DELPHI SURVEY RESULTS

ISSUE 3.1: INDUSTRIAL PROCESSES

ISSUE 3.2: AGRICULTURAL PRACTICES

UNEP (The United Nations Environment Program) defined the green economy as follows: "A green economy is defined as low carbon, resource efficient, and socially inclusive. In a green economy, growth in employment and income is driven by public and private investment into economic activities, infrastructure, and assets that allow reduced carbon emissions and pollution, enhanced energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services."

Green economy encompasses various strategies, policies, and business models aimed at reducing negative environmental impacts, conserving natural resources, and promoting clean energy, all while fostering economic growth and job creation. Key strategies of a green economy may include:

3.1 Industrial Processes

3.2 Agricultural Practices

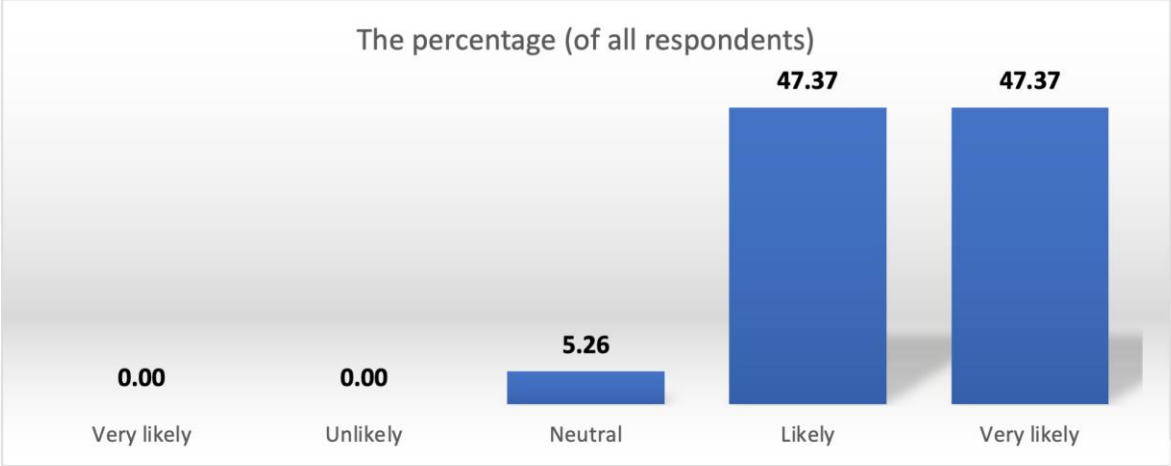
3.3 Waste Management

3.4 Green Tourism

3.1 Industrial Processes

In a green economy, industrial processes refer to the methods and techniques used in manufacturing and production that prioritize sustainability, resource efficiency, and environmental responsibility. These processes are designed to minimize negative environmental impacts while optimizing resource utilization and promoting cleaner, more efficient production methods.

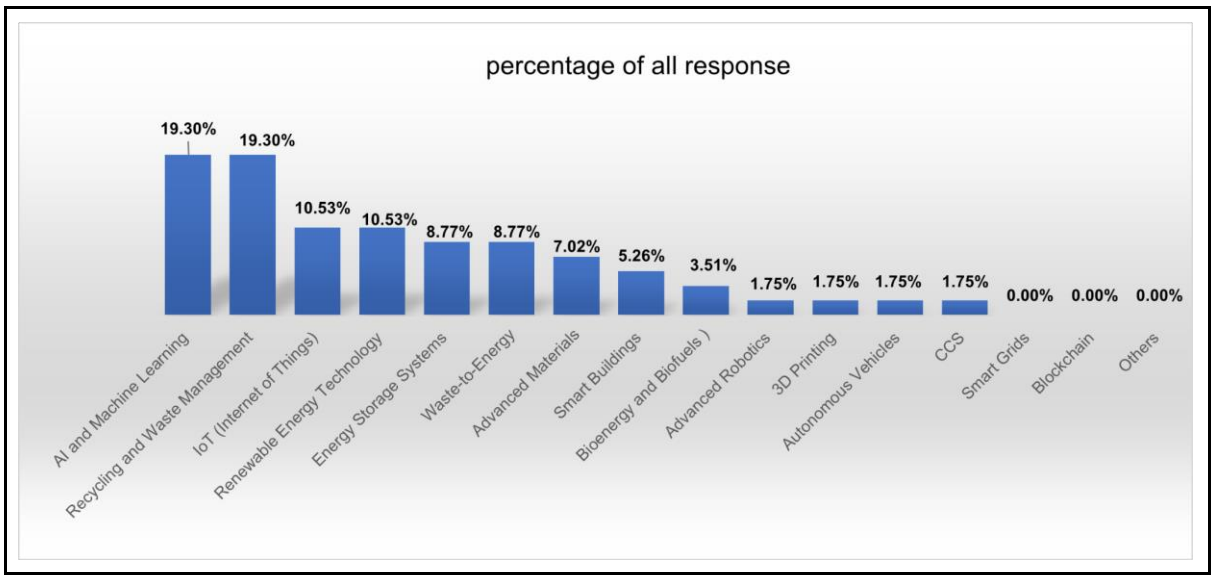
1. Based on your justification, how likely it is for sustainable manufacturing practices, such as waste reduction and resource efficiency, to be adopted for industries in the next decade?



Scale	Comments
Likely	● All stakeholders are aware of this issue, especially from Government Policy and other regulations related to sustainability. ● Waste is a new resource
Very likely	● Tackling climate change, more and more countries and areas committed to a net zero emission target. According to IEA, the industry sector in 2022 was directly responsible for emitting 9.0 Gt of CO2（Including process emissions but not including indirect emissions from electricity）, accounting for a quarter of global energy system CO2 emissions. Sustainable manufacturing practices will be essential to achieve net zero emissions. Technologies have been developed and applied for this purpose. ● Even now companies realize and are implementing sustainable manufacturing practices like waste reduction, recycling to reduce cost for waste disposal and raw material cost. With the global trend in reducing environmental impact e.g. GHG emission on carbon footprint products and organization, more and more companies especially along the supply chain will move towards that practice. ● Due to the higher cost for production, improving efficiency will be a

	must for future industries. Moreover, capitalizing on industrial effluents will become a normal norm in industries to improve its competitiveness

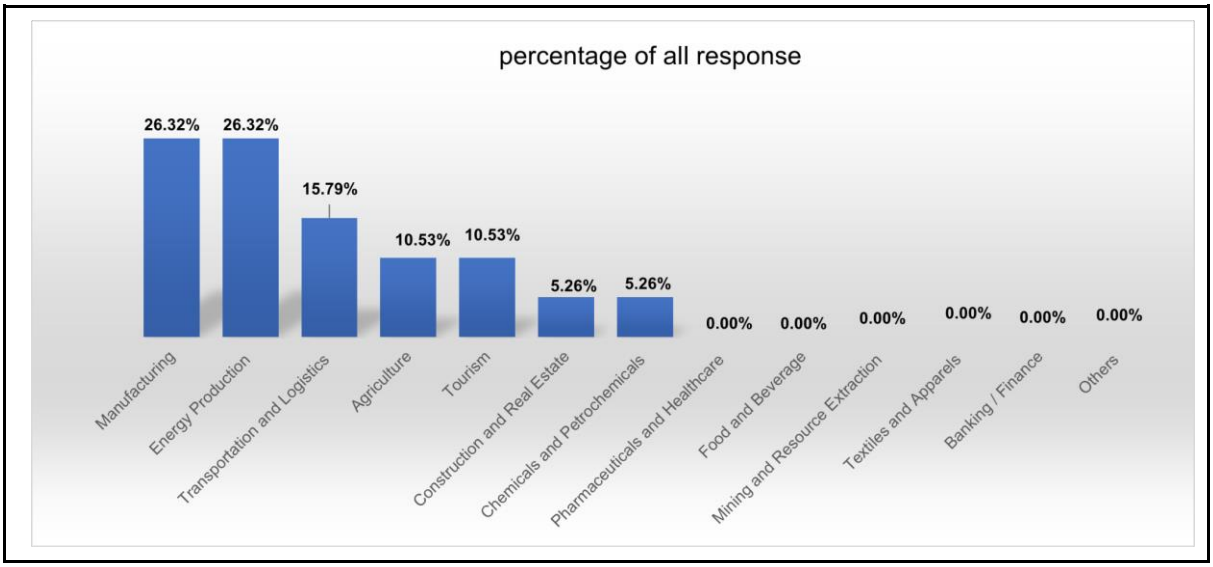
2. Based on your justification, please select three technologies that have the potential to significantly improve industrial efficiency in the green economy.



Technologies	Comment
AI and Machine Learning	● The application of automation and information technologies has greatly improved the efficiency of industrial processes. The development of AI and machine learning has shown the potential to further optimize process management, improve operational stability, and promote the efficient use of energy and resources. ● AI and machine learning can facilitate stakeholders to reduce energy consumption and also provide the most effective way for low carbon industry. ● Process management must include a good harmony in tasks and work
Recycling and Waste Management	● This issue is not only waste management, but also the origin of waste that requires the management to reduce waste from the beginning. After reducing the quantity of waste, waste separation can be employed for utilizing those wastes; e.g. recycling, reusing, or selling, and so on. ● Promoting technological innovation in waste recycling can not only reduce the cost of waste treatment for enterprises, but also make resource utilization of waste materials, which will improve the resource utilization efficiency. ● This includes all kinds of wastes (agriwaste, municipal wastes, industrial wastes) to be used for energy production and raw materials. This not only reduces wastes to disposal but also can replace the use of fossil fuels and materials. ● the proportions of sources and innovation opportunities ● Recycling and upcycling are quite popular in Brunei.
IoT (Internet of Things)	● A powerful tool to help monitor, control and manage energy consumption in an efficient way that is difficult for human to operate
Smart building	● The more we reduce energy consumption, the more efficient low-carbon activities we can do. Smart technology can help humans to manage electricity and reduce GHG. ● A few of smart buildings begins to show its benefits
Energy Storage Systems	● Energy production and demand will hardly be efficient, and storing the excess energy to be used when the demand spike is always necessary. However, the number of energy that can be stored per material volume or weight is still by far ideal. Therefore, better Energy storage system, in particular for cost and efficiency will support the industry to manage and utilized its Energy ● An important jigsaw to allow high ratio RE system to be possible ●

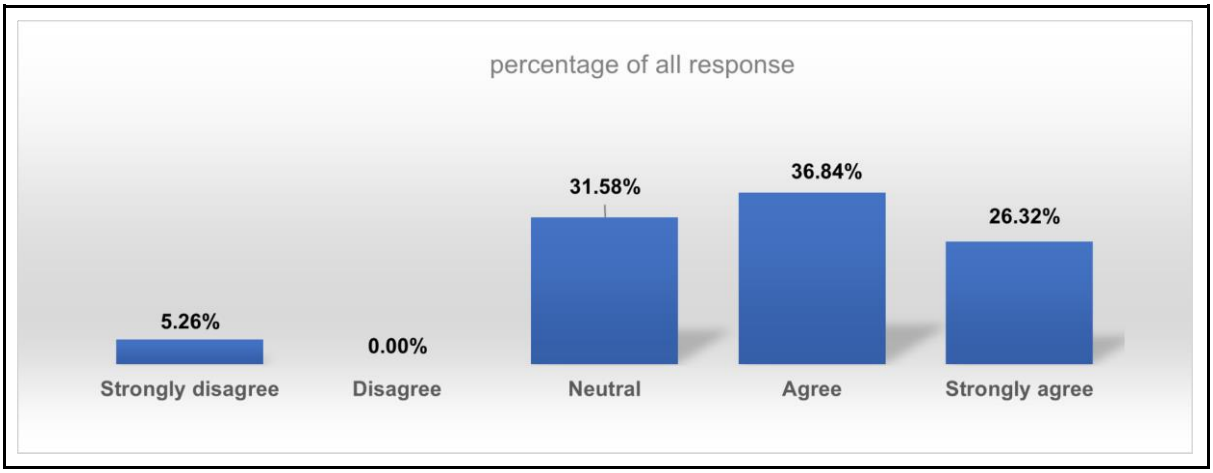
Waste-to-Energy	● These processes are permanent and it is a tendency, it must be possible to find diverse solutions by now ● There is no waste, instead, it is just an untapped resources. ●
Advanced Robotics	● The high efficiency, low cost and high accuracy of advanced robotics will effectively improve industrial efficiency.
Autonomous Vehicles	● Public transport demand needs enhancement
Bioenergy and Biofuels	● Improving efficiency in Bio energy production and utilization will provide better alternative for low cost industries in the future

3. Which industry sector would be most promisingly adopting green technologies?



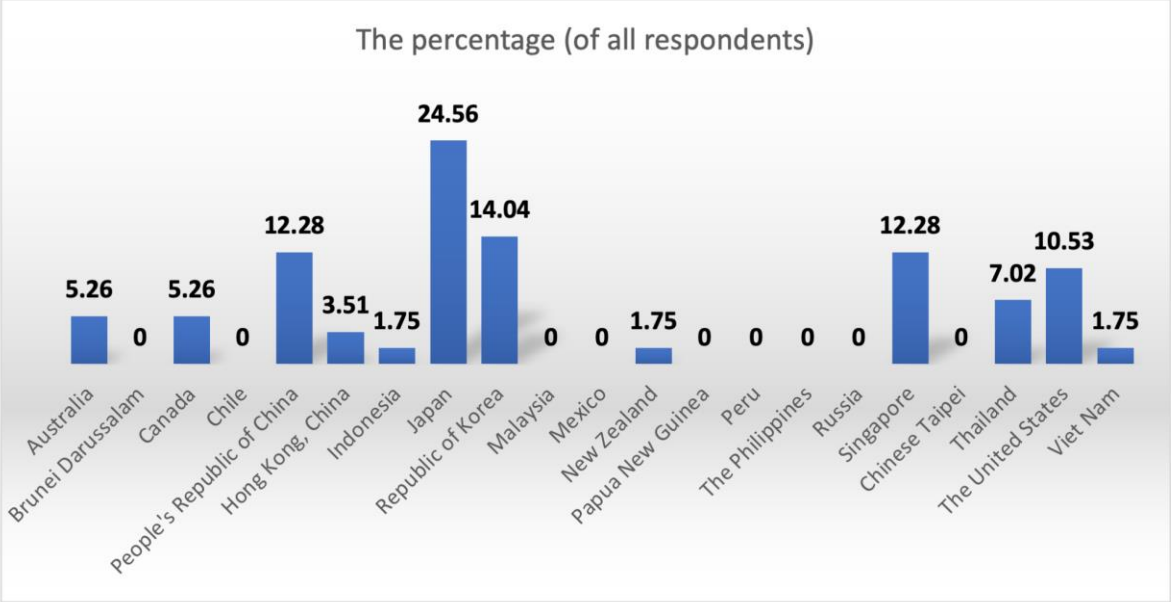
Industry sector	Comment
Energy Production	● Fossil fuel starts to deplete and requires an alternative energy generator. ● It is recognized that electricity generated from fossil energy is responsible for a huge amount of CO2 emissions. Electricity generated from renewable energy and nuclear power, and water electrolysis to produce green hydrogen have been developed and adopted by the industry. ● It is recognized that electricity generated from fossil energy is responsible for a huge amount of CO2 emissions. Technologies of electricity generated from renewable energy and nuclear power, and water electrolysis to produce green hydrogen have been developed and adopted by the industry. ● This industry is the basic infrastructure for other industries. Technologies have been developed although more research and innovation are still needed.
Transportation and Logistics	● This sector is the majority for providing GHGs. It's very difficult to reduce energy consumption or GHG from this sector.
Tourism	● locations are benefitted when tourism is sustainable, we need to invest in prevention and alerts for ambition levels standards ● This industry have a more flexible cost structure, and thus may opt to green energy easily

4. Do you agree that biggest challenge to implementing green industrial processes in capital investment?



Scale	Comment
Strongly agree	• Implementing green industrial processes requires budget and investment; therefore, it is a high cost for businesses to operate. Initial capital investment can support businesses to apply green industrial processes. • It will increase the burden for the investor to provide funding
Strongly disagree	• feasible studies on green industrial processes lies within the infant stage.
Agree	• Big capital investments are needed, but may be paid off sooner or later. For example, energy efficiency can reduce electricity bills.
Neutral	• Initial investment is an important factor in technology adoption, however, techno-economics will be more important. More than enough investment will be attracted to those projects with high internal return rate (IRR) or return on investment (ROI). • it needs to be through capacity building and investment - together as a strategy

5. Based on your justification, please select three APEC economies that have effective policies for industrial processes in the green economy?

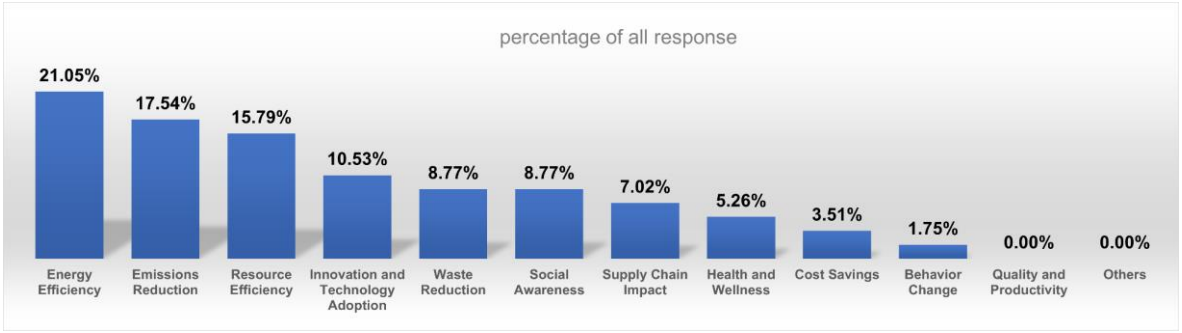


Economy	Comments
People's Republic of China	• In 2008, China faced big pollution problems and the Government developed a strategy for tackling this issue. Finally, China can mitigate GHG through strict policy and strategies. • Certain provinces introduced EV cars. • China announced the Dual Carbon Target in 2020. After that, a series of relevant policies from green technology, green finance, subsidy policies and industrial policies have been issued in China, including "National Clean Production Advanced Technology Catalog (2022)" ,"Green Industry Guidance Catalog (2023 Edition)" ,"Guidelines for the Construction of Carbon Neutral Standard System for Carbon Peaking in the Industrial Sector (2023 Edition)" and "Interim Measures for the Management of Energy Saving and Emission Reduction Subsidy Funds".These policies will promote the green transformation and upgrading of the industrial processes, promote the transformation from dual control of energy consumption to dual control of carbon emissions, and help reduce carbon emissions. • These are economies that heavily depend on external resources.
Thailand	• Thailand's government focuses on this issue and established a new department to manage climate change and environment issues in practicals. • Thailand has Bio, Circular, Green economy. There are financial incentives available for clean energy adoption e.g.

	soft loans. ● I need to learn more about the current opportunities
Canada	● There are many efforts to drive the green economy.
Singapore	● Strong public transportation. ● Singapore has implemented measures to encourage sustainable industrial practices and improve resource efficiency. The country focuses on enhancing energy efficiency in industries, promoting the circular economy, and adopting cleaner production technologies. Singapore also supports initiatives related to research and development in green technologies.
The United States	● Berkeley in California uses hydrogen to fuel public transportation. ● The American Recovery and Reinvestment Act of 2009 (ARRA) was an economic stimulus package with the primary goal of saving existing jobs and creating new ones. The ARRA's clean energy investments were primarily focused on areas of high-value investment to stimulate a sustainable economy. There were 11 tax incentives, primarily focused on promoting new technologies in renewable energy and advanced vehicle technology, but also providing strong support for energy efficiency. ARRA investments in the deployment of clean energy technologies have contributed to dramatic cost reductions for these same technologies. In addition, ARRA-funded energy efficiency projects helped build long-term economic and environmental resilience.
Japan	● Japan released the "Green Growth Strategy Through Achieving Carbon Neutrality in 2050" in June 2021, which sets high targets for the 14 industries identified as expected to grow, including energy-related industries such as next-generation renewable energy, transportation and manufacturing industries, and lifestyle-related industries. The Japanese government will draw up action plans from the perspective of both industrial and energy policies, and will take all possible and necessary measures to achieve the targets for each sector, including budget, taxation, finance, regulatory standardization and international cooperation. ● Japan has long been active in green growth strategy. ● These are economies that heavily depend on external resources. ● Japan has implemented various policies to promote energy efficiency and sustainability in its industrial processes. The country has initiatives to encourage the adoption of advanced technologies, such as energy-efficient equipment and smart manufacturing practices. Japan also places a strong emphasis on research and development in green technologies.

Indonesia	• Agriculture and social strategies are interesting.
Hong Kong, China	• These are economies that heavily depend on external resources
New Zealand	• Those ideas of progress that do not destroy balance are good lessons learned.
Republic of Korea	• South Korea has been actively working on green growth and sustainable development. The government has introduced policies to improve energy efficiency in industries, reduce greenhouse gas emissions, and enhance overall environmental performance. South Korea's emphasis on green technology innovation and investment supports its commitment to sustainable industrial processes.

6. Please select three indicators that should be used to evaluate the extent of green economy adoption?



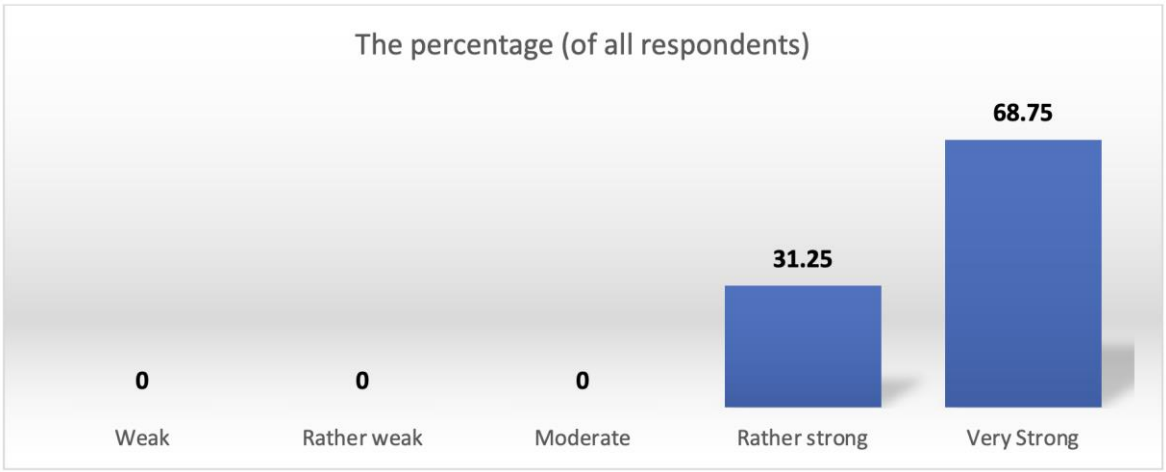
Indicators	Comments
Emissions Reduction	• This is the goal of running a green economy strategy. If waste, sewage water, electricity, and energy are reduced; then the emissions will be reduced. • One of the important development targets of the green economy is to achieve carbon neutrality, for which emission is an important indicator. The extent of emission reduction is important. • No environmental impact. •
Innovation and Technology Adoption	• Technology can help all stakeholders to manage waste, water, energy, and electricity. • Innovation and technology adoption are important to realize the reengineering of hard-to-abate industries to low- and zero-carbon processes. • Change must become easier to implement

Energy Efficiency	● The ability to understand consumption by the public. ● It is the basic support for any progress.
Waste Reduction	● To elevate environmental protection understanding
Cost Savings	● Capital depicts as top priority. ● Cost is fundamental in Economics.
Social Awareness	● Improving social awareness of green development will promote the adoption of a low-carbon lifestyle. Industrial players will have high tolerance for the economic feasibility of technologies due to social responsibility. ● Communities will opt to choose green energy if it can improve their social status.
Resource Efficiency	● A well designed process to use least resources and minimize waste. ● It is the quality challenge in a balance of the future.
Supply Chain Impact	● Sustainable sourcing
Health and Wellness	● Activities that promote health can be a promotional outcomes for green energy utilization

3.2 Agricultural Practices

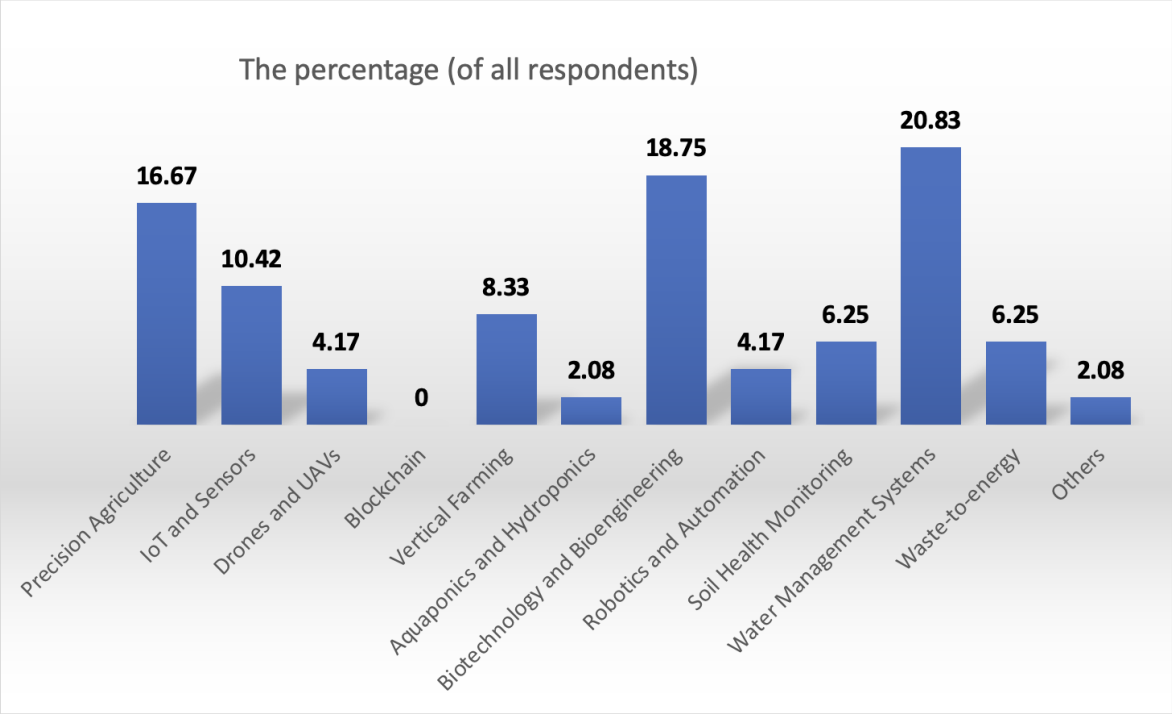
Agricultural practices in a green economy refer to the adoption of sustainable and environmentally friendly technologies and methods within the agricultural sector. These practices prioritize the efficient use of resources, minimize negative environmental impacts, promote biodiversity, and ensure long-term food security while supporting economic viability for farmers.

1. On a scale of 1 to 5, how strongly do you believe sustainable agriculture is essential to address global food security and environmental?



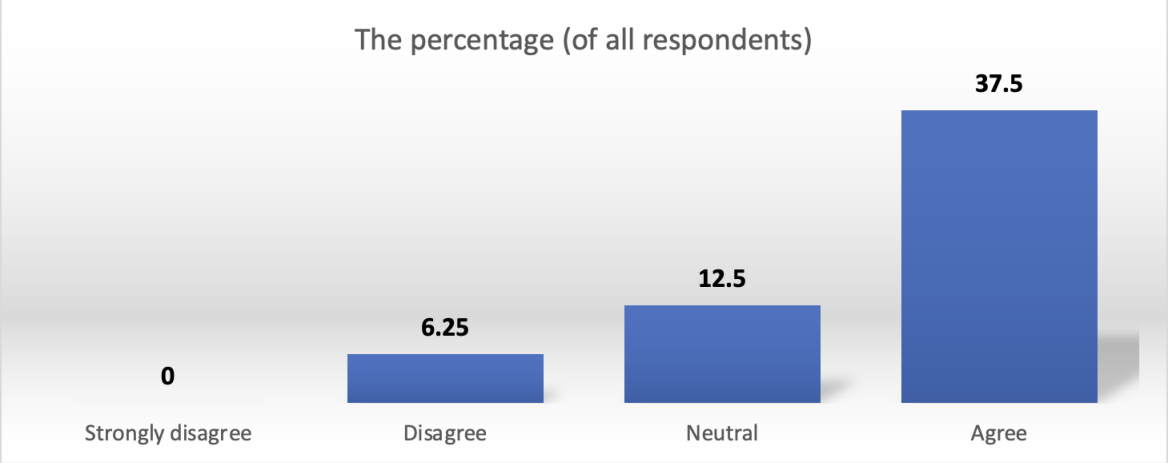
Scale	Comments
4. Rather strong	● high mechanization is changing many businesses .
5. Very strong	● Sustainable agriculture can lead to good food security and environmental challenges by using less chemical, energy or water. ● Resilient to climate, high productivity, food safety (i.e. non-toxic) and enabling supply chain are the keys for sustainability in agricultural and farmers.

2. Based on your justification, please select three technologies that have the potential to significantly enhance the sustainability of agricultural practices.



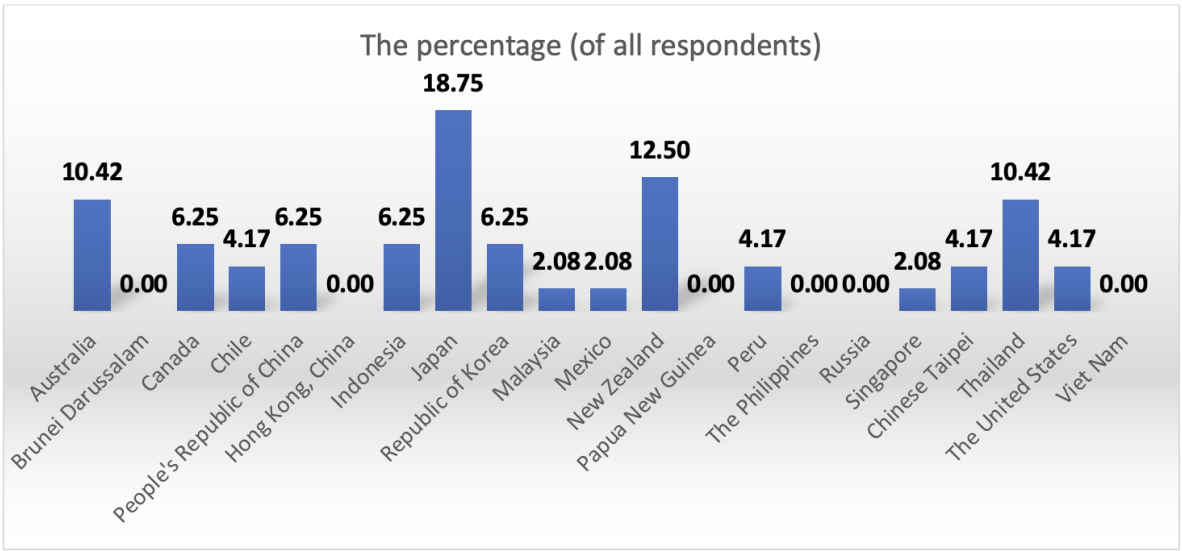
Technology	Comments
Water Management Systems	• Water is one of the important issues for running agricultural practices. • Efficiency in water management will change the quality for our river basisn Peruvian ancestral technology is a very good knowledge to rescue.
Biotechnology and Bioengineering	• To improve/develop varieties that have good yield and are suitable for various conditions.
Precision Agriculture	• No loss is the best strategy.
IoT and Sensors	• Farmers need tools to manage all things in agricultural practices that can drive sustainability. • Tool for farming management.
Drones and UAVs	• To use IoT and Sensors, drones and UAVs will support all works for agricultural practices.
Robotics and Automation	• Many tasks can be replaced and could lead us towards wellbeing
Others (Agriwaste Management)	• Not only waste to energy but also waste to other applications needed like fertilizers, soil moisture protection

3. Based on your justification, do you agree that accessing affordable smart-farming technologies is the challenging factor for small-scale farmers?



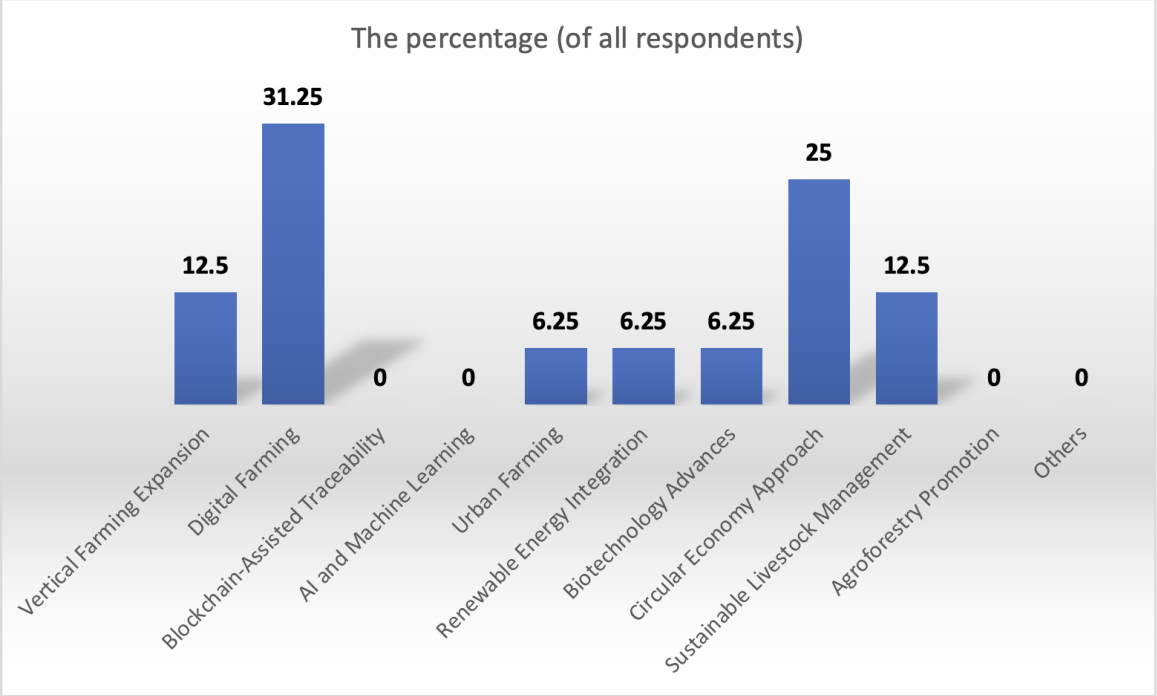
Scale	Comments
3. Neutral	• Suitability and acceptance of technology may be a more challenging factor. Sufficient knowledge and skills are also necessary to have.
4. Agree	• Rather than the cost of running smart farming, knowledge or skills to use the smart farming technologies is the obstacle for small-scale farmers. • Smart farming is probably what andean family farming need.

4. Please select three APEC economies that have effective policies for agricultural practices towards a green economy.



Economy	Comments
People’s Republic of China	● Many academic papers have reported on this issue recently.
Thailand	● As seen from the Government strategy and also research funding in this issue.
Japan	● Informed by media and other official documents.
Indonesia	● I think this county can give good advice
Malaysia	● They lost their forests and have shown great abilities to solution findings in order to recover from the impact
Peru	● Biodiversity is still important and genetically modified seeds have currently been banned in order to preserve Peruvian germplasm and biodiversity for ten more years
New Zealand	● New Zealand has implemented policies to encourage sustainable farming practices, with a focus on reducing greenhouse gas emissions from agriculture. The country has initiatives to improve soil health, enhance water quality, and promote biodiversity conservation. New Zealand's commitment to sustainable agriculture is reflected in its efforts to balance economic productivity with environmental stewardship.
Australia	● Australia has been working on sustainable agriculture practices, including initiatives to improve water management, soil conservation, and biodiversity. The government has implemented policies to promote precision farming, agroecology, and sustainable land management practices. Australia's focus on innovation and technology adoption in agriculture contributes to its commitment to a green economy.
Republic of Korea	● South Korea has policies in place to promote sustainable agriculture and reduce the environmental impact of farming practices. The government supports initiatives such as organic farming, integrated pest management, and conservation tillage. South Korea has also introduced programs to enhance the efficiency of water use in agriculture and promote eco-friendly farming methods.

5. Based on your justification, what would likely be the most significant change in agricultural practices towards a green economy in the next decade?



Technology	Comments
Digital Farming	• Digital farming can provide an alternative way of agriculture practices towards a green economy.
Urban Farming	• This could reduce transport, enhance access to food and lower other costs