj**
*APO Liaison Officer for India,*
*Group Head and Director – Environment and Climate Action, and*
*Group Head and Director – International Services*
*National Productivity Council*
*India*

**Dr. Koh Niak Wu**
*Founder and Chief Executive Officer*
*Cosmiqo International Pte. Ltd.*
*Singapore*

## APO SECRETARIAT

**Md. Zainuri Juri**
*Principal Officer*
*Program Directorate*

**Jittin Kapoor**
*Program Officer*
*Multicountry Programs Division 1*
*Program Directorate*

**Note:** The designations and organizational details of the GPA Council, TWG, and GP Experts are current as of September 2024.


APO