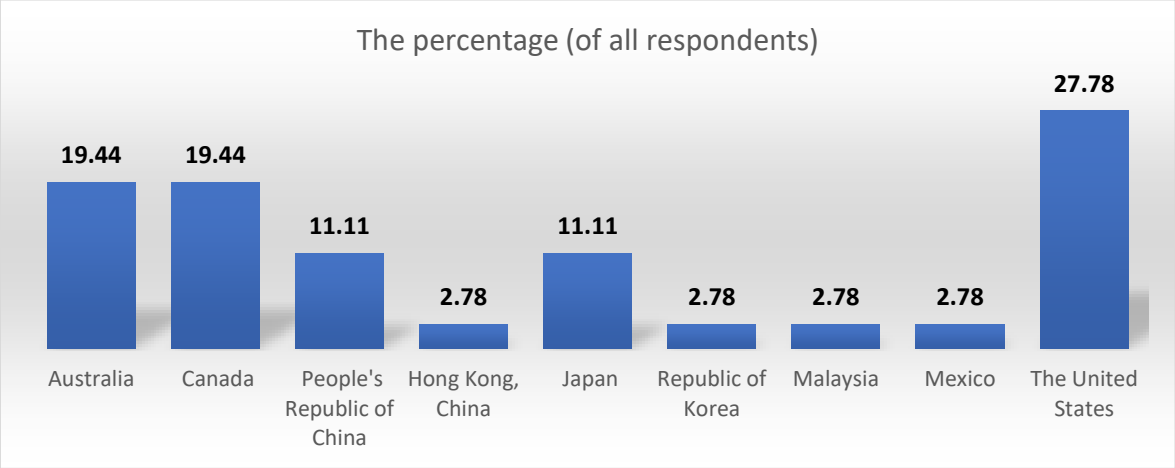
DELPHI SURVEY RESULTS
ISSUE 4:
CARBON EMISSION SINKS

Carbon emission sinks are natural or artificial mediums that can absorb and store carbon dioxide (CO2) for a long period of time and thereby remove CO2 from the atmosphere. Carbon sinks take up more CO2 from the atmosphere than they release.
This survey focuses on the aspects of carbon emission sinks encompassing
- 4.1 Carbon Capture, Utilization and Storage (CCUS)
- 4.2 Land-use practices

4.1 Carbon Capture, Utilization and Storage (CCUS)
Carbon Capture, Utilization and Storage (CCUS) refers to the process of capturing CO2 emissions from sources such as fossil power generation and industrial processes and either storing captured CO2 in permanent geological storages or using captured CO2 for various applications such as synthetic fuels and building materials.
Carbon Capture and Storage (CCS) is the process of capturing, transporting, and storing CO2 at a long-term storage location.

Carbon Capture and Utilization (CCU) is the process of capturing CO2 for further use in creating CO2-based products while maintaining the overall carbon neutrality of the production process.

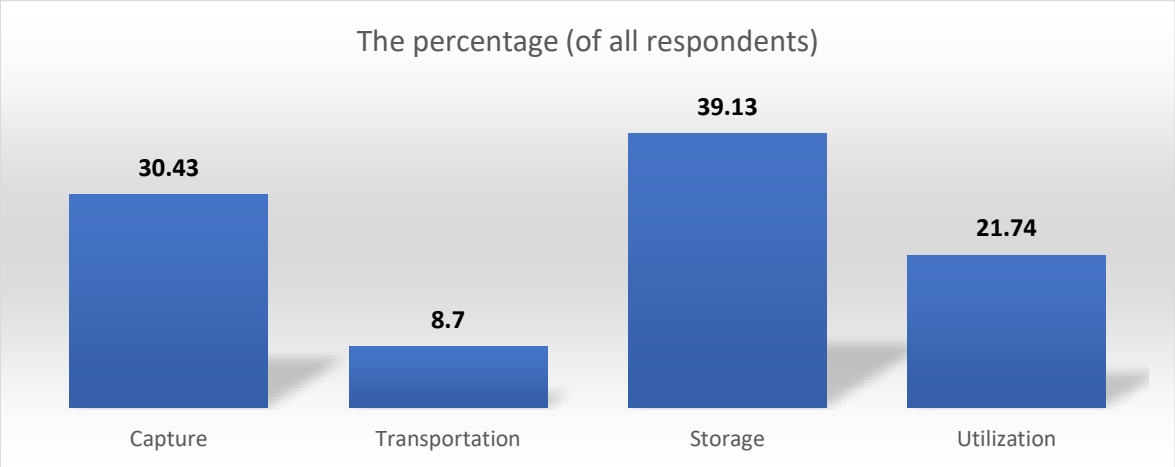
1. Based on your justification, please select three APEC economies that have effective CCUS policies.



Economy	Comments
The United State of America	• The US is the global leader in CCUS, accounting for more than 60% of global CO2 capture capacity and half of all planned capacity, underpinned by new policy incentives and a supportive investment environment. The majority of stationary emission sources in the United States are located close to potential geological storage sites: 85% of emissions come from plants located within 100 km of a site and 80% within 50 km. Total potential storage is estimated at 800 Gt, or 160 years of current US energy sector emissions.

Economy	Comments
	• The US provides field implementation with financial benefits and strong government regulations/incentives. • The U.S. government has supported research and development in this area.
Australia	• Australia has had an active role in CCS for some 20 years, primarily in the areas of geological storage, greenhouse gas monitoring and verification, provision of technical advice, and outreach and education. The Australian Government released 10 offshore areas for greenhouse gas storage assessment on 29 August 2023. Companies are invited to submit work program bids for acreage. Bidding closes on Tuesday 28 November 2023. • Australia has been involved in various CCUS projects and has shown interest in advancing technologies for carbon capture and storage. • Australia has more than a decade research, with field deployment and government funding scheme.
Canada	• Canada has been investing in CCUS research and development and has committed to reducing carbon emissions through various measures, including the promotion of CCUS technologies. • Canada has field implementation with financial benefits and strong government regulations.
Japan	Japan's roadmap to tackle the challenge of climate change is bold and ambitious. The most ambitious milestone calls for Japan to achieve net zero GHG emissions by 2050. This bold pledge sets Japan on a course to become Carbon Neutral in 30 years. One successful milestone is the Tomakomai CCS Demonstration Project, Japan's first full-chain CCS project, captured and stored CO2 from a coastal oil refinery on Hokkaido Island in Japan from 2016-2019.

2. What part of the CCUS processes require urgent technological development or breakthrough? (select at least one choice)

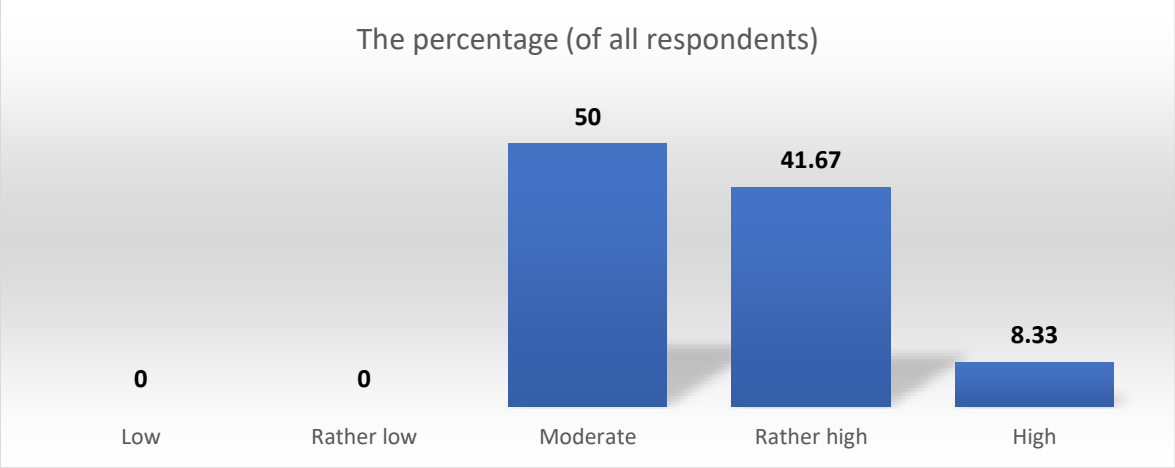


Process	Comments
Capture	• Carbon capture process is the first common step of both CCS and CCU. Furthermore, there is promising technical feasibility for capture process improvement, e.g. low-temp capture technology.

Process	Comments
	• There is a need for cheaper capturing cost, which potentially leads to more affordable implementation.

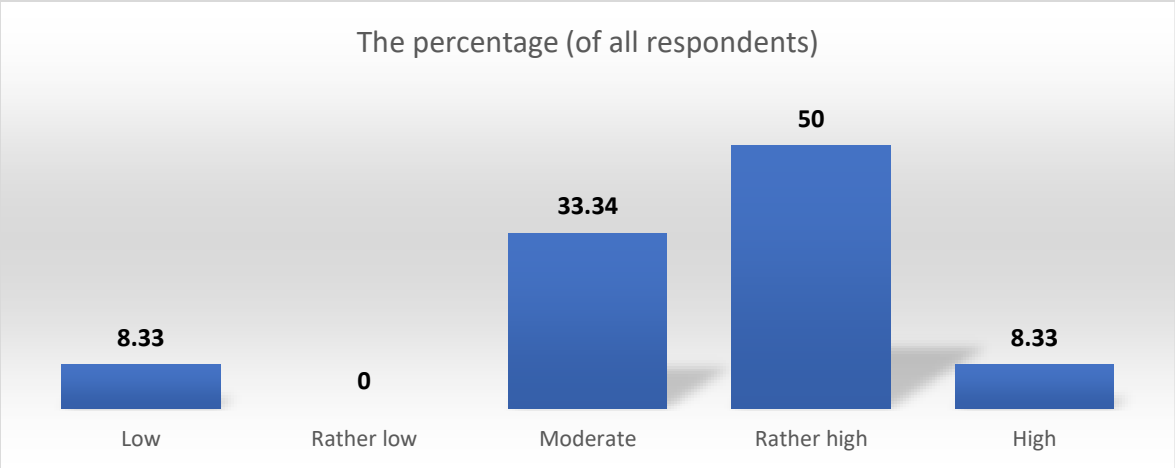
3. On a scale of 1 to 5, please rate the severity of the following bottlenecks for Carbon Capture and Storage (CCS) deployment in APEC.

a. Policy



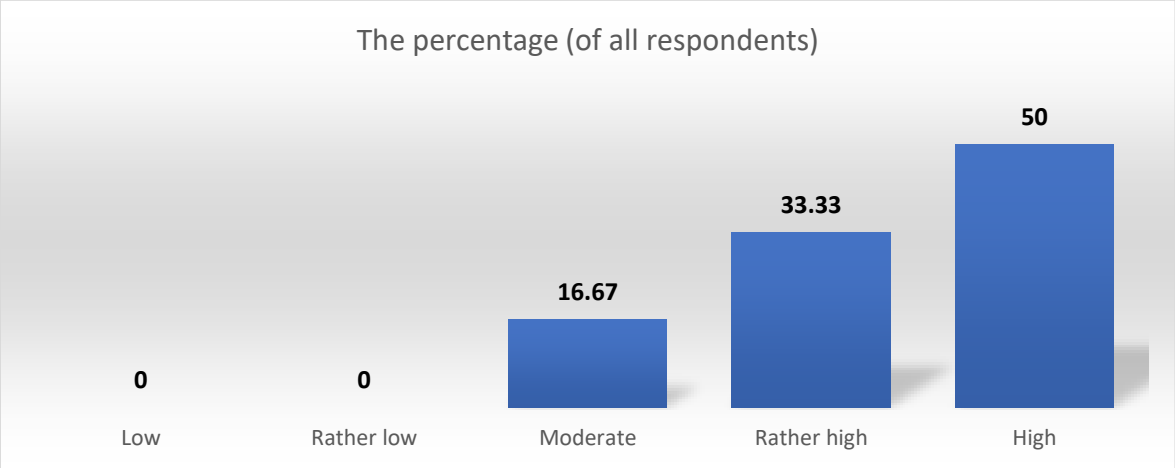
Scale	Comments
3. Moderate	Most of economic areas are still lack of directive policy.

b. Regulation



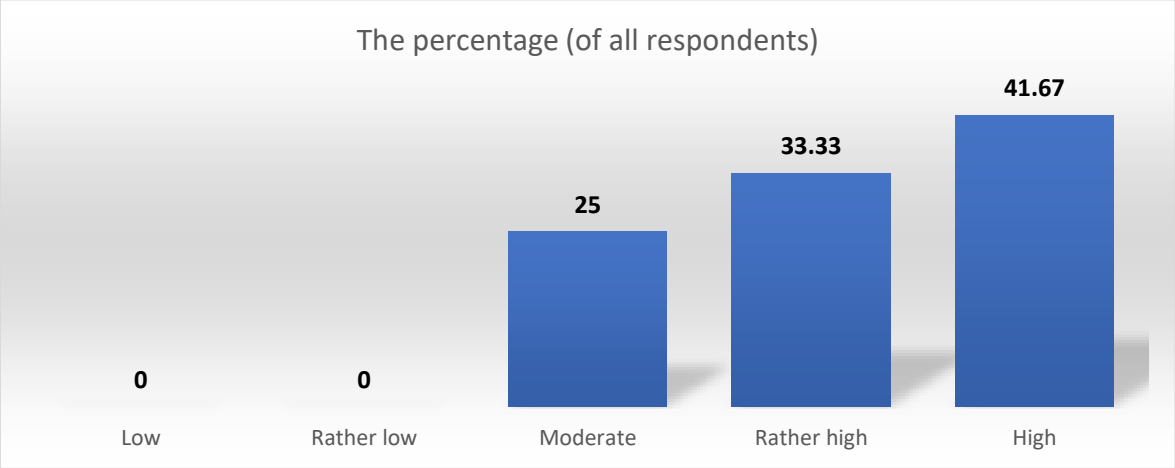
Scale	Comments
4. Rather high	Most of economic areas still lack of regulation.

c. Investment



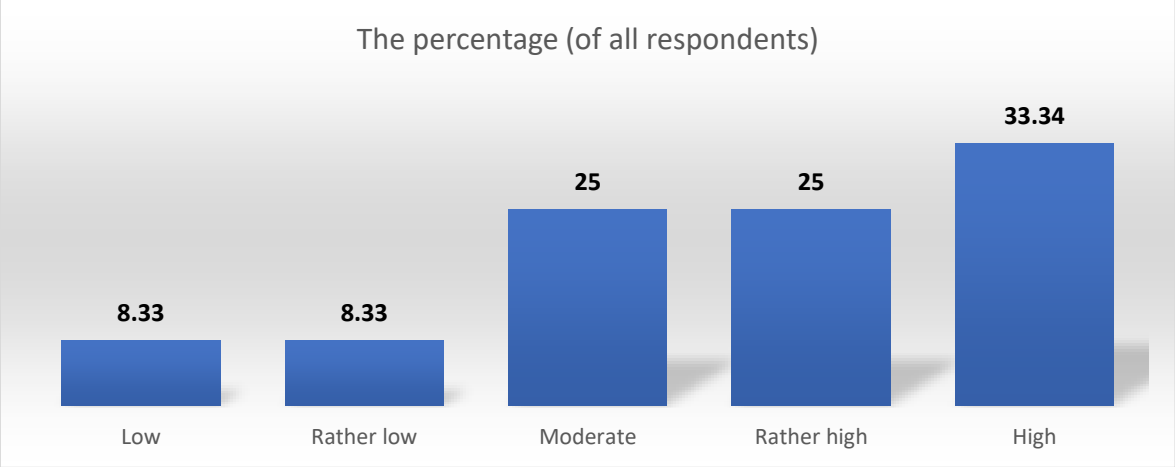
Scale	Comments
4. Rather high	Transboundary CCS needs clear policy and regulation in APEC which will facilitate cross-country investment.

d. Infrastructure



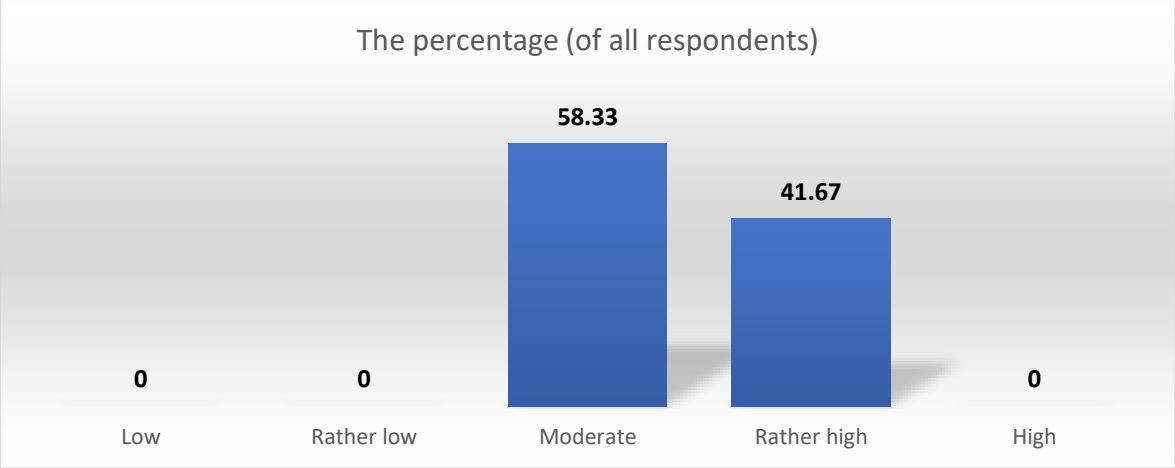
Scale	Comments
3. Moderate	Capture and transport infrastructures are still short of.

e. Technology



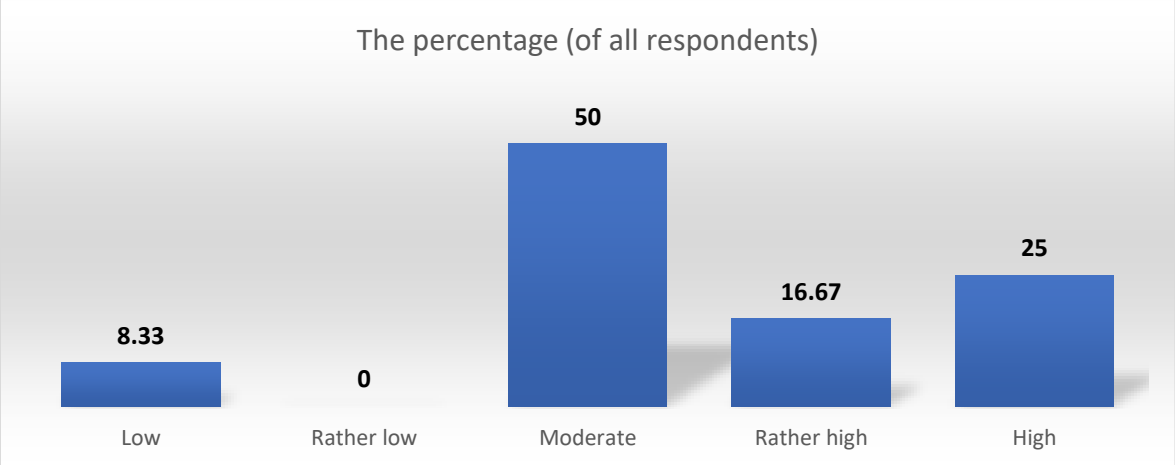
Scale	Comments
3. Moderate	Could be transferred/localized.

f. Manpower



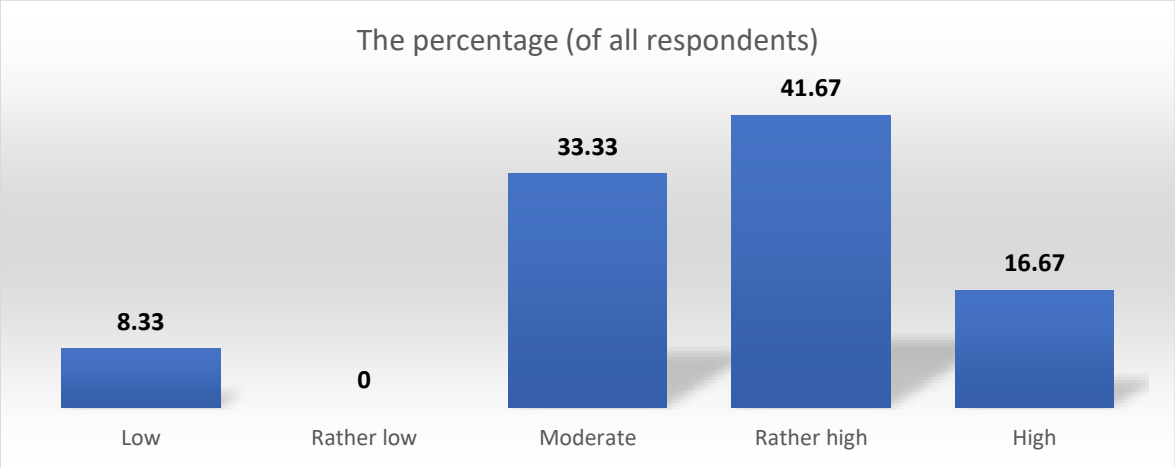
Scale	Comments
4. Rather high	Though some of the CCS chain can be conducted by current industrials or existing trained personnel, integrated knowledges and re-skilling coupled with specialties on CCS are still needed.

g. Safety concerns



Scale	Comments
5. High	Since no demo or pilot project is widely operated, safety concerns are far to be yet though of.

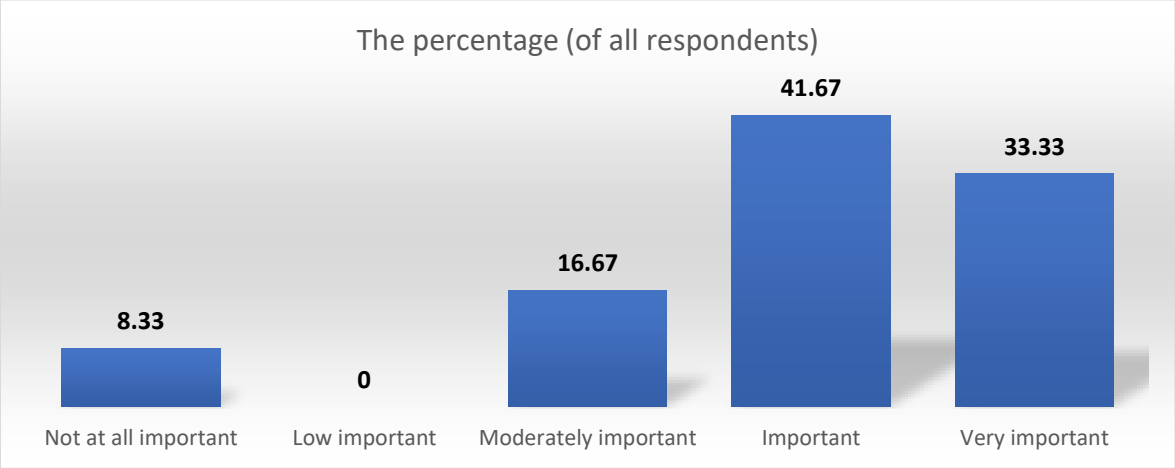
h. Public perception



Scale	Comments
4. Rather high	CCUS is not yet known to the public at large, then a little public perception has been addressed.

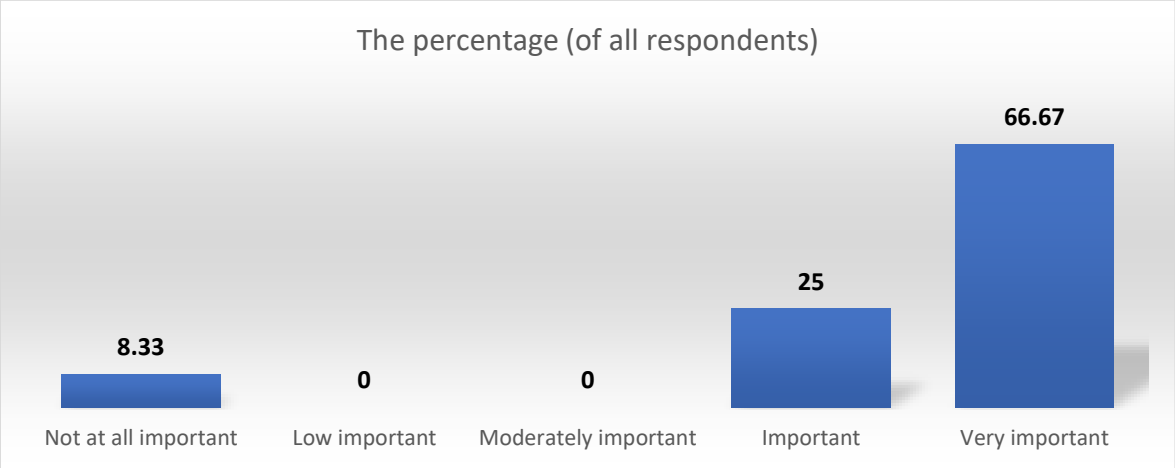
4. To what extent do you believe the collaboration among APEC economies regarding CCS are driving progress towards net-zero emissions?

a. CCS Infrastructure sharing



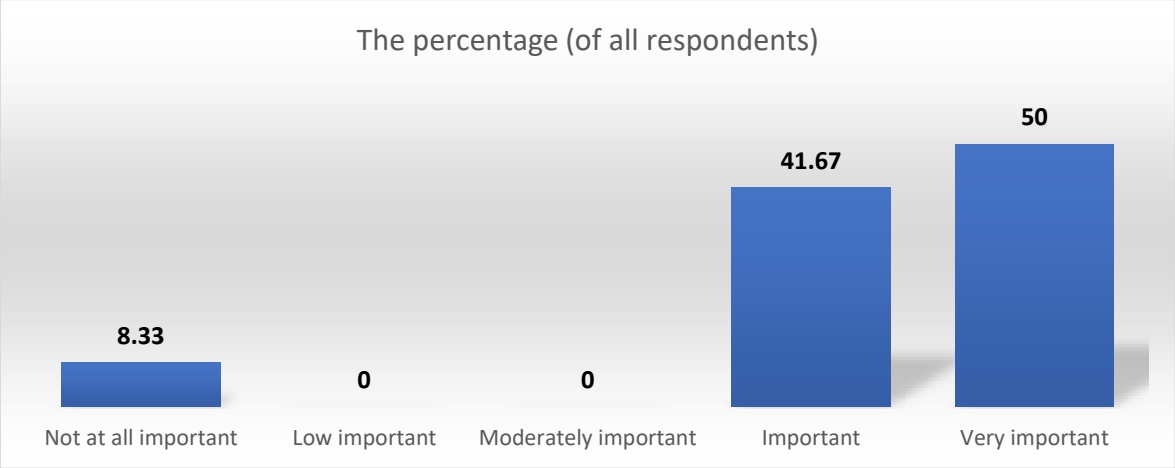
Scale	Comments
5. Very important	CCS is a big-scale industry - transboundary project with shared facilities needed.

b. Knowledge sharing



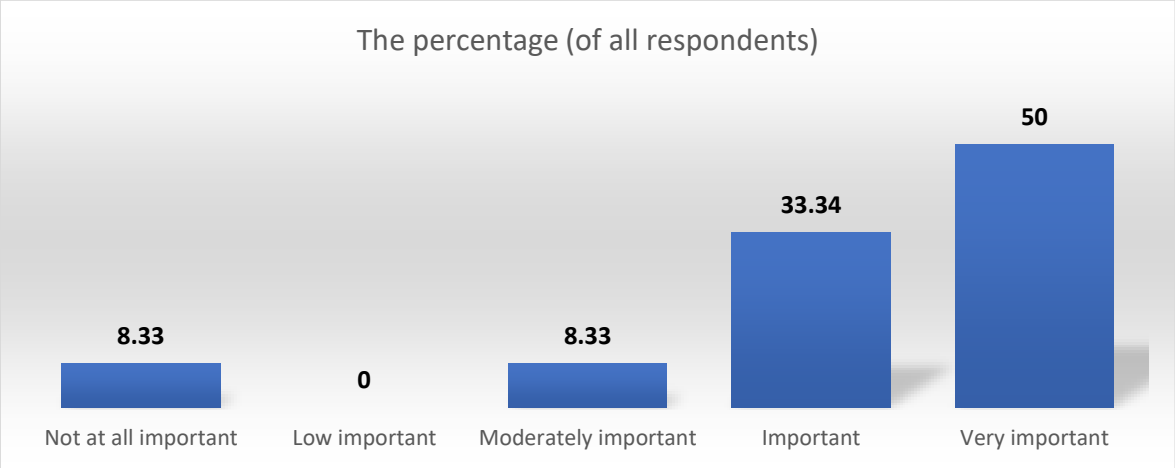
Scale	Comments
5. Very important	Some APEC areas have well developed CCS, while most of other areas have not done so but could benefit from knowledge sharing.

c. Technology transfer



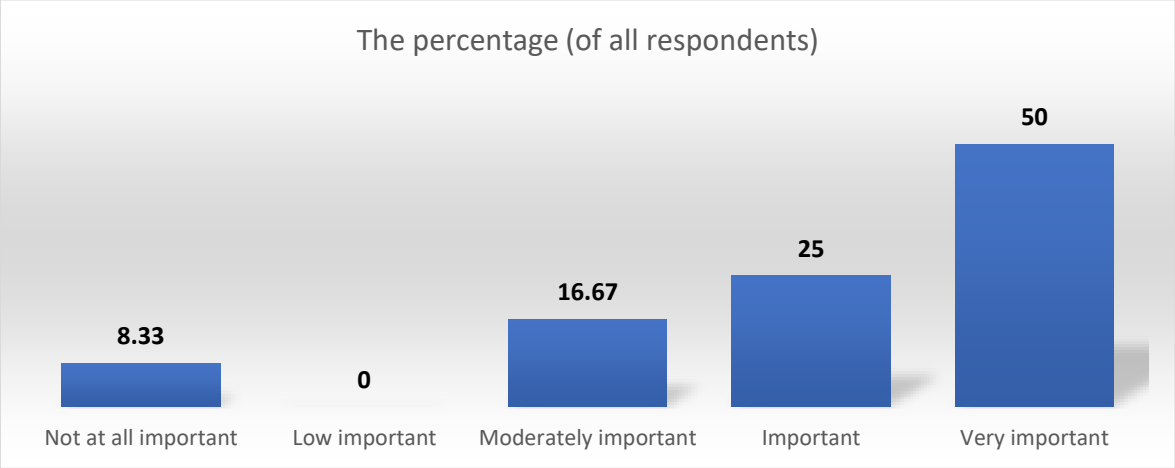
Scale	Comments
5. Very important	This will help and accelerate the knowledge and infrastructure sharing.

d. Capacity building



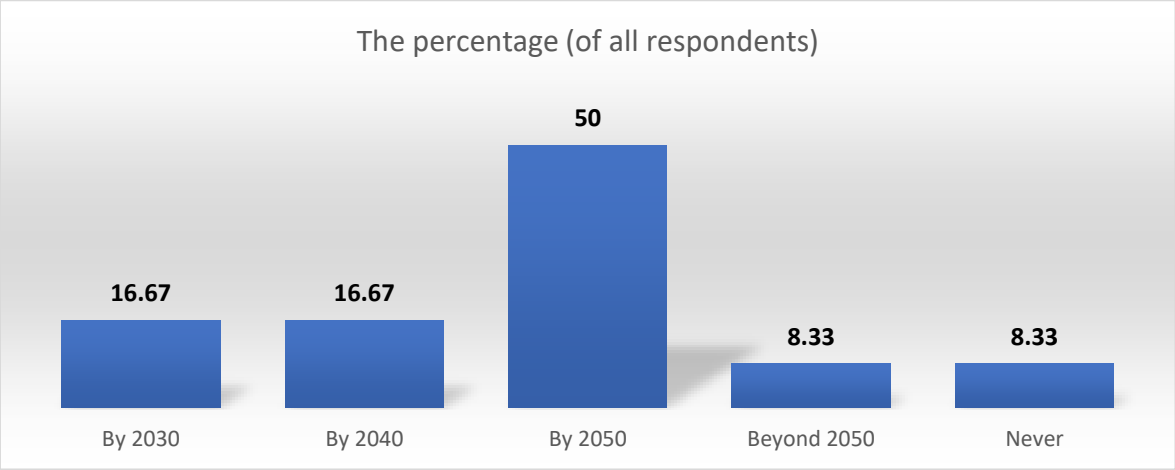
Scale	Comments
5. Very important	This will help and accelerate the knowledge and infrastructure sharing.

e. R&D collaboration



Scale	Comments
5. Very important	This will help and accelerate the knowledge and infrastructure sharing.

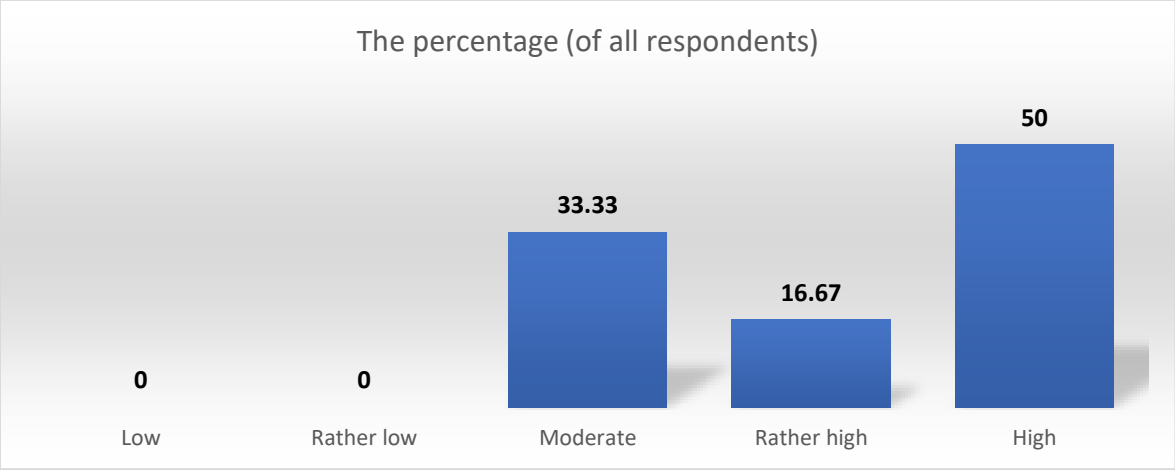
5. Based on your justification, when do you expect CCS to play a critical role in achieving net-zero emissions in APEC?



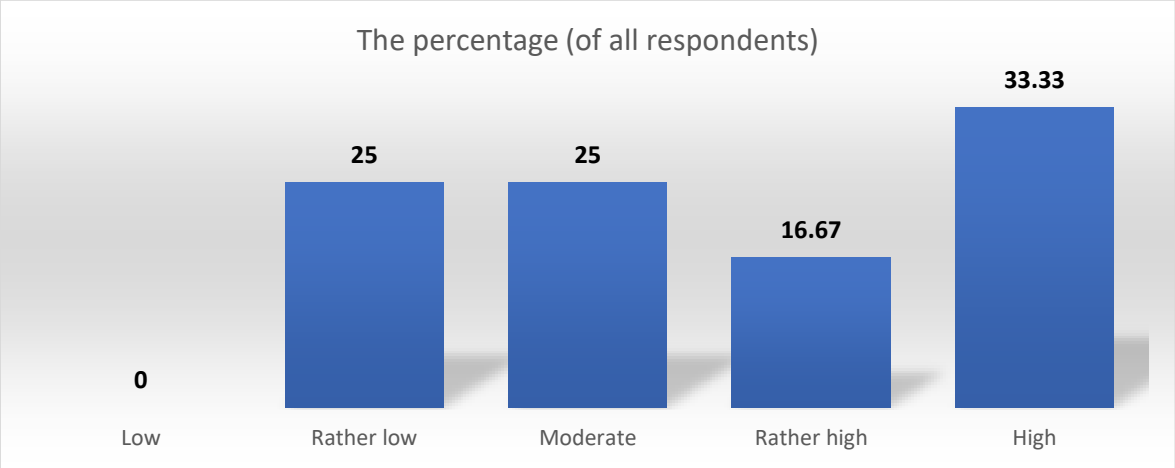
Scale	Comments
By 2050	Collaborations in every aspect are needed, but it takes time.

6. On a scale of 1 to 5, please rate the following collaborations that your economy requires from APEC economies, to successfully implement CCS.

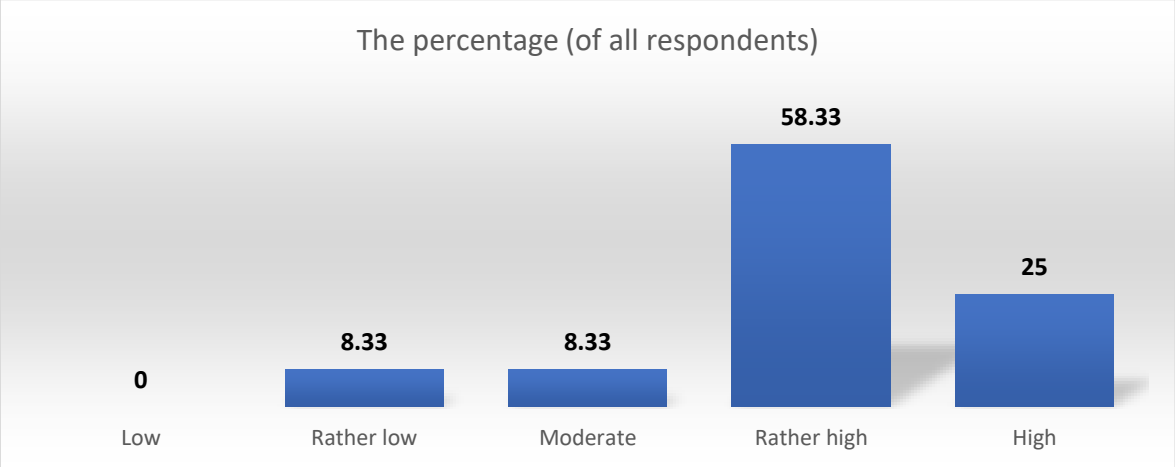
a. Financial support



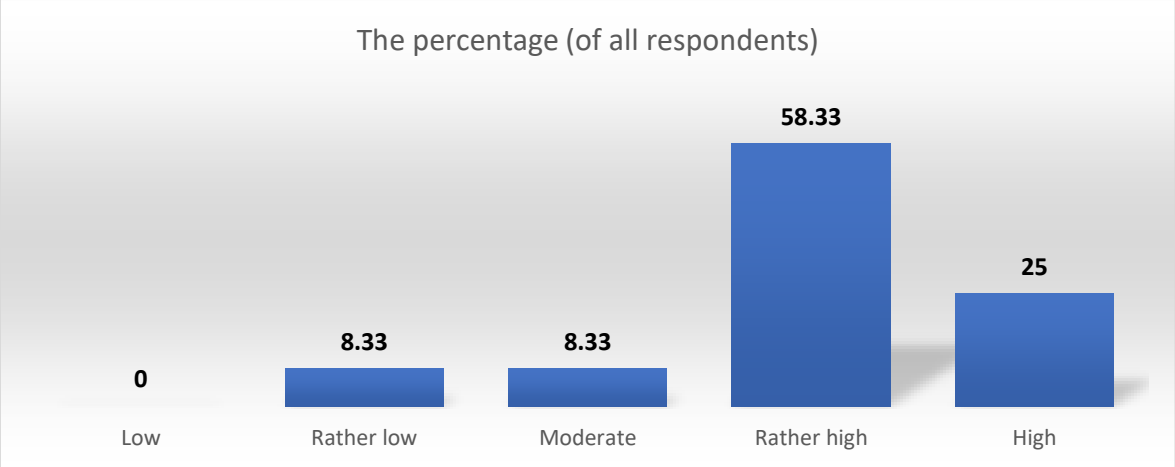
b. CCS Infrastructure sharing



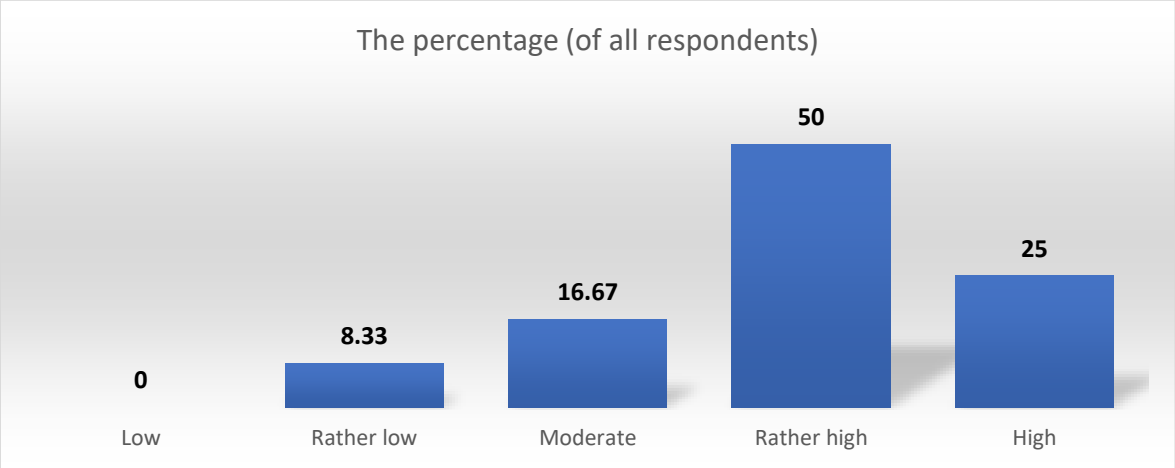
c. Knowledge sharing



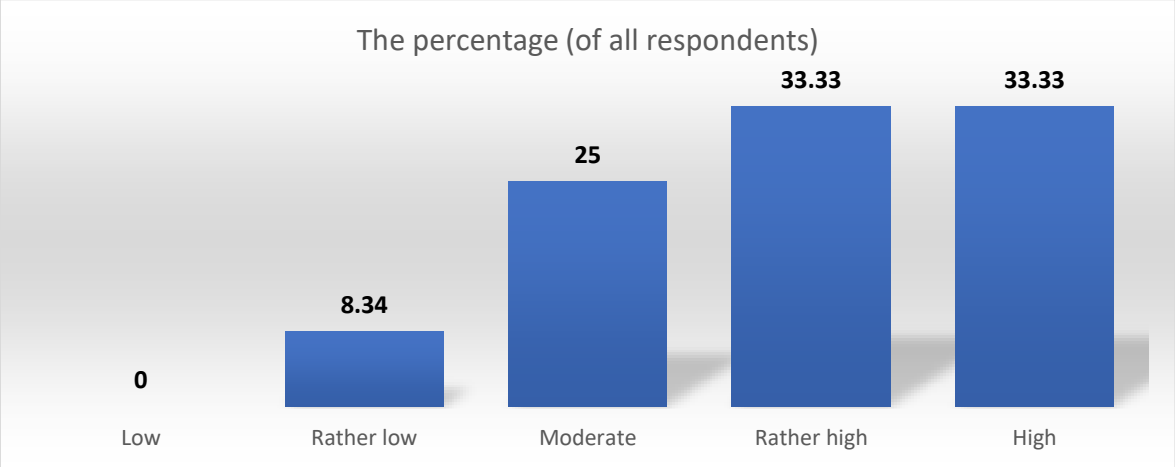
d. Technology transfer



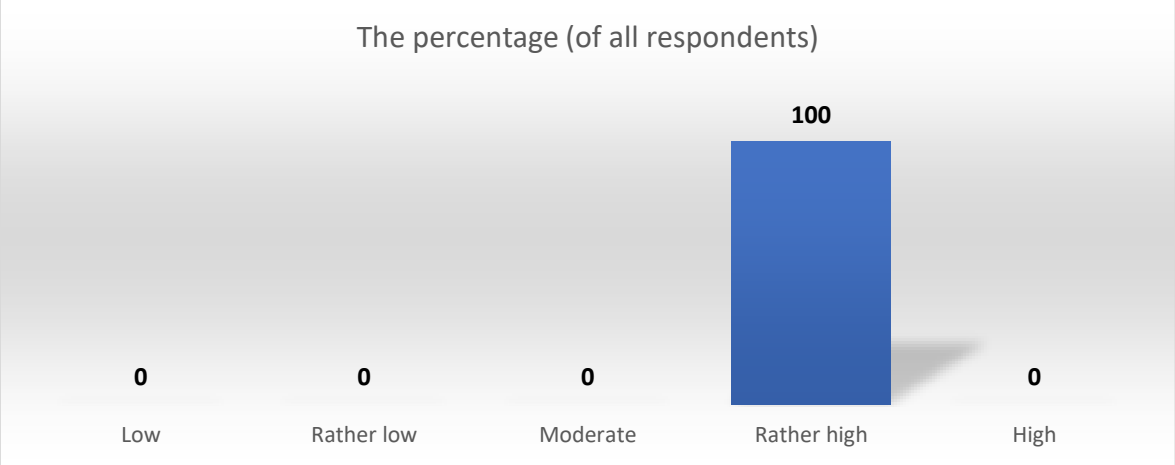
e. Capacity building



f. R&D collaboration



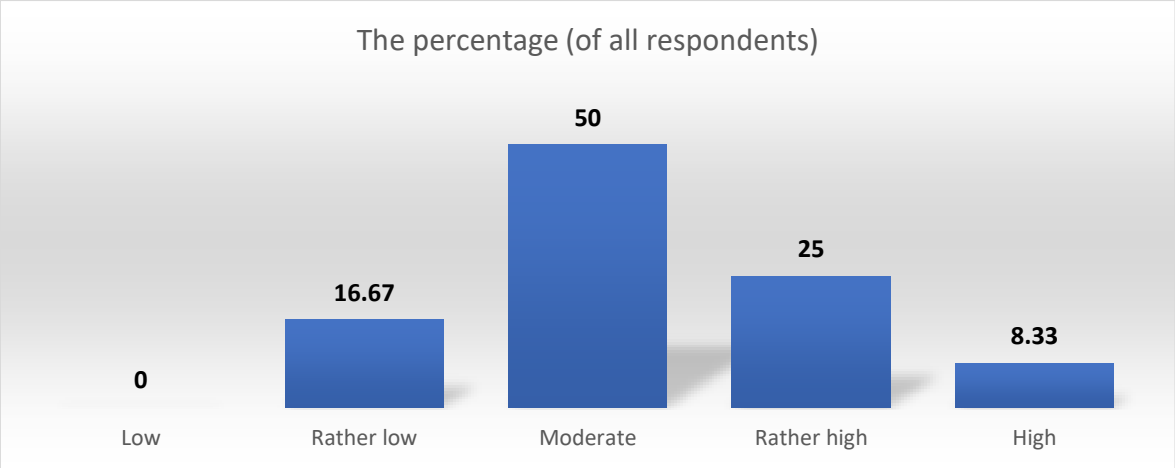
g. Others



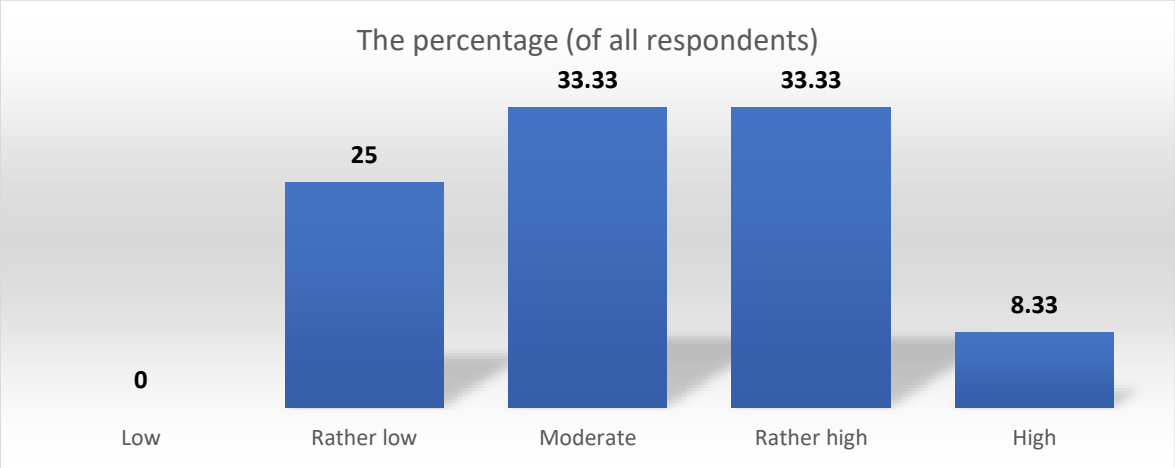
Scale	Comments
4. Rather high	Talent Cultivation

7. On a scale of 1 to 5, please rate the severity of the following bottlenecks for Carbon Capture and Utilization (CCU) deployment in APEC.

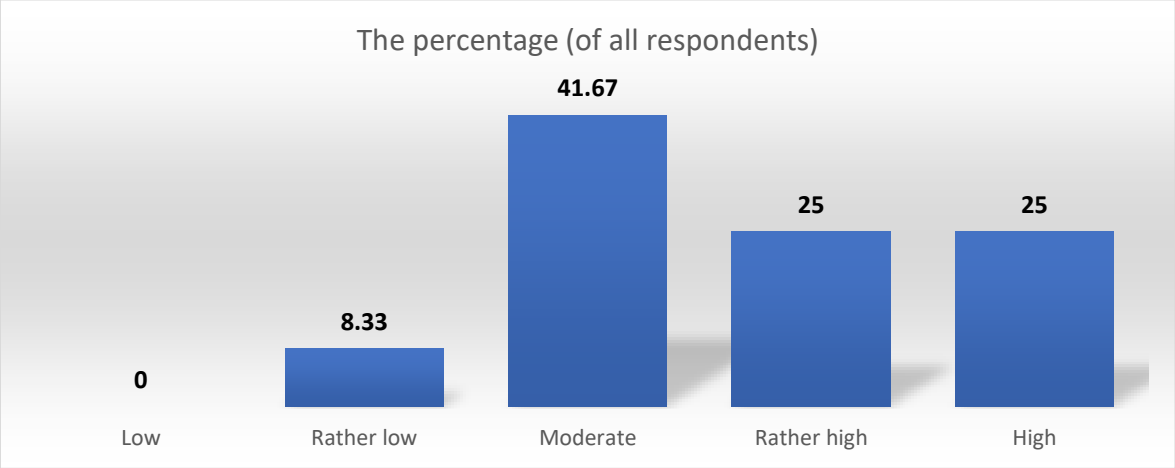
a. Policy



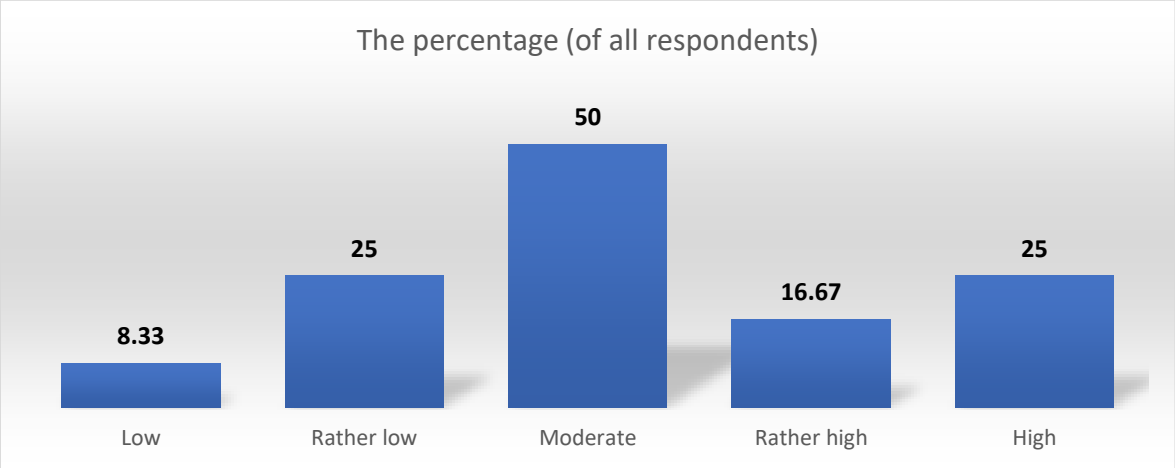
b. Regulation



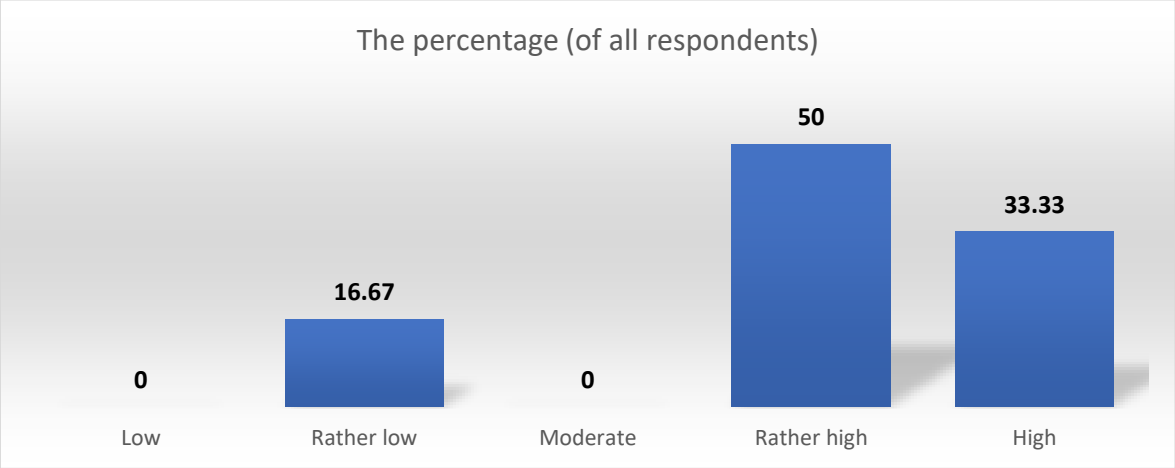
c. Investment



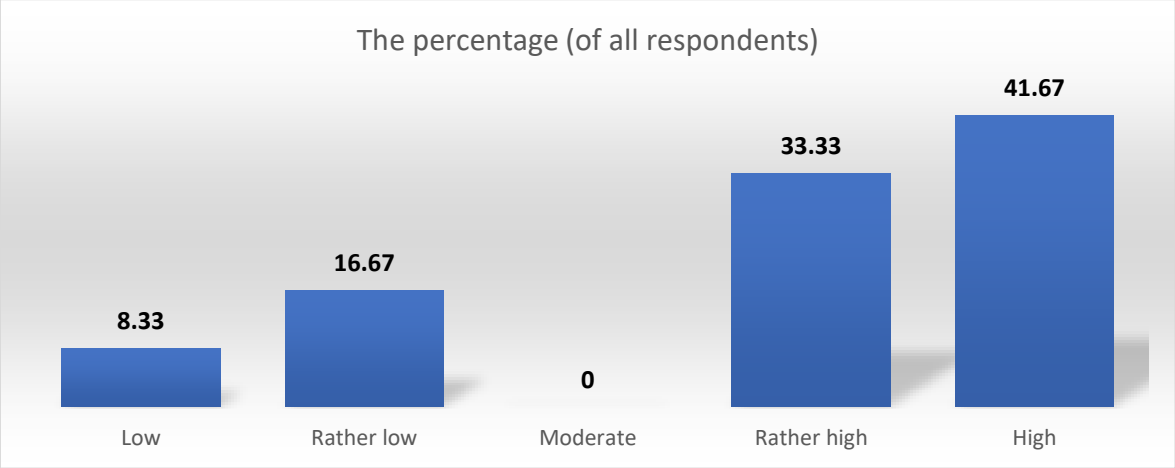
d. Incentives



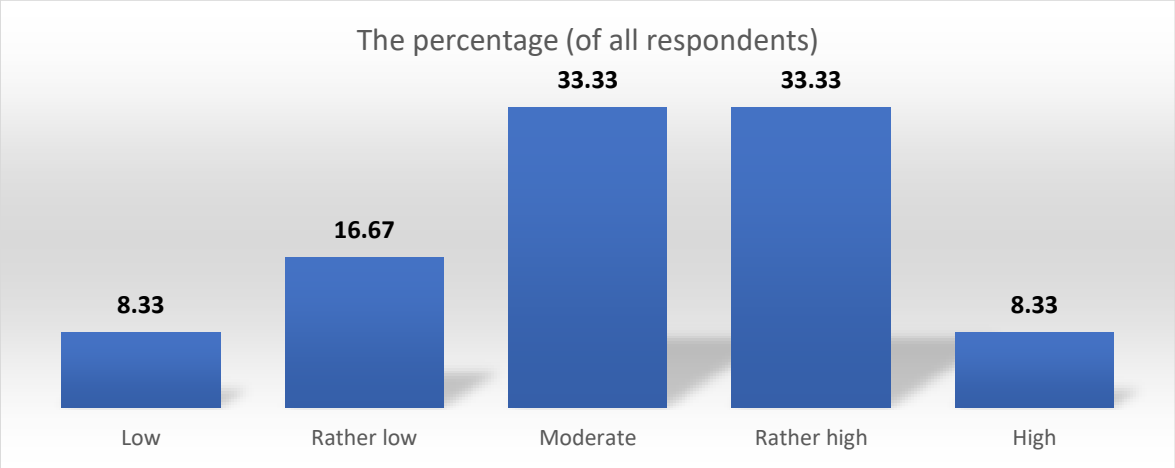
e. Market demands



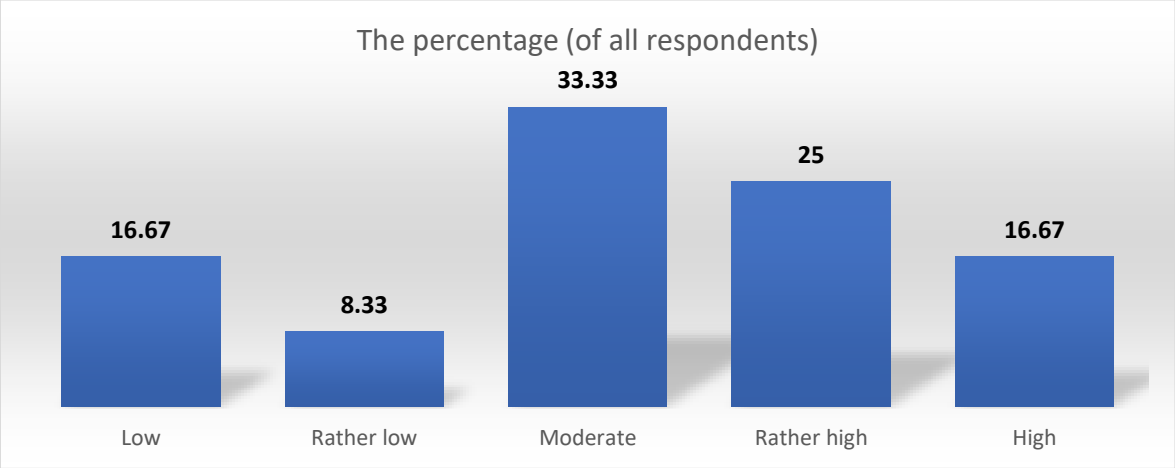
f. Technology



g. Manpower

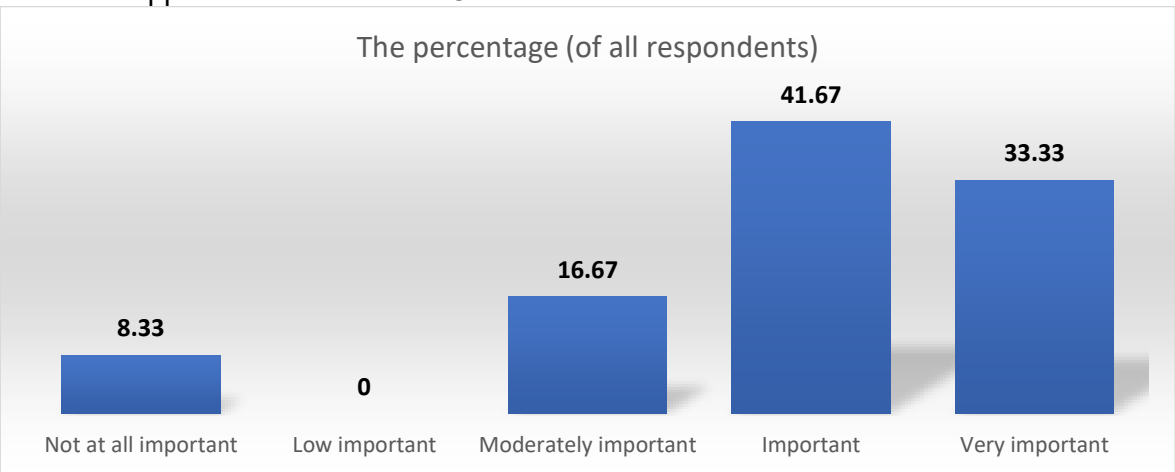


h. Safety concerns

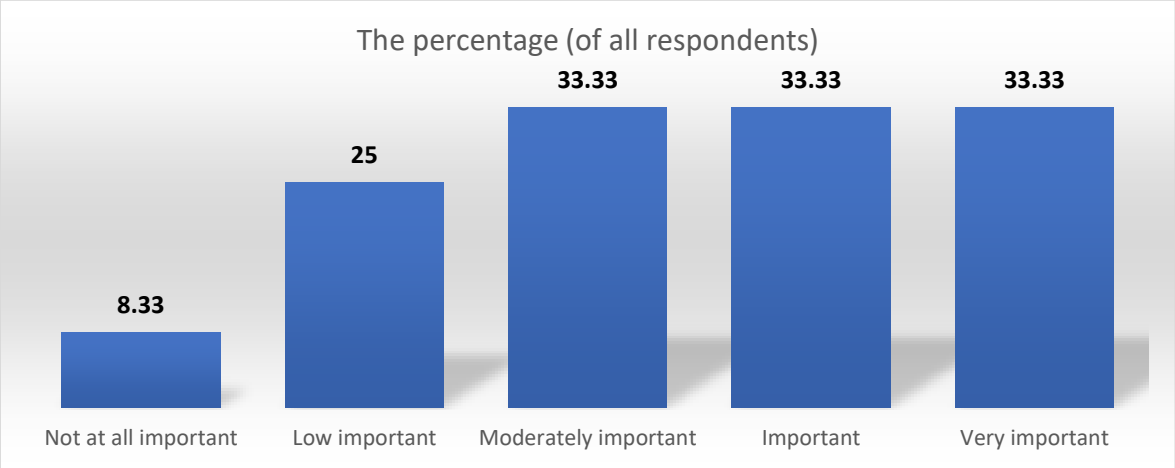


8. To what extent do you believe the collaboration among APEC economies regarding CCU are driving progress towards net-zero emissions?

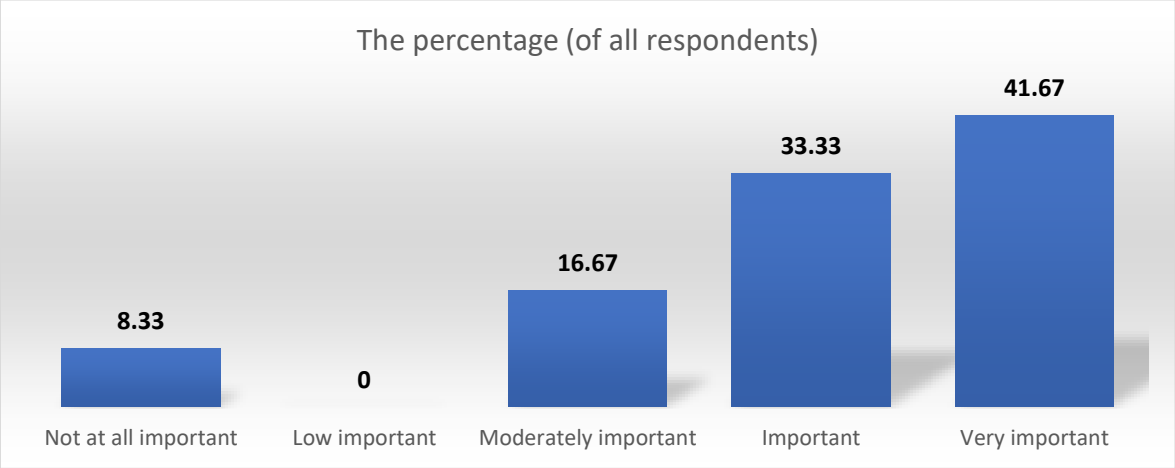
a. Market opportunities within APEC



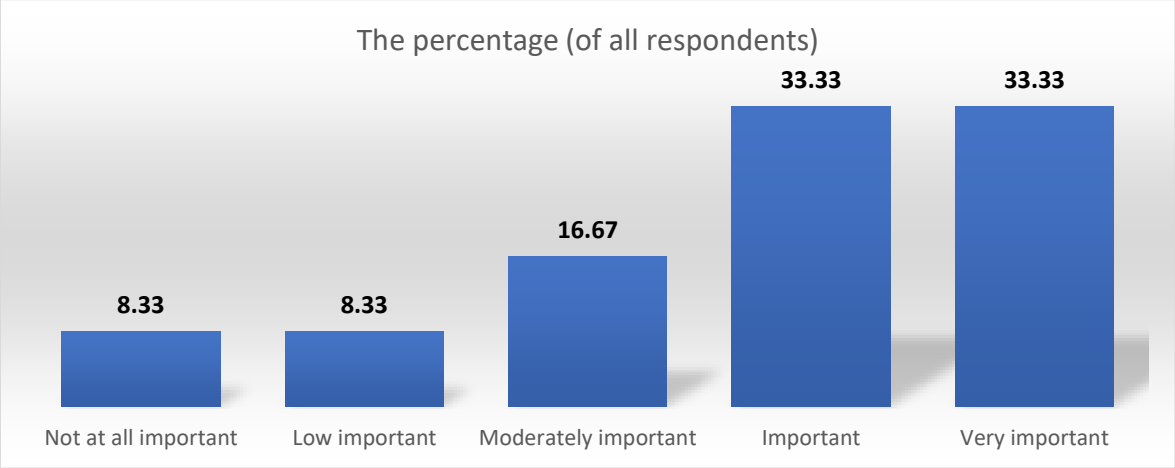
b. Knowledge sharing



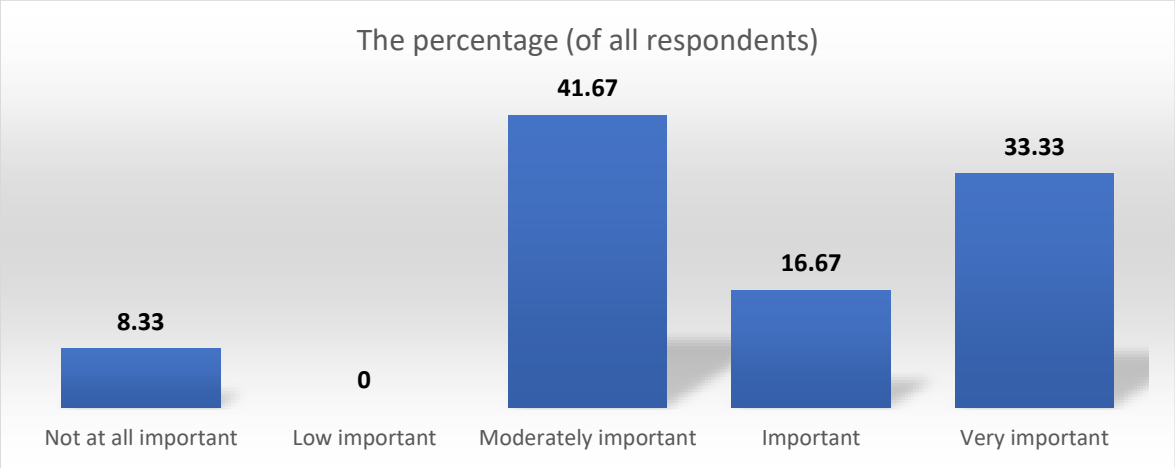
c. Technology transfer



d. Capacity building

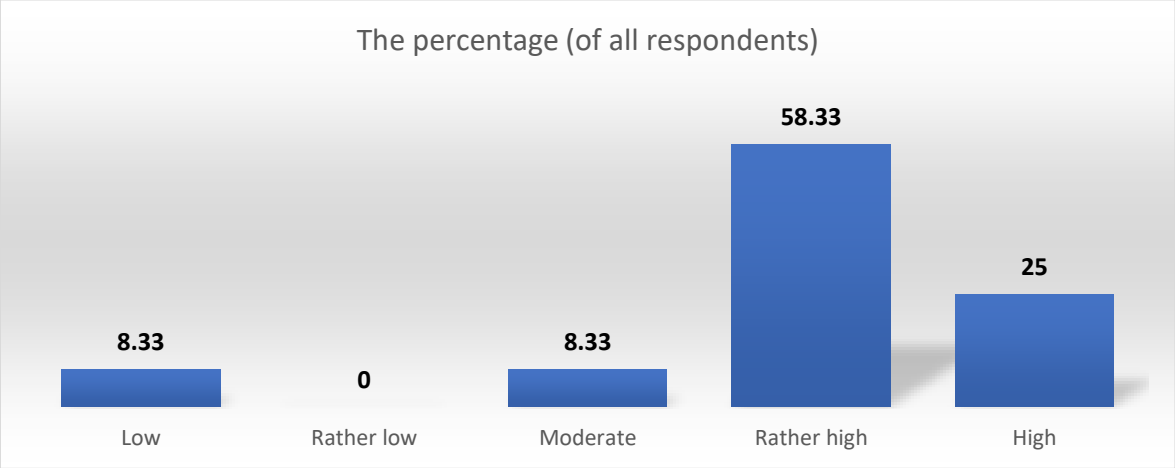


e. R&D collaboration

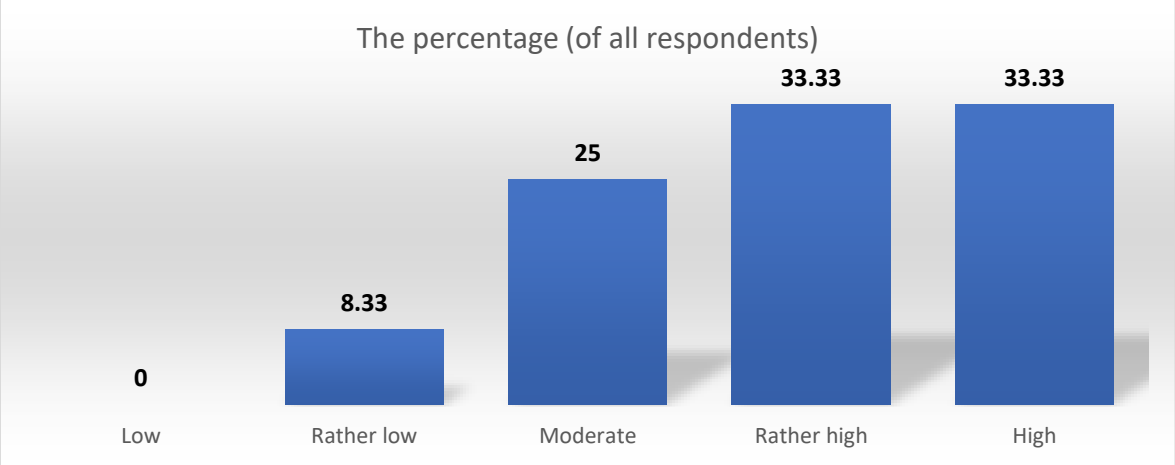


9. On a scale of 1 to 5, please rate the following collaborations that your economy requires from APEC economies to successfully implement CCU.

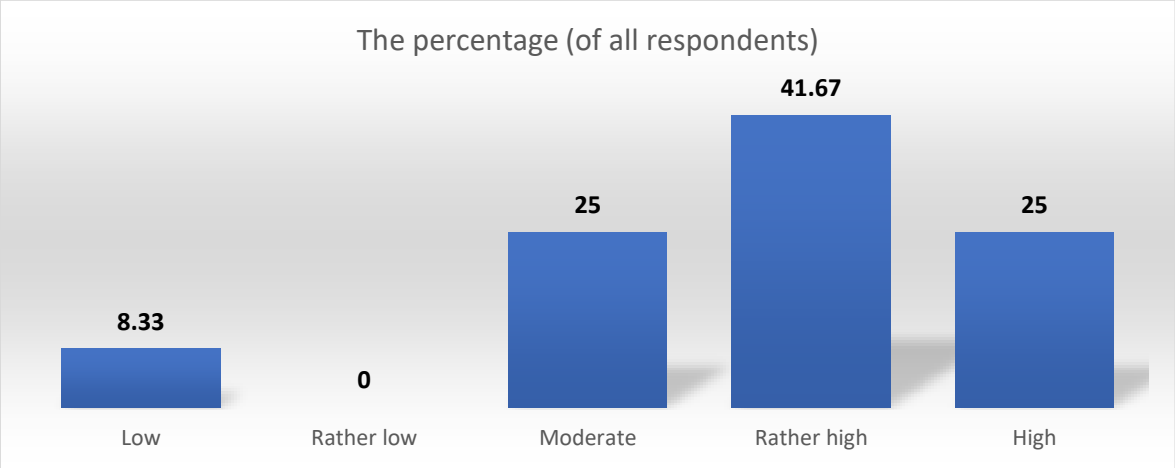
a. Market opportunities within APEC



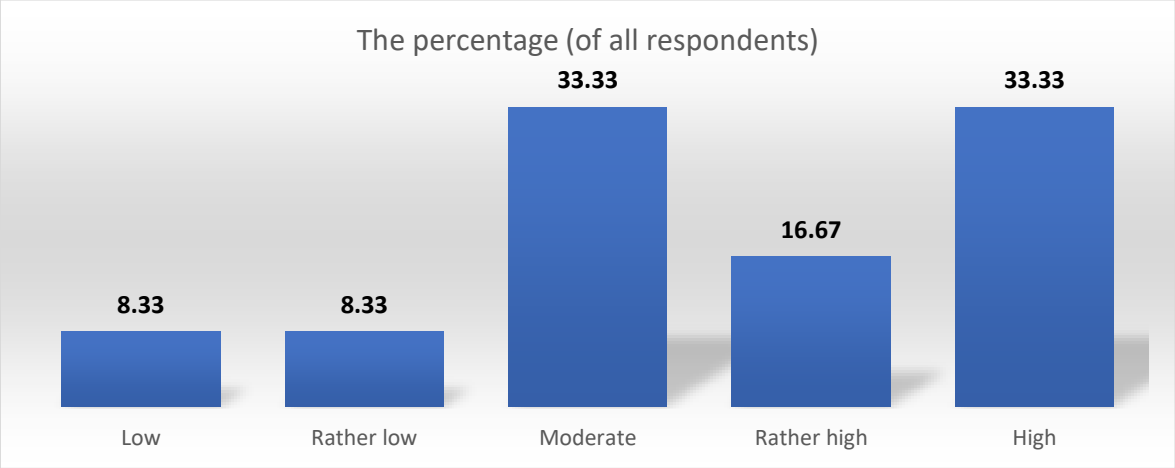
b. Knowledge sharing



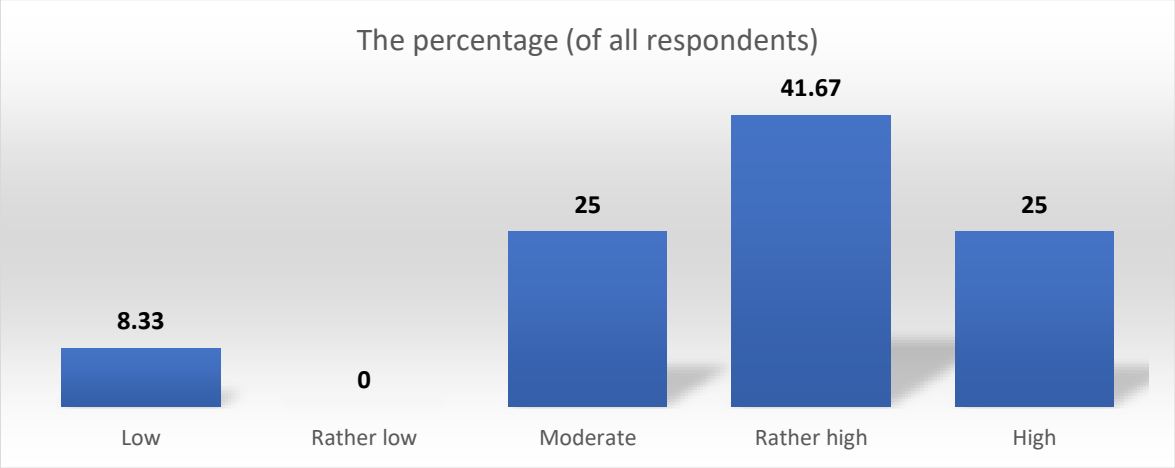
c. Technology transfer



d. Capacity building



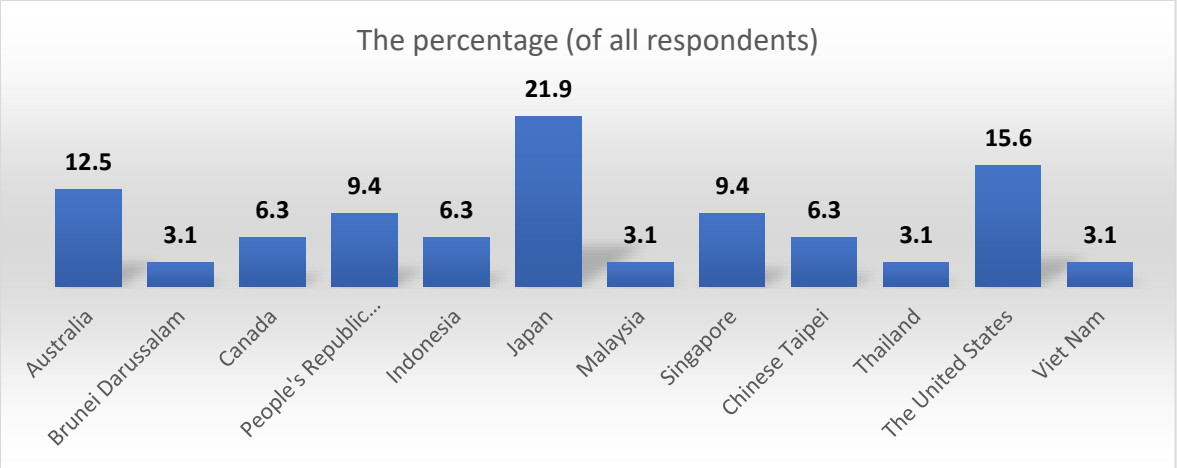
e. R&D collaboration



4.2 Land-use Practices

Land-use practices for net-zero emissions refer to activities such as reforestation, afforestation, agroforestry, and carbon farming which is a holistic farm approach to optimizing carbon capture and storage by implementing practices that can improve the rate at which CO2 is removed from the atmosphere and stored in plants and/or soils. Net-zero emissions require transformative changes in land use for direct GHG reduction, especially from the agricultural sector and for carbon sequestration.

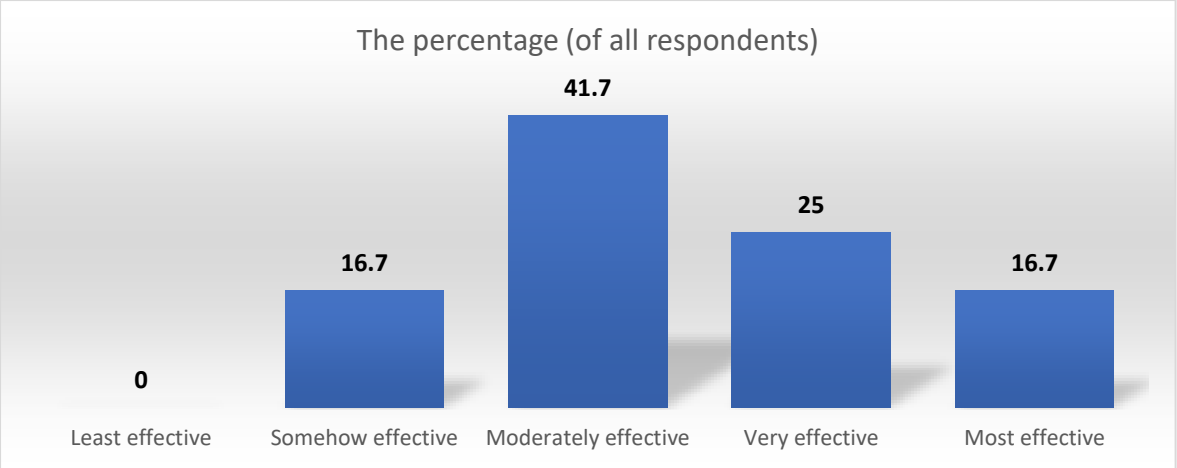
1. Based on your justification, please select three APEC economies that have effective land-use policies for net-zero emissions?



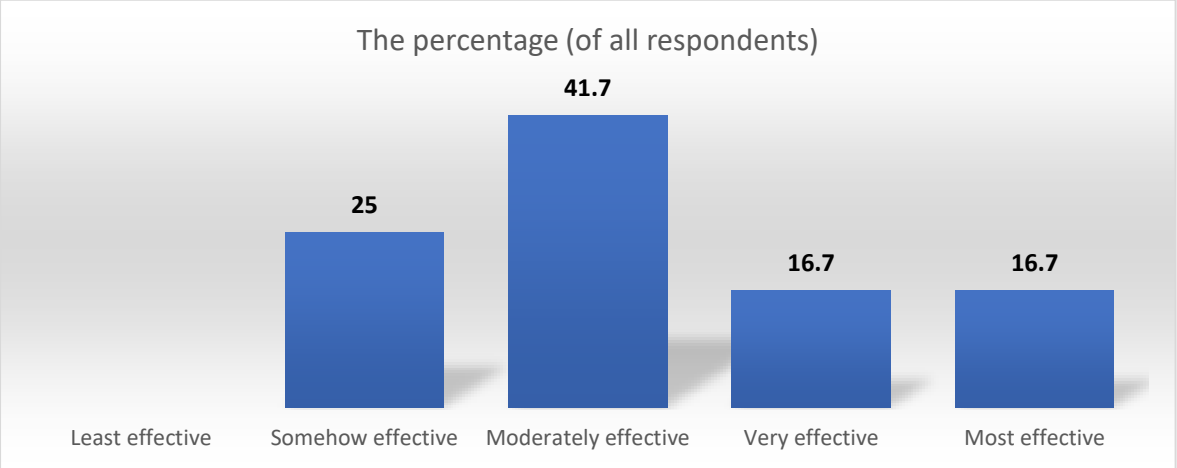
Economy	Comments
The United States	The U.S. has been focusing on nature-based solutions as part of its climate and conservation efforts. Various projects aim to restore wetlands, protect forests, and enhance natural carbon sequestration.
Indonesia	Big Share of Low-cost nature climate solution (NCS) potential.
Malaysia	Big Share of Low-cost nature climate solution (NCS) potential.
New Zealand	New Zealand has been working on policies related to sustainable agriculture, forestry, and land use as part of its efforts to combat climate change.
Australia	Australia has initiatives and policies aimed at sustainable land use and management, particularly in the context of agriculture and forestry.
Japan	Japan has been focusing on policies that promote sustainable agriculture and forestry practices, as well as initiatives related to biodiversity conservation.

2. On a scale of 1 to 5, please rate the effectiveness of land-use practices for net-zero emissions in APEC.

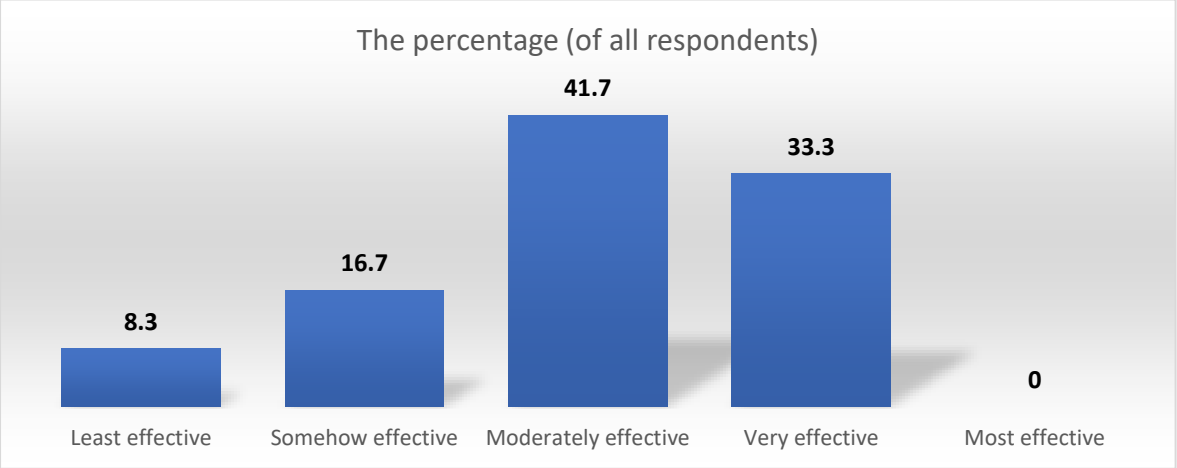
Reforestation



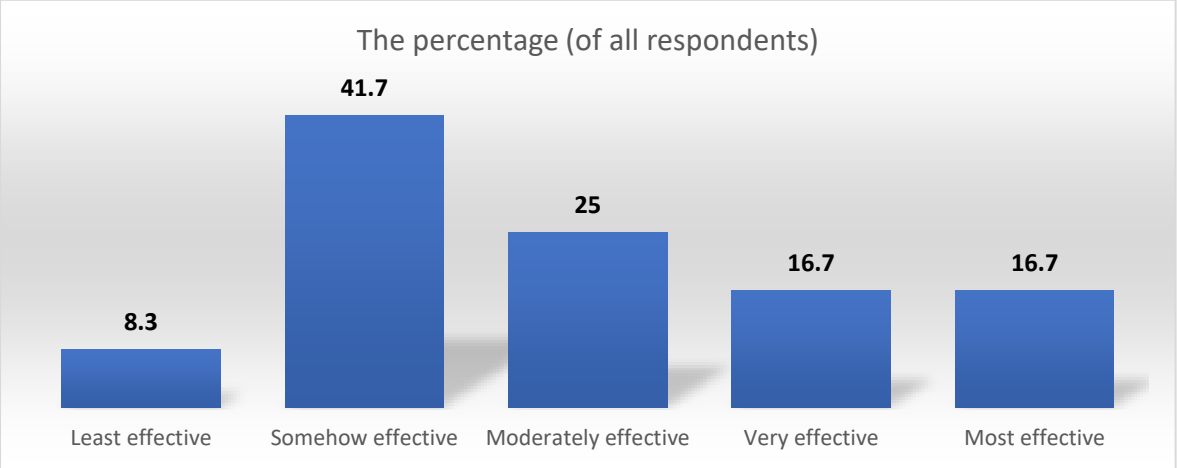
Afforestation



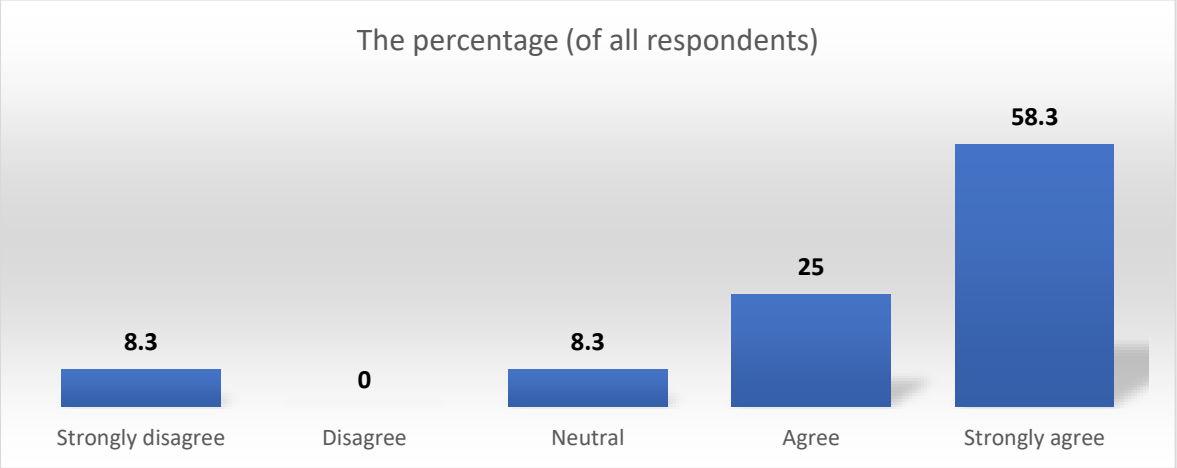
Agroforestry



Carbon farming

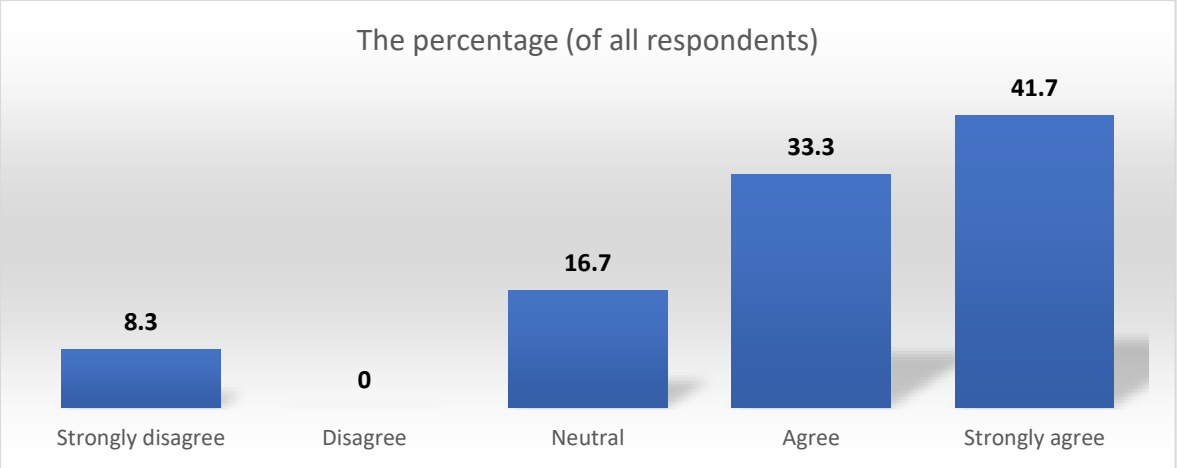


3. Based on your justification, do you agree that forest carbon credits should be included in an Emission Trading Scheme (ETS) to accelerate reforestation and afforestation?



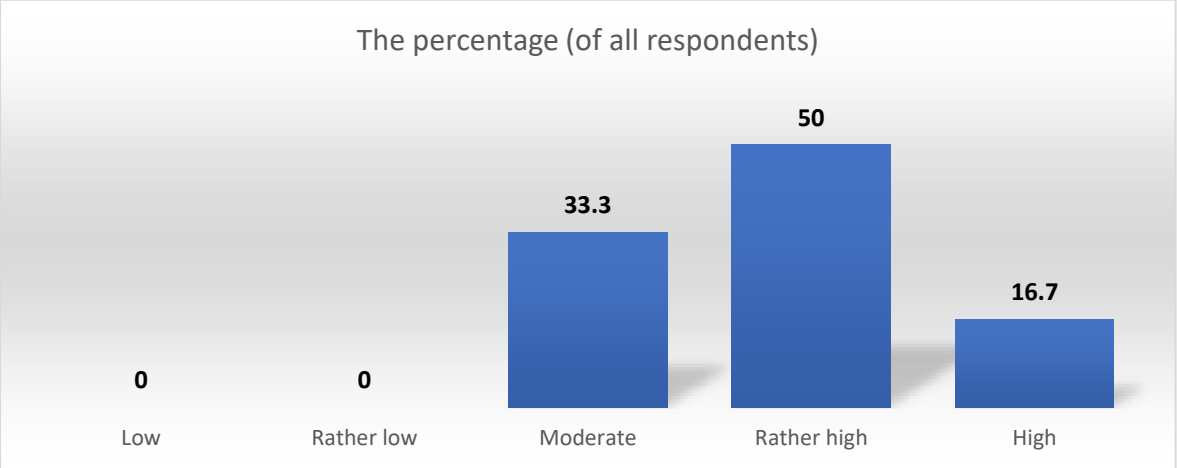
Scale	Comments
1. Strongly disagree	It will encourage mono-culture plantation, will severely damage biodiversity, and may induce land grabbing, expel the Aboriginals.

4. Based on your justification, do you agree that a payment scheme for public goods and services, such as those related to climate mitigation and biodiversity, is a key policy instrument for supporting agroforestry?

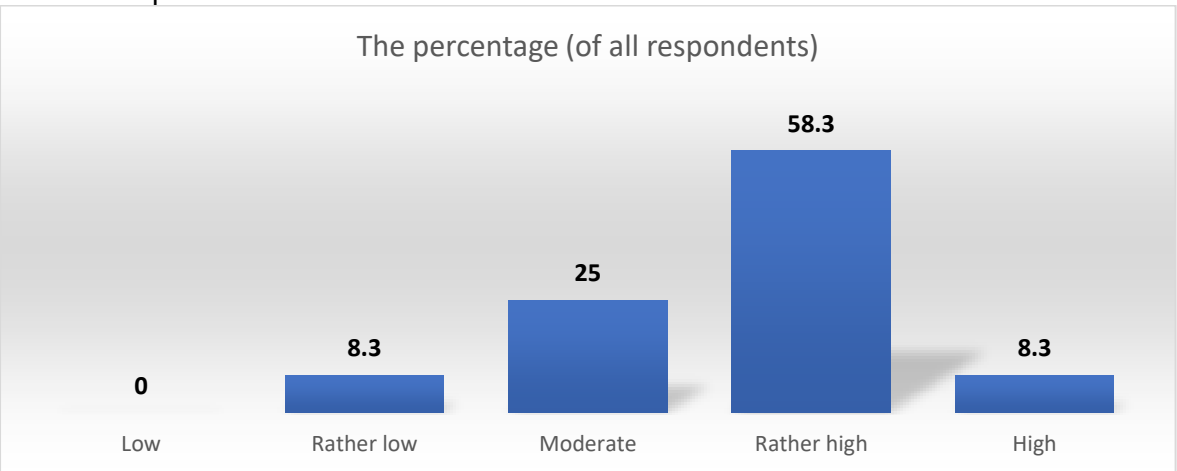


5. On a scale of 1 to 5, please rate the severity of the following bottlenecks for implementing carbon farming in APEC?

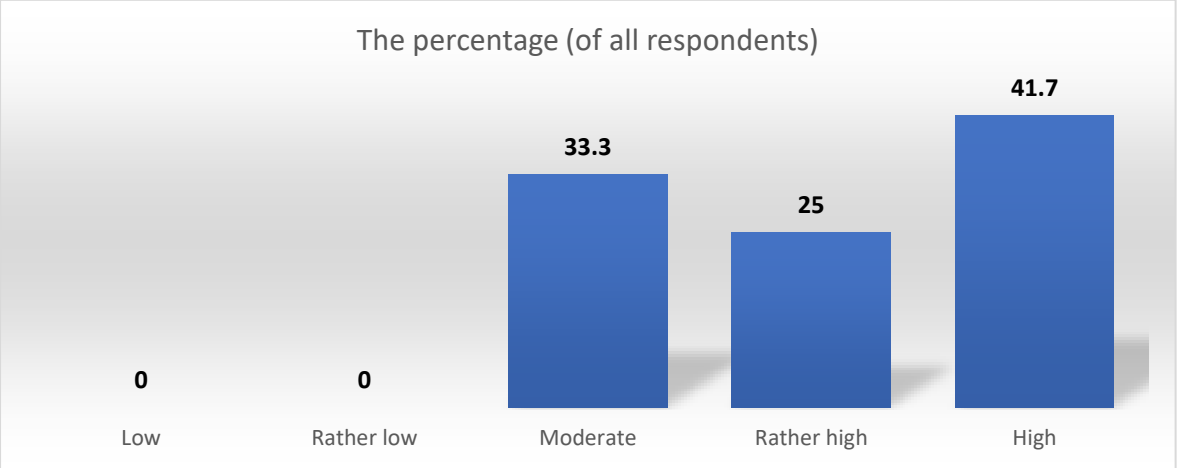
Policy



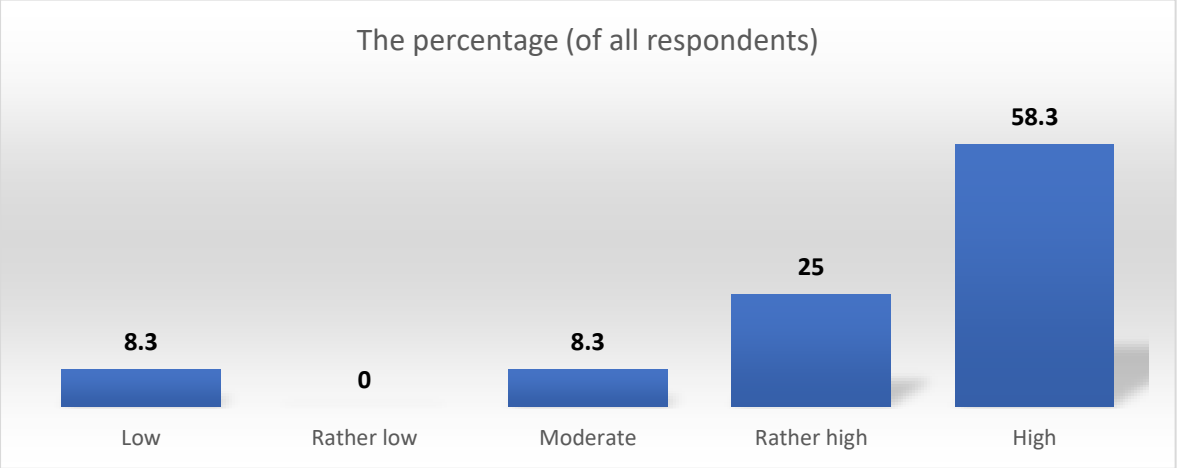
Farmer adoption



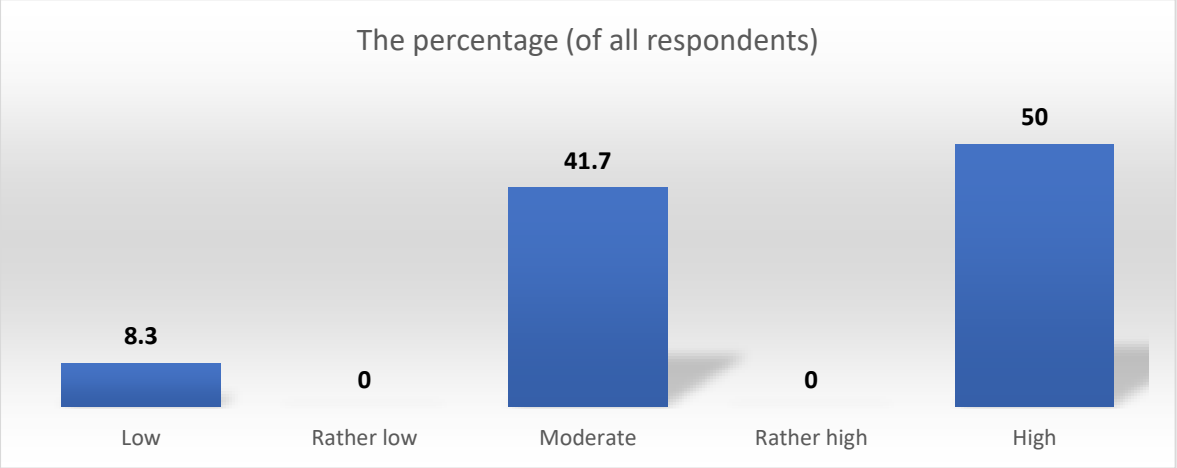
Incentives



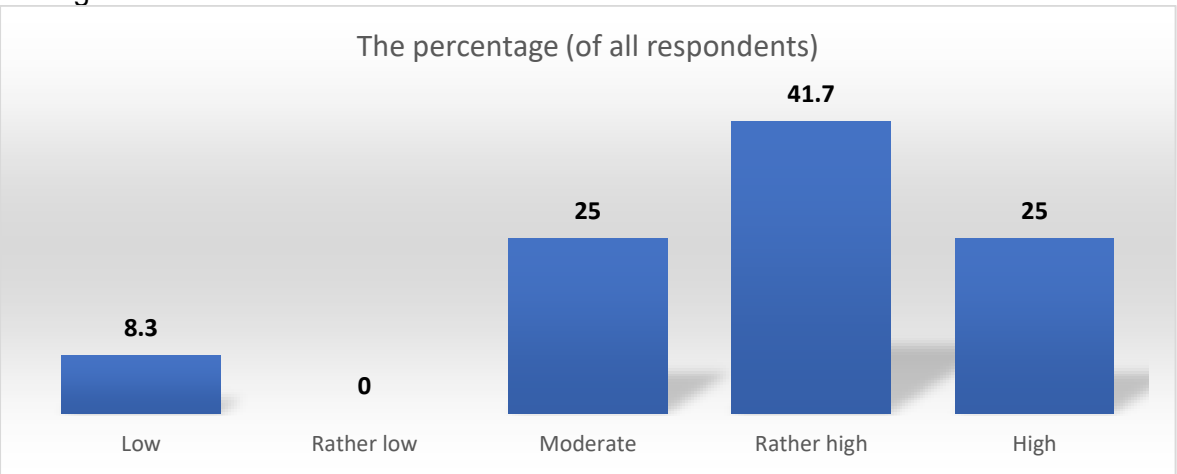
Carbon market



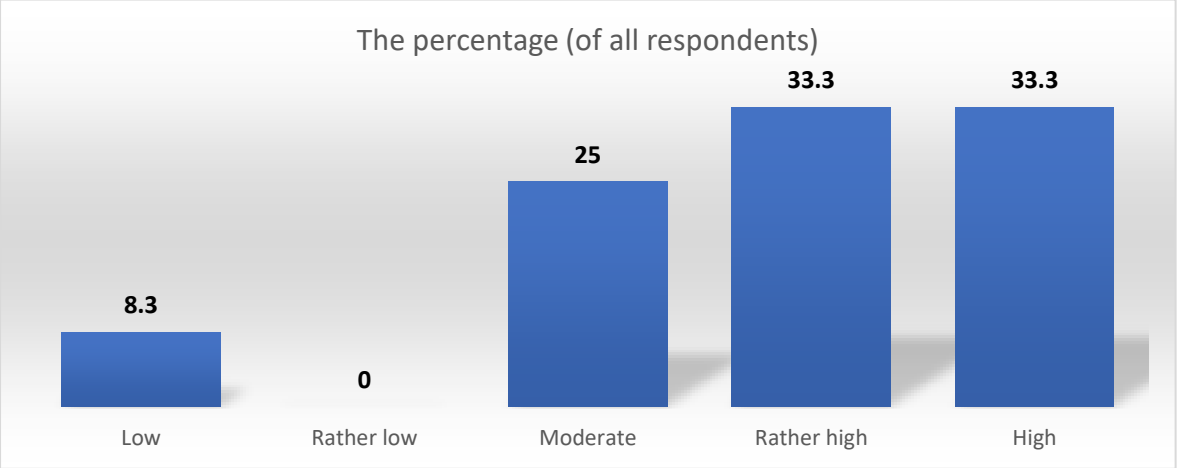
Knowledge



Managerial abilities

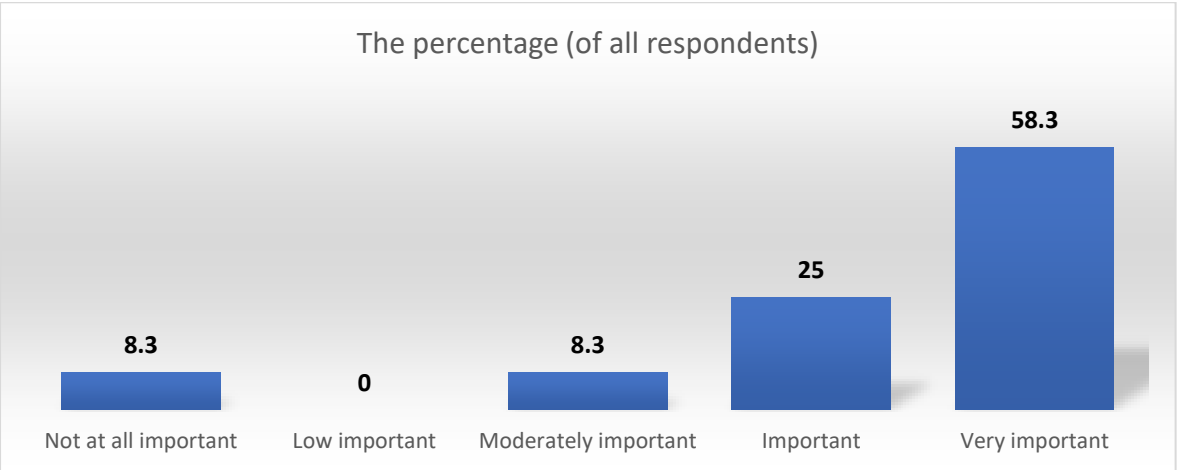


Technology

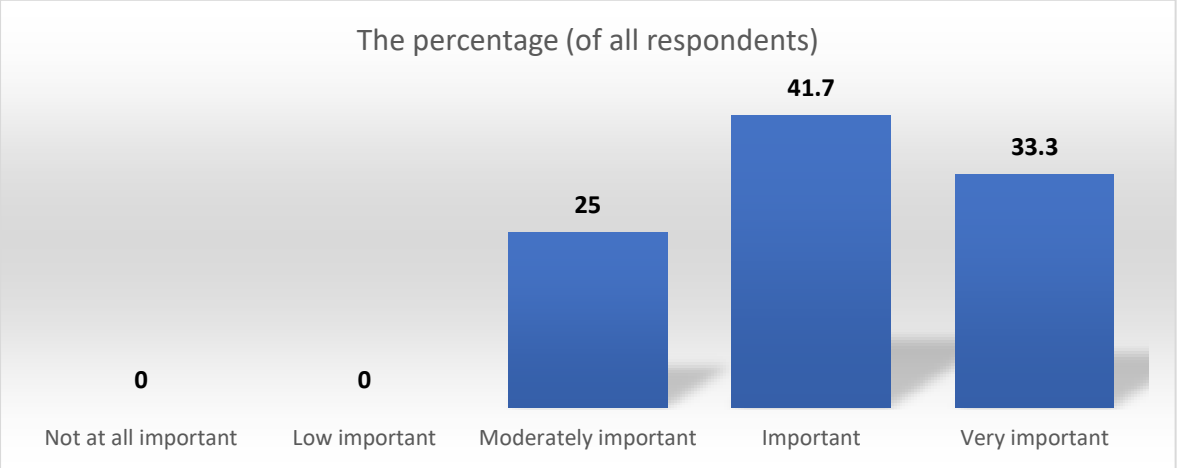


6. To what extent do you believe the collaboration among APEC economies regarding land-use practices are driving progress towards net-zero emissions?

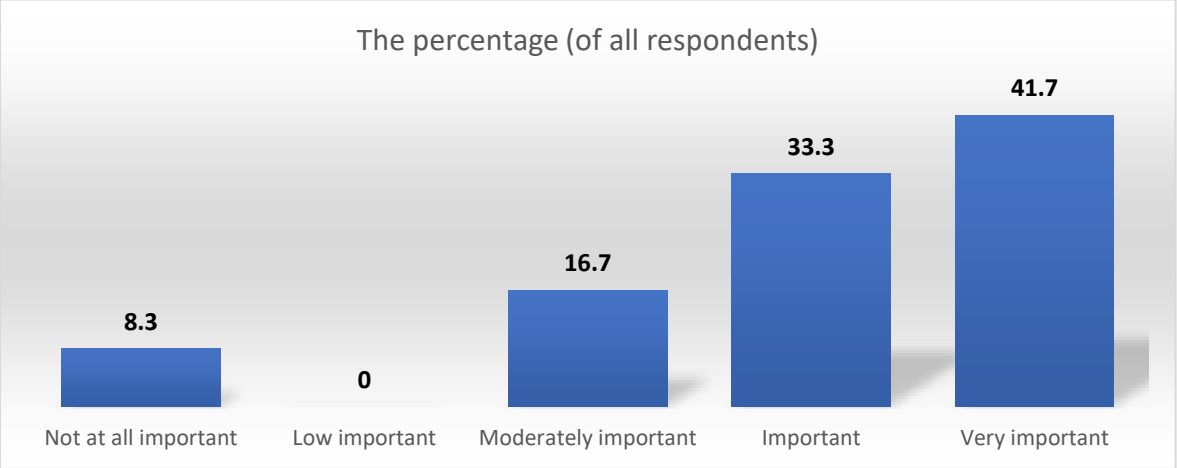
Carbon trade within APEC



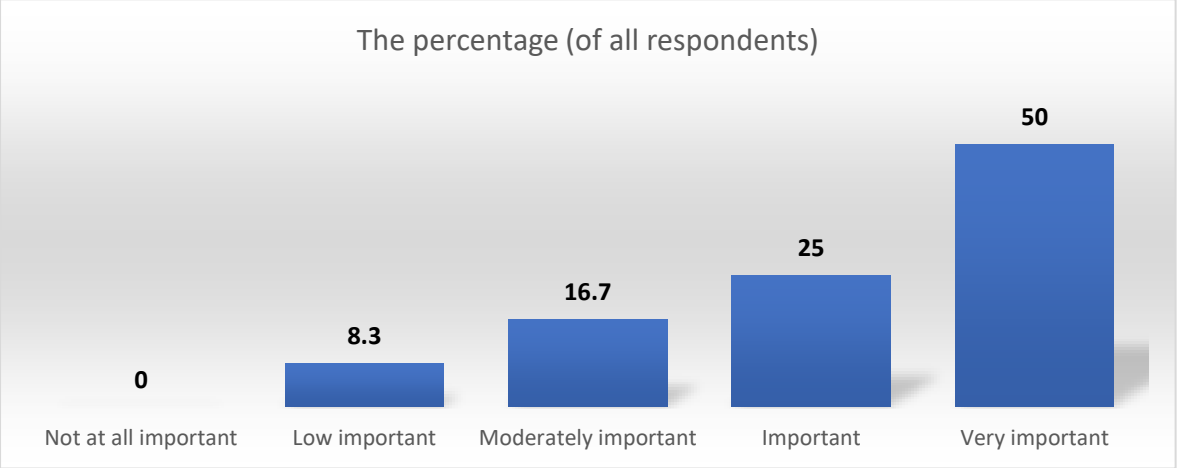
Knowledge sharing



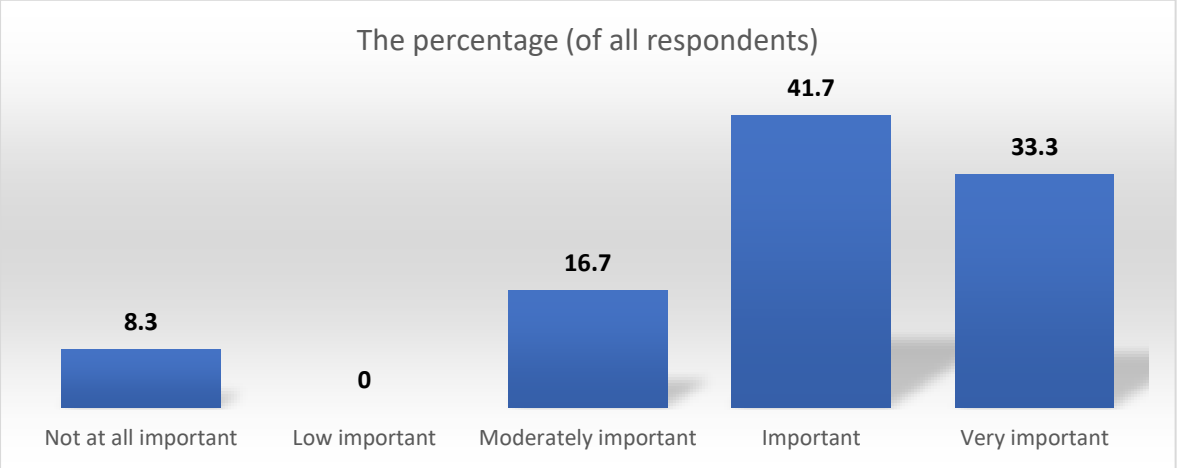
Technology transfer



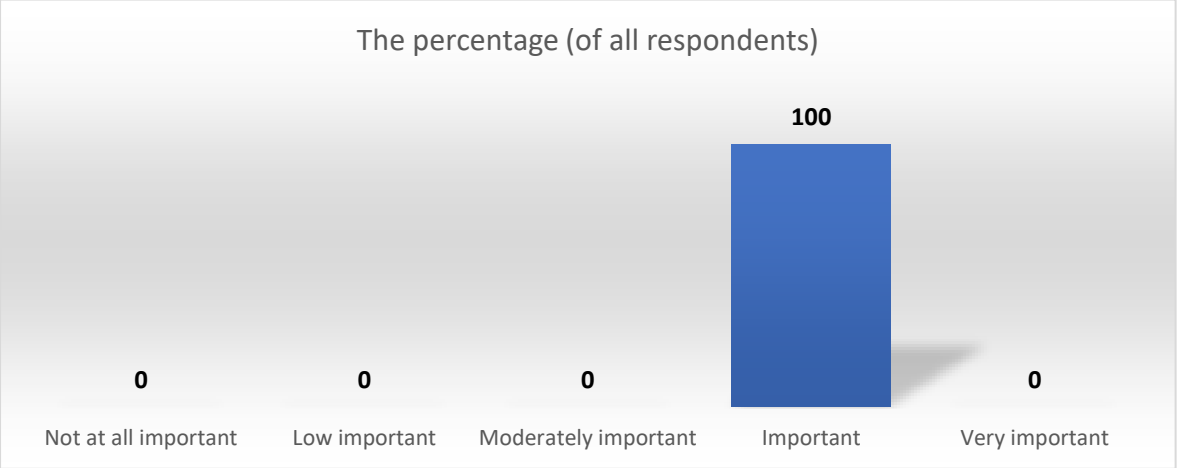
Capacity building



R&D collaboration



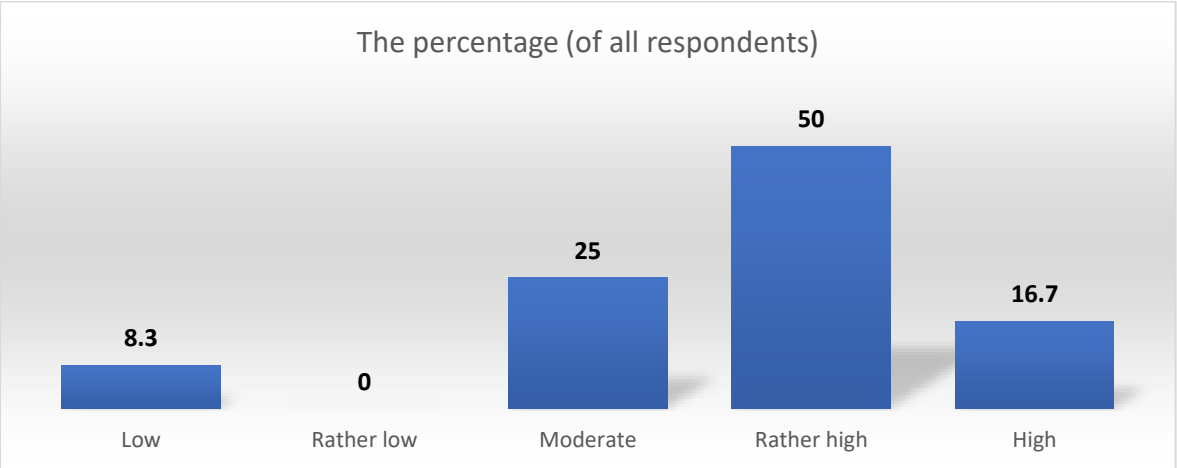
Others



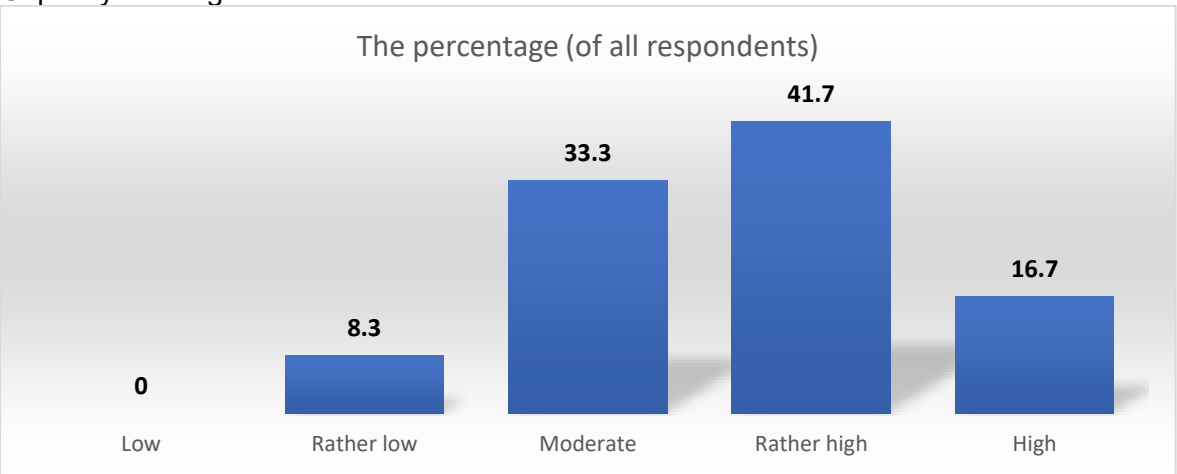
Scale	Comments
4. Important	Talent cultivation

7. On a scale of 1 to 5, please rate how much your economy would require the following collaborations from other APEC economies to effectively implement land-use practices for achieving net-zero emissions.

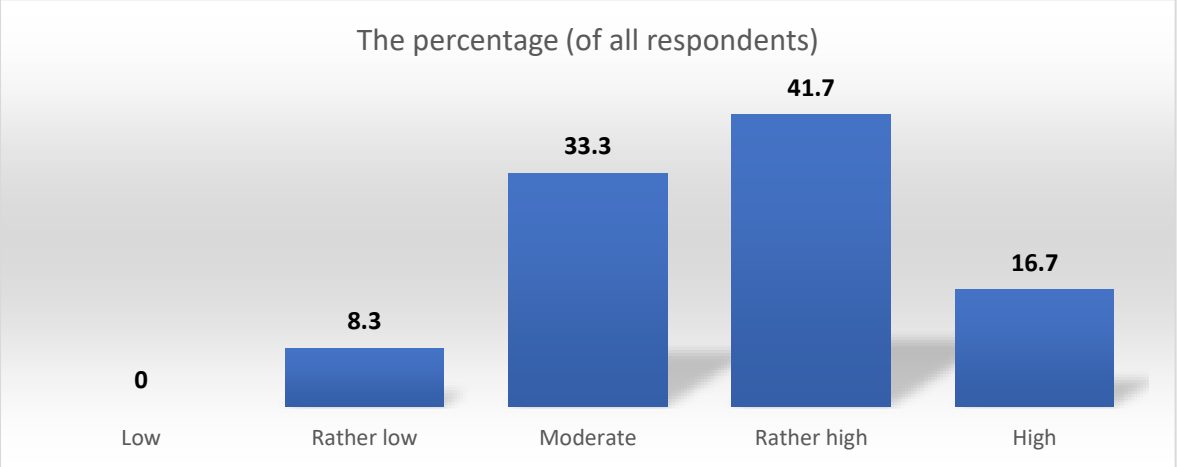
Carbon trade within APEC



Capacity building



Technology transfer



R&D collaboration