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CLEANTECH INNOVATION

Cluster Development Framework

GCIP
Global Cleantech innovation programme

Cleantech Group

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Glossary

Accelerator
It is a structured cpacity building programme desgined to accelerate the growth of innovative cleantech startups and SMEs by strengthening their bsuiness models, enhancing theit market and invetsment readiness, connecting them with mentors, invetsors and ecosystem partners to enable the commercialization and sclaing of technologies.

Cleantech
A broad range of solutions (technologies, processes, services, business models, and their combinations) that lead to an increase in positive impact or a decrease in negative impact on climate change mitigation, transition to a low-emission economy, sustainable energy systems, and other dimensions of environmental sustainability. Climate technology, clean energy technology etc. are subsets of cleantech.

Cleantech Entrepreneurship Ecosystem
The network of entreprenuers, startups, support organizations, investors, policymakers, reserach instituions, corporations and other stakeholders that work together to enable the creation, growth, and scaling of cleantech enterprises.

Cleantech Innovation and Entrepreneurship Ecosystem (CIEE)
The network and interactions among innovation and entrepreneurship stakeholders and the social, economic and policy environment, and their combined influence on the development and commercialization of cleantech solutions.

Cleantech Innovation Ecosystem
The network of stakeholders, institutions, polciies, financing mechanisms, and support services that enable the creation, development, commercialization and scaling of innovative clean technologies as solutions.

Country/National Child Project
In the context of GEF, country-specific GCIP implementation project designed in line with the GCIP Global Programme, to address the maturity, priorities, and needs of the national cleantech innovation ecosystem.

Ecosystem
The wide range of stakeholders, factors and influences as well as the interactions between these. Can range from a low-level, small context such as city or community, to the high-level macro-view of whole countries or regions.

Entrepreneurship
Willingness and ability to turn an innovation into a profitable business model through identifying or creating a market opportunity.

Finalists
Selected group of semi-finalists advancing to the final stage of the accelerator and judging process.

GCIP Alums/Alumni
Entrepreneurs and companies that have successfully completed a GCIP accelerator cycle and remain engaged through the programme's alumni network.

GCIP Coordination Child Project

Global coordination project responsible for maintaining the GCIP methodology, ensuring consistency, and supporting collaboration across all national child projects.

Gender Mainstreaming / GEEW (Gender Equality and Empowerment of Women)

Cross-cutting activities ensuring equitable recruitment, participation, opportunities, and benefits for women and men throughout the programme.

Generalist Mentor

Experienced entrepreneur, investor, or cleantech professional providing overall business coaching and strategic guidance to participating startup and MSME teams. Generalist mentors may not invest in a mentee company during the competition cycle.

Global Accelerator

Global competition for innovators from developing, emerging, and transition economies without a national GCIP project, held after the national accelerators conclude.

Implementing Agency

In the context of GEF donor, the organization responsible for providing overall programme oversight, technical guidance and quality assurance throughout the implementation of the GCIP project. The Implementing Agency supports the NPEE, ensures compliance with project objectives and standards, and facilitates knowledge sharing and coordination across participating countries.

Innovation

The development of new, adapted, or alternative solutions and/or improvements to existing processes or addressing challenges.

Innovation Challenges

Mechanism for identifying demand-driven solutions to industrial climate and sustainability challenges by matching innovators with private-sector-defined market needs.

Investment Readiness

The degree to which a startup, product or solution is prepared to attract and secure external investment. It reflects the maturity of the venture, including a validated business model, scalable solution, capable team, financial planning and a compelling value proposition for investors.

Manufacturing Readiness Level (MRL)

A standardized scale used to assess the maturity of manufacturing processes, technologies, and production capabilities for a specific technology, component, or system. The MRL framework evaluates the readiness of manufacturing from initial concept and process development through stable, full-rate production, supporting the transition from innovation to commercial-scale manufacturing.

National Academy

Core component of the GCIP Accelerator, designed to equip participating entrepreneurs with the knowledge, skills and tools needed to strengthen their business models, validate their technologies and prepare for market growth and investment through expert-led workshops, mentoring and networking opportunities.

National Accelerator

Country-level platform and competition process that brings together national cleantech stakeholders and delivers the annual GCIP accelerator.

National Project Executing Entity (NPEE)

The institution/organization within the participating country that is responsible for the day-to-day implementation and execution of the national GCIP project. The PMU sits within the NPEE that manages the project implementation at the national level.

Post-Acceleration Support

Continued support for GCIP alumni focused on business growth, internationalization, partnership development, investment readiness, and access to finance.

Project Management Unit (PMU)

The operational unit responsible for the day-to-day management and implementation of the GCIP project. It coordinates project operations, stakeholder engagement, procurement, communications, training, mentoring and event delivery, ensuring the effective execution of national GCIP activities.

Proof of Concept (PoC)

An early demonstration that verifies the technical feasibility and potential effectiveness of an innovation, providing evidence that the proposed solution can successfully address the intended challenge.

Semi-finalists

Applicants selected from the pool of entrants to participate in the GCIP accelerator programme and receive structured support. Typically 15-25 nationally and 10-15 globally.

South-South and Triangular Industrial Cooperation (SSTIC)

A UNIDO-led cooperation approach that promotes the exchange of knowledge, technologies, expertise and resources among developing countries to advance inclusive and sustainable industrial development. Through triangular cooperation, these partnerships are further supported by developed countries or multilateral organizations to enhance their impact and scale.

Specialist Mentor

Subject-matter expert providing technical advice in a specific area, such as finance, marketing, engineering, legal affairs, or intellectual property.

Technology Readiness Level (TRL)

A standardized scale used to assess the maturity of a technology, from early-stage research to full commercial deployment. The TRL framework ranges from TRL 1 (basic principles observed) to TRL 9 (actual system proven in an operational environment) and is widely used to evaluate technological progress and readiness for commercialization.

Winners / Runners-up

Top-ranked finalists selected by the judging panel based on the programme's evaluation criteria.

knowledge exchange and partnership building among different CIEEs.

The purpose of this framework is to provide guidance to policymakers and project executing entities (PEEs) in the GCIP partner countries in defining and implementing policy strategies to promote cleantech innovation and entrepreneurship and to increase the participation of women and youth in cleantech entrepreneurial activities and as leaders in this sector. The framework does this by analysing insights from policymakers in countries that have demonstrated tangible results to identify policy strategies, programmes and measures that have contributed to success and which can be replicated by GCIP partner countries.

Section 1 profiles countries that demonstrate observable success in innovation, especially cleantech innovation and entrepreneurship, and describes that success in terms of tangible results.

Section 2 examines the policy strategies these countries have implemented to achieve those results.

Section 3 profiles countries that demonstrate observable success in providing opportunities to women and youth through cleantech innovation and entrepreneurship, and describes what that success looks like.

Section 4 examines the characteristics of successful ecosystems that can unlock opportunities and proposes interventions to foster those characteristics.

Methodology

General Approach

This section describes our approach, sources and other key inputs. A full list of sources is available in the appendix. The general approach is based on:

- Identifying countries that have demonstrated success in cleantech innovation and/or in providing opportunities for women and youth in cleantech innovation.
- Understanding the factors that contributed to this success to produce a replicable framework that can be adopted by GCIP countries.

Selection of countries leading in innovation policy

We focused on two country groups: countries that are leading in innovation policy globally and countries that share certain characteristics with GCIP countries that have achieved good results according to success metrics identified in the rankings below.

We used the following global innovation rankings to identify countries that have achieved the best results overall and in cleantech innovation specifically:

- Information Technology and Innovation Foundation (ITIF): 2021 Global Energy Innovation Index
- World Intellectual Property Organization (WIPO): 2022 Global Innovation Index[1]
- Startup Genome & Cleantech Group: 2021 Global Cleantech Startup Ecosystem Rankings

Leading countries were defined as ranking in the global top 10 in two or more of these indexes. The second group of countries exhibits economic, demographic or climate risks that closely resemble those of GCIP partner countries. This assessment is based on a comparison of the following factors:

- Income level
- Population and geographical characteristics
- Most serious climate risks being faced
- Sectors at risk from climate change

This produced a list of 12 countries that are innovation leaders either at global level or at country group level sharing characteristics similar to one or more GCIP countries. These countries are presented in Section 1.

1 The Global Innovation Index measures innovation inputs (institutions, human capital and research, infrastructure, market sophistication and business sophistication) and innovation outputs (knowledge and technology outputs, creative outputs).

Selection of countries leading in opportunities for women and youth

The selection of countries was based on their track record of achieving positive outcomes for women and youth in cleantech innovation and entrepreneurship. More precisely, success in providing opportunities for women and youth in cleantech innovation was defined as countries that have produced women or youth-led startups ranking in one of the following indexes:

- Cleantech Group 50 to Watch list
- Cleantech Group GCT 100
- 2022 Mastercard Index of Women Entrepreneurs
- GEM 2021/22 Women's Entrepreneurship Report
- Startup Genome Top 10 Startup Ecosystems for Female Founders

Executive Summary

Countries that are successful globally in cleantech innovation share common strategies which have contributed to that success. Similarly, countries that have successfully increased the participation of women and youth in cleantech entrepreneurship have also adopted common strategies. GCIP partner countries can leverage these policy strategies to strengthen their domestic capacity for cleantech innovation and to increase the participation of women and youth in domestic cleantech startups and micro, small and medium-sized enterprises (MSMEs).

Figure 1: The most effective set of policies differs according to stage of innovation[2]

Successful countries design and implement targeted interventions to advance their innovation priorities and broader objectives. They also create support mechanisms that stimulate private investment in innovation. The most effective set of policies varies depending on the stage of innovation that countries aim to prioritize. Early-stage innovation encompasses activities from the lab to prototype stage, or the earliest stages of company formation. Mid-stage innovation includes the demonstration and initial commercialization stages, while later-stage innovation entails scaling and internationalization.

Policy strategies to increase the supply of early-stage innovation include establishing a national body dedicated to innovation; setting long-term policy signals; aligning research and development (R&D) funding with national climate and innovation priorities; implementing measures to maximize the impact of R&D funding; encouraging intra-governmental coordination on innovation; educating future innovators, and measures to retain talent and attract an international workforce.

Policy strategies to support demonstration and commercialization include encouraging the private sector's active participation; using targeted financing mechanisms to de-risk

2 Key components of cleantech innovation policy include distinct support mechanisms in early stages of innovation, demonstration and commercialization, scaling and internationalization with an underlying premise of inclusive policy for women and youth in cleantech. Source: Cleantech Group

early commercial projects; developing enabling infrastructure; green public procurement, and responsive regulation.

Policy strategies to accelerate the growth of scaling companies include sharing best practices with other nations; partnering with global innovation leaders; proactively developing international trade opportunities, and creating a level playing field to allow emerging cleantech solutions to compete with incumbent technologies.

Increasing the participation of women and youth in cleantech entrepreneurship can lead to increased economic growth. Encouraging women and youth to establish cleantech businesses and providing them with a fair percentage of investment not only generates wealth but also enables communities to narrow earnings gaps. Spurring entrepreneurship within these groups increases job creation and drives innovation that anticipates market demands from diverse perspectives.

Coordinated action of key ministries drives cleantech entrepreneurship opportunities for women and youth. Ministries in high-performing countries with a focus on business, innovation, gender and youth coordinate their programmes, funding, data tracking, and monitoring and evaluation to streamline the policy building process and improve outcomes. The outcomes include the formulation of policies, budget allocation to fund programmes, and increased participation of priority groups in the sector. **Countries that prioritize access to STEM education, green jobs and entrepreneurship while addressing biases in hiring practices have a higher involvement of women and youth in the cleantech sector.** Education curricula on climate change, sustainability, and cleantech innovation engage youth and expose them to career opportunities.

As leaders, women and youth are more likely to promote increased access to funding and opportunities for marginalized groups. Programmes tailored for women and youth that offer training, mentoring, networking and recognition serve as pathways to leadership roles in government, financial institutions and corporations. Such programmes recognize the diversity of perspectives from individuals with different socio-economic backgrounds, ethnicities, regions, abilities, genders and life experiences.

The establishment of policy initiatives and programmes to incentivize funding for women, youth and marginalized groups in cleantech spurs access to capital through both non-profits and private industry. Designated funding sources for priority groups address historically unequal distributions of capital, while increased access to capital for these groups directly fosters inclusion, representation and successful outcomes for entrepreneurs.

Publicly recognizing the achievements of women and youth in innovation improves these groups' prospects. When success is amplified through media and events, these founders attract the interest of potential future investors, customers and partners.

I. Global Innovation Success Stories

The countries featured in this section have earned their place as either global innovation leaders or cleantech innovation leaders, according to leading global innovation indexes. Each of these countries ranked high on either a global or regional scale in the WIPO's Global Innovation Index (GII), a reputable publication that uses over 80 indicators to rank countries based on recent global innovation trends. Several of these countries are also home to some of the world's leading global cleantech clusters according to Startup Genome's 2021 report. We have also included insights from five of the top 10 countries on ITIF's 2021 Global Energy Innovation Index, which measures national contributions to global energy innovation system.

The second group includes countries that share similarities with one or more GCIP partner countries, including income level and economy, climate hazard risk, sectors at risk from climate change and other geographical and demographic factors.

Global Innovation and Cleantech Innovation Leaders

Canada

Canada is among the top 15 global innovators, returning to the top 15 for the first time since 2016. Canada outperforms the high-income group average in all GII pillars, demonstrating particular strengths in market sophistication, human capital and institutions. Canada has a well-developed investment ecosystem, securing the top position in VC recipients and a strong performance in indicators such as availability of credit and access to international markets. Canada is home to some of the best universities globally, and ranked 9th for university-industry R&D collaboration. The country also ranked high in metrics measuring the political and regulatory environment. Canada hosts four of the world's top 100 science and technology clusters.

Denmark

Denmark ranks as the tenth most innovative country in the world according to WIPO, owing

to its robust and well-developed innovation ecosystem that outperforms the high-income country average in all seven pillars that compose the ranking. Denmark's key strength is its infrastructure and its institutions: Denmark's political and operational stability, government effectiveness, regulatory quality and rule of law are all ranked among the top six in the world. Denmark is also an R&D leader, being one of ten countries allocating 3 per cent of GDP annually to R&D spending.

Finland

Finland ranked 9th in the WIPO 2022 Global Innovation Index, performing above the high-income group average in all GII pillars. Like its Nordic neighbours, Finland's greatest innovation strengths are its institutions, infrastructure and human capital. Finland ranked 1st globally in rule of law, and 3rd in government effectiveness and regulatory quality, illustrating the country's institutional soundness. Finland also ranked 1st in the world for financing startups and scale-ups due to the availability of credit and the protection provided to both borrowers and lenders.

Israel

Israel is well-known for its outstanding innovation and vibrant startup ecosystem. The country is a leader in both market sophistication and R&D. Israel ranks first globally in venture capital deals, while also grabbing the top spot in R&D expenditure as a percentage of GDP; Israel is the only country in the world that spends more than five per cent of GDP on R&D, reaching 5.4 per cent in 2020. The country's level of university-industry research collaboration is also among the highest in the world. Finally, Israel is a world leader in women employed with advanced degrees and PCT patents.

Japan

Japan ranks 4th in Asia & Oceania and 13th globally in the 2022 Global Innovation Index, scoring high in metrics such as R&D, patent creation, domestic market scale, political stability, and regulatory environment. Japan ranks first in production and export complexity, demonstrating the country's high value-added economic outputs. Japan's Tokyo-Yokohama cluster is globally recognized as one of the most important in the world, ranking as the top science and technology cluster in the Global Innovation Index, and placing 9th in Startup Genome's 2021 Ecosystem report.

Switzerland

Switzerland has ranked first in the Global Innovation Index for the last 12 years. The country scores highly on government effectiveness and favourable policies for doing business, and has strong R&D capability and a high level of university-industry R&D collaboration. Switzerland ranks second globally in high-tech manufacturing. The country is also a leader in knowledge creation, ranking first in patent creation on a per capita level.

United States

The United States of America (U.S.) ranked second in WIPO's Global Innovation Index for 2022. The U.S. leads in terms of number of innovation indicators, placing first in 15 of the 81 indicators used to build the Index. The country ranks first in R&D, quality of universities, university-industry R&D collaboration, VC investors, and quality and impact of its scientific publications. According to Startup Genome's 2021 Ecosystem report, seven of the top 14 global startup ecosystems are in the U.S., with Silicon Valley and New York City ranked 1st and 2nd, respectively.

Successful Countries Similar to GCIP Partner Countries

Bulgaria

Bulgaria positioned 2nd in innovation among upper-middle income countries in 2022 and has been categorized as an "innovation achiever" since 2020 for performing above expectations on innovation considering its income level. Despite parliamentary conditions which have obstructed the legislative process, Bulgaria performs very strong in innovation outputs, including utility models/patent applications and creative outputs[3], and ranks 19th in impact of innovation activities at the micro- and macro-economic level.

Chile

Chile is the most innovative country in Latin America and the Caribbean, placing 1st in the region in the WIPO rankings for the past seven years (since 2016). It is the only Latin American country in the top 50, ahead of the other regional powerhouses such as Brazil and Mexico. Chile has strong institutions—including rule of law, regulatory quality and government effectiveness—while also having a well-developed education system, ranking among the top 25 for both school life expectancy and tertiary education enrolment. Chile's capital, Santiago de Chile, is considered an important global science and technology cluster.

China

China's leading status as a global innovator is largely due to its heavy investment in R&D as well as strong science and technology clusters. China is the 2nd highest spender in overall R&D globally, with total R&D spending increasing 9.6 per cent in 2021 alone.

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3 Creative Outputs is one aspect of WIPO's ranking mechanism and includes intangible assets, creative goods and services and online creativity.

China ranked amongst the top five countries in the world for patents and high-technology exports, a testament to the country's strong R&D culture. Furthermore, China had 21 science and technology clusters in 2022, tied with the United States for 1st place, including the crucial Beijing cluster.

India

India reached 40th place in the 2022 Global Innovation Index, up from 76th in 2014. India ranks 1st among lower-middle income countries and 1st in Central and South-East Asia. The country continues to be the world leader in information and communication technology (ICT) service exports and has a fast-growing startup environment; India is now home to the third largest startup economy in the world, and ranked 8th for financing startups and scale-ups, with an active VC ecosystem. India's strong science and engineering programmes also provide quality human capital.

Viet Nam

Viet Nam has climbed nearly 30 positions on the Global Innovation Index over the last ten years, and is currently ranked 2nd among lower-middle income countries. Viet Nam has a comprehensive innovation framework and scores above average even when compared with upper-middle income countries in every innovation pillar except for human capital and research. The country ranks 1st worldwide in high-tech imports and 3rd in high-tech exports, as its technological assembly and strong trade framework enables it to actively participate in global supply chains.

II. Successful Innovation Policies Enacted in Countries Leading in Cleantech Innovation

Introduction

Innovation is a fundamental driver of economic growth, job creation, and global competitiveness. Cleantech innovation has the capacity to foster economic growth without increased GHG emissions and to create decentralized job opportunities in different regions, and improve living and working conditions for populations without access to electricity and water networks. Cleantech startups and MSMEs can also provide alternative employment to those dependent on exploitation of the Earth's resources for livelihood.

Governments play a critical role in creating an environment that fosters innovation by implementing policies that support and incentivize innovative activity. This includes direct support, as well as approaches that encourage all participants to actively contribute to the innovation ecosystem. International collaboration can enhance national success both by exploiting synergies to maximize the leverage of committed resources, and by increasing the demand connection opportunities for domestic innovation.

The most successful countries we interviewed have introduced the following mechanisms to increase results:

- They design and implement targeted interventions to realize innovation priorities and comprehensive targets;
- They design support mechanisms that incentivize private investment in innovation.

Innovation priorities can vary depending on the stage of ecosystem maturity. Nascent

ecosystems often prioritize R&D and early-stage support to increase 'innovation supply', in other words, the creation of startups and MSMEs. A mid-stage ecosystem may pursue measures to encourage the demonstration or commercialization of new technologies, while the most developed ecosystems, which already feature a robust supply of scaling ventures, may look to boost national and international demand for those companies and their innovative solutions. In the cleantech space, effective policy also includes measures to address common barriers to scale, shared by many cleantech innovators, such as the first commercialization 'valley of death' and the need to compete with lower-priced, polluting incumbent technologies. Figure 2 presents the high-level policy levers that can be implemented to accelerate cleantech innovation according to different priorities.

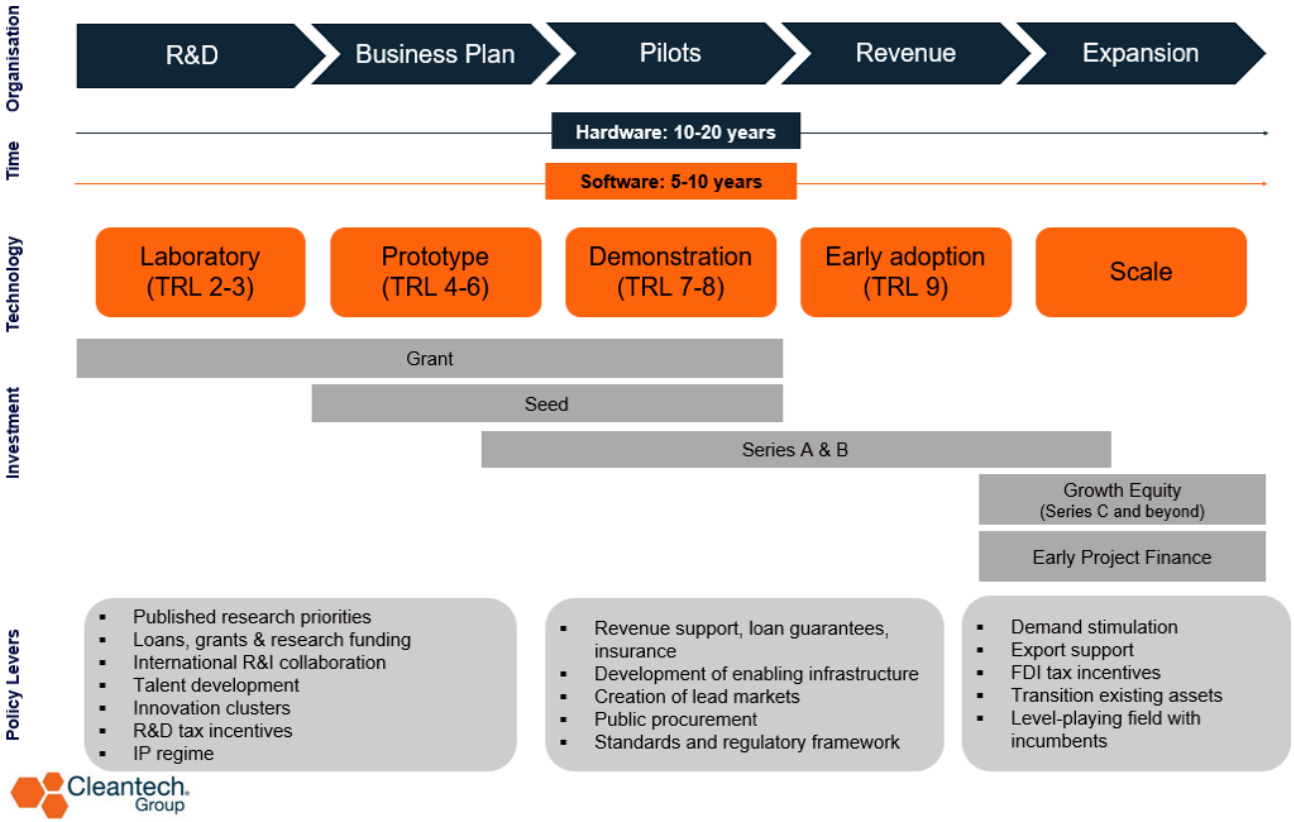

Figure 2: Policy Levers by Lifecycle Stage[4]

This chapter explores in more detail the tools governments can use to strengthen their innovation ecosystems in line with the stage of startup and MSME development they seek to prioritize. The first section examines the ways in which leading governments use policy interventions to support early-stage startup growth. The next section details policies that target growth at the demonstration and commercialization stage. The final section analyses policies that can be implemented to support companies that have reached the growth stage and need to scale. Each stage considers both policies that offer direct support, as well as those incentivizing private sector involvement.

4 Source: Cleantech Group research

Policy Strategies to Increase Supply of Early-Stage Innovation

As outlined in the previous section, governments play an essential role in stimulating innovation by establishing frameworks, policies and providing the initial support needed to foster research, innovation and commercialization, especially in underserved technologies.

Establish a national body dedicated to promoting innovation

Countries that consistently demonstrate innovation results often have a dedicated government ministry or agency focused on developing innovation across the country. Prominent examples of countries with dedicated innovation agencies include Finland, Israel and Mauritius.

The Israel Innovation Agency is the government agency responsible for promoting innovation through investment, R&D and other local and ecosystem support. They support companies at all stages, including startups, growth-stage companies, R&D and technology innovation funding, and connect all types of companies with global innovation initiatives. The Israel Innovation Authority functions as an autonomous entity, with distinct directors and board members separate from those serving its parent government ministries such as the Ministry of Science and Technology. This autonomy has enabled public initiatives aimed at strengthening innovation to continue through five successive changes of government between 2019 and 2022.

Business Finland is a public organization that supports innovation through funding, increasing access to export markets, supporting international growth, and ecosystem strengthening. Business Finland assists companies across all stages, including funding R&D, broad funding and ecosystems support for MSMEs and helping large companies improve international growth and access global R&D cooperation schemes. Business Finland follows a five-year strategy (2020–2025) which gives long-term policy signals to the market. Business Finland provided EUR 701 million in innovation and research funding to 3,912 companies in 2021 alone[5].

Mauritius, ranked the most innovative country in sub-Saharan Africa[6], directs its innovation activities through the Mauritius Research Innovation Council (MRIC).

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5 Business Finland (2021). Results and Impacts. https://www.businessfinland.fi/493904/globalassets/finnish-customers/news/events/2022/results-and-impacts_2021_en.pdf

6 Global Innovation Index (2022). World Intellectual Property Organization. https://www.wipo.int/global_innovation_index/en/2022/

The MRIC's objective is to promote research for sustainable development to enhance the quality of life across the country. MRIC is government-funded and has various programmes to support innovation and research in academia and industry. Some examples include the National Innovation Scheme to support prototypes and the launch and growth of startups; the Proof of Concept scheme to validate business feasibility of novel research ideas, and the Collaborate Research and Innovation Grant Scheme, which connects local businesses with academia and research centres to conduct join research projects. The country's innovation agenda is guided by its National Roadmap for Research and Innovation, which runs between 2023–2027. From 2014–2019, the total number of projects carried out by the MRIC increased from 489 to 773, while project value more than tripled[7].

Set long-term policy signals that are consistent over time

Governments with consistent, actionable innovation policies are more successful in driving public measures to support innovation as well as private sector activity.

Both Business Finland and China's National Research and Development Council develop five-year plans to send strong long-term policy signals to the private sector and wider innovation ecosystem. Finland's plan outlines strategic priorities in terms of economic growth, sustainability and competitiveness. The UK, on the other hand, has a three-year spending review budget planning cycle. Policymakers commented that this shorter planning cycle leads to uncertainty over the long term, and increases the risk premium on private sector engagement, which reduces the leverage of public-private investment. In other words, every unit of public spending results in a correspondingly lower amount of private investment.

Maintaining long-term priorities across changing governments is crucial. Granting some level of autonomy to the national innovation agency can facilitate this: Israel's Innovation Authority has the mandate to build long-term plans to promote startups, industry, and engage with stakeholders to foster innovation, which has allowed it to maintain positive results despite successive changes of governments. The separation of the Israel Innovation Authority from other branches of government was a strategic choice to prevent the Authority's work from being influenced by the specific needs or wants of the incumbent government and ministries in power and to maintain the long-term vision of Israel's innovation policy.

On the other hand, Bulgaria has faced challenges in progressing key legislation to promote cleantech innovation, including the Innovation Strategy Implementation Plan, the Hydrogen Strategy and the Research and Innovation Law. Although Bulgaria has a separate Ministry dedicated to Innovation and Growth, stakeholders have stated that

7 Mauritius Research and Innovation Council (2019). Mauritius Research Council 2018 – 2019 Annual Report. https://www.mric.mu/_files/ugd/d4e70d_967f0b1c99b1465db05092218927ee36.pdf

this was not sufficient to ensure the climate strategy's prioritization above other political considerations.

Publish clear, national R&D priorities and align R&D funding to them

There is a positive correlation between gross domestic spending on R&D and a country's innovation performance. Some of the most innovative countries in the world, including Denmark, Israel, Finland and the U.S., have historically spent above the OECD average on research. Israel has the highest gross domestic spending on R&D as a percentage of GDP globally at 5.4 per cent[8].

Some of these countries have set R&D targets for research spending. Finland, for example, has a goal of four per cent of GDP spending on R&D; while the country is currently one per cent behind its target, it is still spending a higher share of GDP than other developed economies. China has increased overall R&D spending nearly threefold from 0.9 per cent of GDP in 2000 to 2.4 per cent of GDP in 2020[9]. Contributors to this report cited the Chinese national government's commitment to R&D as a key driver of China's innovation success in recent years.

The Israel Innovation Agency invests over USD 500 million annually in its innovation activities, with climatetech as one of its priority areas. Research by the Hebrew University of Jerusalem on the impact on business of government support for innovative R&D concluded that this support resulted in the creation of 5-10 times more value to the industry than the initial government investment[10].

The impact of R&D spending is maximized by aligning it with national climate targets and innovation priorities. The UK has committed to achieving net zero by 2050, and has signalled that innovation is an important enabler for reaching this target. The government has identified R&D needs to reach the 2050 target, which are then used to determine short-term priorities for the next five to ten years. The UK expects much of the necessary investment to be delivered by the private sector.

Maximize the impact of R&D investment through international collaboration

One way Mauritius has dealt with the challenge of being a small island nation is by collaborating with international stakeholders to promote R&D. The Research and

8 OECD Data (2022). Gross domestic spending on R&D. https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm

9 Ibid.

10 Israel Innovation Authority. Innovation Authority – Strategy and Policy. https://innovationisrael.org.il/en/contentpage/strategy-and-policy

Innovation Bridge programme, sponsored by the MRIC, provides grant funding to support local companies to work together with international companies or research institutions to collaborate on R&D projects with commercial potential. Mauritius also offers a scheme through the Higher Education Commission, which funds international professors to spend time in Mauritius and provide expertise on priority areas.

Focus early-stage support on developing novel industries and high-growth ventures

Policymakers interviewed for this report commented that direct government support is most effective when it is geared towards supporting nascent technologies, industries and innovators as opposed to supporting large corporations or existing technologies. Many contributors agreed that grants and subsidies should no longer be used once a technology is commercially available and able to compete in the market, as it is not an optimal use of public resources. Similarly, several country representatives highlighted how resources should be targeted towards MSMEs, given that large corporations generally have the balance sheet to finance innovation, especially compared to innovators. Ensuring that public support is channelled directly to innovators ensures that assistance is directed to innovation that is least likely to materialize, thus encouraging efficient use of government funds.

Countries such as Denmark, Finland, Israel and Chile have used a mix of policy tools, including subsidies, grants, loans and R&D incentives to support early-stage startups and MSMEs and in some cases kick-start new industries.

Denmark has successfully implemented subsidies to develop its offshore wind industry. After identifying offshore wind as a future strategic technology in the 1990s, the Danish government provided grants to offshore wind developers. This kickstarted the industry by creating a business case and driving down costs for developers. Today, nearly 50 per cent of the country's energy comes from wind power[11], and developers are competing for rights to build offshore wind platforms. The Danish government states that its support for nascent technology through policy and grants has had a considerable impact on the country's innovation and economy.

Using offshore wind as a model for success, the government is now using similar grant-based schemes to support nascent technologies such as green hydrogen. Business Finland runs programmes that target innovation at different stages, ranging from R&D to corporate engagement. However, between 2010 and 2021, 65 per cent of its innovation funding went to startups and MSMEs (with the remaining 35 per cent being allocated to large companies)[12].

11 IEA (2021). Wind Energy in Denmark. https://iea-wind.org/about-iea-wind-tcp/members/denmark/#:~:text=In%202021%2C%20the%20net%20installed,wind%20accounts%20for%202%2C300%20MW

12 Business Finland (2021). Results and Impacts. https://www.businessfinland.fi/493904/globalassets/finnish-customers/news/events/2022/results-and-impacts_2021_en.pdf

Business Finland uses the following tools to support MSMEs:

- **Innovation vouchers** - intended for MSMEs to buy expert services that bring new knowledge and expertise required for innovation in their company;
- **Research, development and pilot funding** – both in the form of grants and low-interest loans (1 per cent) that cover up to 50 per cent of project costs;
- **Talent funding** – grant that covers up to 50 per cent of project costs to improve capacity for international growth by creating working, organizational and management practices that support internationalization;
- **EU and international funds** – participation in Horizon 2020 programmes and international financial institutions programmes.

Business Finland also supports collaborations between MSMEs and universities and larger corporations by incentivizing large companies to commit to increase R&D spending and work together with smaller companies to support their R&D and innovation needs. Business Finland has had a tremendous impact on the innovation ecosystem and growth of MSMEs: between 2017 and 2020, exports by MSMEs that had been supported increased by 25 per cent, revenues rose by 22 per cent and the number of jobs by 15,000[13].

The Israel Innovation Authority has oriented its policy towards supporting innovators. Its primary objective is to amplify the number of startups and propel them to a stage where they can secure investments from the private sector. Consequently, the agency primarily invests in pre-seed, seed and Series A rounds. The Authority also offers convertible loans to support MSMEs; if the innovator succeeds, he/she repays the loan equivalent to the amount received. If the innovator does not succeed, he/she is not penalized. There is a match-funding requirement which mandates that MSMEs that receive government funds must also obtain "matched" support from other investors and or/companies. Nearly 40 per cent of all cleantech startups in the country receive support from the Israeli Innovation Authority (250 of the 650 cleantech startups), including innovators in clean energy, transportation, alternative protein and green construction. The Israel Innovation Authority also runs seven specialist cleantech incubators covering themes including agritech, food-tech, net zero and smart industry.

Chile's Corporación de Fomento de la Producción (CORFO), the government agency in charge of supporting innovators, innovation and competitiveness, is implementing specific programmes and expanding existing programmes to better support early-stage innovators. CORFO's main early-stage programme, Start-Up Chile, is a public accelerator which provides equity-free funding and a 4-8 month programme to help develop businesses across all stages. Start-Up Chile has supported over 2,000 innovators since its inception, which have collectively generated over $1 billion in sales[14].

13 Business Finland (2021). Results and Impacts. https://www.businessfinland.fi/493904/globalassets/finnish-customers/news/events/2022/results-and-impacts_2021_en.pdf

14 CORFO. Start-Up Chile – Our Impact. https://startupchile.org/en/our-impact/

Incentivize private sector investment through R&D tax credits

To further strengthen innovators, the Chilean government is exploring ways to ensure that the country's R&D tax law, which provides up to 30 per cent cashback on R&D investments, is used by more innovators, not predominantly large corporations.

Implement mechanisms to ensure cross-departmental collaboration on innovation issues

Improving innovation is a complex goal that requires the coordination of elements including research, science, business and commercialization, financing, trade and international collaboration. As a result, governments leading in innovation often implement mechanisms to facilitate communication between the various ministries, agencies and other actors participating in the innovation process.

The UK's Net Zero Innovation Board (NZIB) provides oversight of public net-zero programmes, identifies opportunities for enhanced collaboration on energy innovation, and ensures spending is aligned with government priorities. The Board has representatives and observers from all major government departments that are active in net zero programmes, including the Ministry of Business, Energy, Environment, Housing, Research & Innovation, Transport, and Treasury.

Chile similarly imposes mechanisms to facilitate coordination between ministries working on innovation and commercialization. Chile's CORFO promotes the commercialization of innovation, while Agencia Nacional de Investigacion y Desarollo (ANID) focuses on early-stage R&D and technological innovation. As a result, CORFO frequently coordinates with ANID, as ANID is more in touch with the latest research developments from universities and other research partners that could have a commercial impact. CORFO also collaborates with ANID to arrive at solutions for the technological demands identified by industry.

Countries with innovation barriers can also successfully use coordination mechanisms between government actors. Bulgaria's Hydrogen Strategy (still in draft form) has been developed though cross-ministry collaboration. The Ministry of Economy and the Ministry of Innovation and Growth, which will both play an important role in executing its delivery, have collaborated strongly on this initiative. Similarly, the Research and Innovation Law[15] is a joint effort between the Ministry of Education and Science and the Ministry of Innovation and Growth, given their overlapping mandates and responsibilities for research and innovation.

15 On April 2024, the Bulgarian national assembly adopted a new Law on Research and Innovation.

Develop appropriate programmes to educate the next generation of innovators

Improving access to and quality of education has high potential to promote entrepreneurship and innovation[16]. Consequently, innovation policy should ensure that sufficient education and upskilling to meet future skills needs are integrated into the innovation ecosystem through public and private education, training and development within corporations, and other relevant organizations.

Chile has improved its human capital by partnering directly with research institutions established by industry. While most research and innovation in Chile occurs via tech-transfer offices at universities, Chile took interest in the successful models developed by other developed nations which provided innovation from non-university research institutes. Chile launched the International Excellence Centre Attraction Programme 10 years ago, which brought ten research centres from France, Germany and Australia to Chile (through the Sustainable Mining Institute), and other nations to improve the country's human capital. Chile now has the necessary human capital to manage technical development projects that match technology demand from industry with the technology supply from research centres and universities.

A common concern among policymakers interviewed for this study was the need to catalyse innovation, especially scientific innovation, for future workers. Some innovation ecosystem actors in Finland want to further examine the role the ecosystem can play in accelerating education for the next generation. While home to one of the best education systems in the world, Finland also has fewer adults with tertiary education than their OECD peers (40 per cent of Finnish adults vs 47 per cent of OECD average)[17].

Implement measures to retain talent and attract an international workforce

Talent development is a crucial part of a country's successful socio-economic development. Attracting international talent can drive innovation and growth in key sectors and lead to increased competitiveness in the global marketplace, higher levels of economic growth, and the creation of new job opportunities.

"Brain drain" represents a major problem for Mauritius, which has a limited technical workforce. The departure of the higher educated population risks weakening the country's innovation ecosystem as future talent move to pursue opportunities abroad. Mauritius has tried to limit the impact of this "brain drain" by facilitating work visas and other

16 National Bureau of Economic Research (2021). Education and Innovation. https://www.nber.org/system/files/working_papers/w28544/w28544.pdf

17 OECD Data (2022). Population with tertiary education. https://data.oecd.org/eduatt/population-with-tertiary-education.htm

permits to remove the red tape involved in the migration process as well as to attract talent to the island.

The China 1000 People Programme is an example of a government-led initiative aimed at attracting and retaining highly skilled professionals. The programme provides incentives such as funding for research projects, salary and housing subsidies, and access to research facilities and equipment to attract Chinese professionals who live abroad to return to work in China. This programme has been successful in attracting a significant number of talented individuals back to China, which has contributed to the growth of key sectors such as science, technology, engineering and mathematics (STEM), as well as finance, management and education. Additionally, it has helped develop China's human capital and increase its competitiveness in the global marketplace.

Support regional development across the country to promote balanced economic growth, reduce regional disparities and reach untapped potential

Governments worldwide are actively working towards stimulating development in their countries by providing funding through a range of initiatives aimed at supporting regional development and promoting sustainable economic growth.

For example, the UK government provides funding for feasibility studies through various programmes and initiatives aimed at promoting economic growth and development in different regions across the country. One such initiative is the Regional Growth Fund (RGF), which was established in 2010 to support economic growth and create jobs across England. The RGF provides funding to businesses, local authorities and other organizations to support projects that will create long-term economic growth in their region. This funding can be used for a range of activities, including feasibility studies.

Another UK initiative that provides funding for feasibility studies is the Industrial Strategy Challenge Fund (ISCF), which was launched in 2017. The ISCF aims to support research and innovation in areas of strategic importance to the UK, such as clean energy, artificial intelligence and mobility. The fund provides funding for feasibility studies as well as R&D projects.

Collaborate with all key actors across the innovation ecosystem – nobody can do this alone

Developing and implementing innovation requires buy-in from all stakeholders: government, universities, business enterprises, communities and citizens. Innovation policy should target multi-stakeholder management approaches that allow all participants to voice their thoughts, concerns and ideas to strengthen and coordinate innovation ecosystems.

Finland has a high degree of cooperation among all actors within the country's innovation ecosystems, as it is widely recognized that bringing together stakeholders who are affected by a problem is crucial to resolving it. Finland benefits from being a small country—geographically and demographically—which makes cooperation among diverse players easier. One example of stakeholder management in Finland comes from hydrogen development. There is active coordination not only between government, business and research bodies, but also with the communities located in proposed project sites, as they must be actively involved in related zoning issues.

Bulgaria's efforts in the field of hydrogen have also embraced a multi-stakeholder approach. Although the Hydrogen Strategy is a government initiative, the Ministry of Innovation and Growth is involved in thematic groups that include a range of stakeholders from academia to businesses to effectively shape the country's hydrogen roadmap. Lessons from Bulgaria illustrate how a multi-stakeholder approach leads to enhanced information sharing, improving the decision-making process and lending more legitimacy to outcomes, which involved a range of actors not just one group in isolation.

Hydrogen Denmark, an organization that brings together all ecosystem actors working in green hydrogen and fuel cells, has members from industry, research institutions, public institutions, and network organizations which ensure that it engages in dialogue with all relevant actors across the value chain.

One last example of a multi-stakeholder approach is the Israeli government's work to invest and participate in consortia. Each consortium represents dozens of companies and researchers across several innovative industries, ranging from plastics to meat production. The ultimate aim of these groups is to bring together large companies, smaller innovators and researchers from universities and institutions to collaborate with the goal of addressing the challenges of specific industries and technologies. They have been an effective means to bring together stakeholders, promote widespread cooperation, share different perspectives and ultimately resolve industry challenges.

Policy Strategies to Support Demonstration and Commercialization

Encourage the private sector to take ownership of the innovation agenda

Successful countries demonstrate strong private sector engagement in the innovation agenda and ecosystem. Policy must be designed to promote the private sector's active participation in innovation activities: while government is instrumental in the earliest stages of the innovation lifecycle, it is generally the private sector that scales innovation for material climate and economic impact.

Innovation leaders like the USA, Finland, Israel and the UK leverage the private sector to create the majority of impact derived from innovation. For example, Business Finland acknowledges that the bulk of innovation outcomes are attributable to the private sector and therefore serves as a facilitator to promote and support the innovation process. Likewise, the UK's multi-billion dollar Net Zero Framework will primarily be executed by the private sector. Finally, the Israel Innovation Agency focuses on supporting early-stage businesses under the premise that when these businesses become self-sufficient, their participation in the market will be the most important driver of innovation and impact in the country.

One compelling example of the private sector's crucial role in spearheading innovation is found in Bulgaria. Although key policies have not yet been implemented, the private sector has succeeded in driving innovation forward in several highly innovative areas, including IT, hydrogen, high-efficiency electrolyzers and advanced water treatment. The country is home to many small startups in cleantech and other sectors, as well as large industrial zones such the Trakia Economic Zone, a cluster of 200 companies (including world-renowned firms like ABP and Schneider Electric), which have proactively set a target for carbon neutrality by 2040. Industrial development in Bulgaria has been almost exclusively an entrepreneurial venture and has become an important driver in attracting investments from global companies. While Bulgaria's potential for innovation could be intensified with stronger political backing, the private sector's capacity to foster local innovation without substantial political support is quite impressive.

One major barrier that may prevent the private sector from engaging in innovation is the complexity of the local policy framework and regulation. In Denmark, for example, one of the challenges the government identified in supporting cleantech innovation was that

companies, especially MSMEs with limited resources, could not successfully navigate all the rules, procedures, permit processes and other bureaucratic aspects that are part of setting up an innovative company. A survey carried out by Cleantech for Europe found that startups in the EU deem the opportunity cost of applying for EU funding to be too high, and that timeframes for receiving the funds are too long to help startups who need to grow quickly[18]. Accelerating and simplifying these processes, for example by streamlining application processes for public support, can facilitate innovators and MSMEs' involvement in innovation. To support funding applications by young companies, the U.S. DoE allows startups and investors to approach its officers directly with queries about the application process and to give them advice on how to increase the quality of their applications.

Case Study: Market Creation through Joined Up Policy and Regulation

We spoke with innovative electricity sector companies in the UK and abroad, and they highlighted the UK's electricity sector as a leader in adopting reforms that accelerate the transition to clean energy production and enable innovative startups and MSMEs to play a role in this transition. In the UK, startups provide services such as alternative electricity supply to consumers, aggregation and trading of small-scale flexibility, and grid optimization services. This case study describes how the coordinated policy and regulartory environment facilitates this, thereby creating a market for these innovative services.

The UK government has shown a clear high-level commitment to climate targets over the last ten years, and legislation to achieve net zero by 2050 has been in effect since 2019. This broader context has raised widespread general interest in climate innovation. In energy policy, in particular, Ofgem (the regulator) and the Department for Energy Security and Net Zero (formerly BEIS) have collaborated continuously over several years on policy and strategies, giving a clear signal that energy transition and incorporation of flexibility assets are a priority.

The Smart Systems and Flexibility Plan (first published in 2017) sets out priorities for transforming the UK's energy system, including supporting flexibility from customers, removing barriers to flexibility on the grid, and reforming electricity markets. Ofgem's price control framework (RIIO) has also requested proposals for the provision of flexibility services, sending a clear market signal which has driven commercial contracts between network operators and innovative start- ups working in this space. The combination of consistent policy signals and clear regulatory and market direction over a number of years has resulted in a growing market and a supportive environment for electricity system innovators.

18 Cleantech for Europe. (2023, March 7). Horizon Europe, A Powerful Asset in the Global Cleantech Race. Retrieved from Cleantech for Europe: https://www.cleantechforeurope.com/policy/horizon-europe-a-powerful-asset-in-the-global-cleantech-race

Implement targeted financing mechanisms to de-risk first commercialization

Many cleantech ventures fail at the point when they are ready to take their product or solution to market. This is sometimes referred to as the 'Valley of Death'. By this point, the company has a working prototype or demonstration, and is ready to serve its first customers. But many companies, even those with promising order books, fail to attract either the equity financing they need to scale their company, or the debt financing they need to ramp up production facilities or generation installations. Targeted public support, including revenue support and loan guarantees, can help give private sector investors and other finance providers the confidence to fund newly commercializing ventures.

The UK has used contracts for difference (CfDs), a form of revenue support, as a way to secure private investment to grow a domestic offshore wind industry. CfDs offer a government-backed guarantee to 'top-up' the offtake price for a wind farm, which limits a portion of the commercial risk for potential financers of that project. Since the scheme began in 2015, it has supported more than 5.2 GW of new offshore wind generation capacity. The UK is now planning to use CfDs to support the growth of other emerging technologies, including green hydrogen production.

Canada's Export Credit Agency, Export Development Canada, is primarily focused on helping companies scale to enter international markets. However, when EDC started working with the cleantech sector, it realized that earlier-stage Canadian cleantech companies face significant financing difficulties. Therefore, EDC developed a suite of financial tools aimed at supporting cleantech companies with commercialization, including loan guarantees, performance guarantees, credit insurance and small-scale project finance. These tools are all aimed at incentivizing commercial banks to finance cleantech companies.

Develop enabling infrastructure

Finland is heavily dependent on energy to support cleantech derivatives, including green hydrogen production, battery technologies and industrial decarbonization. This is supported by a high-performance grid structure, which guarantees high availability and allows reliable power transmission from production sites to demand centres.

Finland's economy is also dependent on exports, and 90 per cent of international trade moves by ship. Therefore, the country has also invested in port infrastructure, with ports that are able to remain operational through the country's harsh winters.

The U.S. Department of Energy's Technology Transitions Office works to connect infrastructure projects with early-stage innovation programmes to ensure that supporting infrastructure is in place when new technologies reach the commercialization stage.

Boost demand for green products and services through public procurement

Unless tendering procedures specifically include sustainability as part of the decision criteria, tenders will usually be awarded on the basis of price alone, which may disadvantage green solutions. Canada's government has committed to net zero procurement of goods and services by 2050 as part of a wider pledge towards net zero operations. These commitments apply to all core government departments, and agencies and will be monitored by the Centre for Greening Government[19].

By increasing market demand, green public procurement also helps bring down the price of sustainable products and services, thus increasing volumes.

Ensure regulation responds to the pace and ambition of innovation

Regulation can help or hinder technological progress in novel industries. Innovation, especially in the cleantech sector, may bring new hardware and technologies that have never been used at a commercial scale before, and therefore may not be covered by existing regulatory frameworks. Regulators should work with innovators to ensure that regulation recognizes and encourages innovation and development, while simultaneously ensuring that novel technologies are safe and fit for commercial applications.

Chile's green hydrogen industry provides an example of the importance of regulation in cleantech. Traditionally, petrol and other fuels in Chile have been charged at a high tax rate to increase government income. New e-fuels such as green hydrogen are at the forefront of the national agenda; it might be more appropriate to tax them at a lower rate to encourage growth in the sector. To date, there is no regulation on how these new products will be taxed: CORFO is working with Chilean regulators to identify relevant gaps and ensure the entire value chain of green hydrogen (including windfarms, electrolyzers, etc.) is not impeded by regulatory practices.

19 Government of Canada. (2023). Greening Government Strategy: A Government of Canada Directive. Retrieved from Government of Canada: https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/strategy.html

Policy Strategies to Accelerate Scale-up of Growth-stage Companies

Implement measures to boost demand for clean technologies

The U.S. Department of Energy (DoE) has developed an Adoption Readiness Level (ARL) scale to assess a community or market's willingness to implement new cleantech solutions. The DoE plans to integrate this assessment into future funding calls to spread awareness of the need for behavioural change among purchasers. During 2023, the DoE's Office of Clean Energy Demonstrations is also requesting public input on effective demand-side measures to accelerate the adoption of clean technologies to inform the design of future interventions. These may include advanced market commitments, direct procurement and guaranteed offtake[20].

Share best practices with other nations

Connecting global innovation ecosystems has several critical advantages, including learning best practices from other countries, working with international actors for increased sophistication of local economic activity, and leveraging international networks to improve export, investment and research. A key advantage of international collaboration is the opportunity to learn the best innovation practices implemented worldwide. A good case study of this is China's emission trading system.

Another area where China has adopted best practices from the EU is geographical indication trademarks, which identify the region and/or country from which a specific product originates. To address China's problem with trademark and intellectual property infringement, the government reached an agreement with the EU to protect European geographical indication trademarks for particular products, such as regional wines or food. China now has three organizations that deal with trademarks and intellectual property rights to reduce counterfeits and protect local and foreign intellectual property and trademarks. China's collaboration and the upgrading of its own intellectual property systems have had considerable results in protecting imports, highlighting the effectiveness of international cooperation. These initiatives are not always straightforward: the agreement with the EU was the result of ten years of negotiations.

20 Office of Clean Energy Demonstrations. (2023, February 2). Public Insight Requested for Demand- Side Support for Clean Energy Technologies. Retrieved from Energy.gov: https://www.energy.gov/oced/articles/public-insight-requested-demand-side-support-clean-energy-technologies

Partner directly with global innovation leaders to bring added-value and innovation to economic activity

Another exciting opportunity for global cooperation on innovation comes from the ability to work hand-in-hand with innovation ecosystems around the world to bring value-added activities to local economies. Building on its success in establishing human capital development to increase innovation capacity by working with industry research leaders in ten countries to build and operate research centres, Chile is now examining a similar approach to add more value to its exports.

Chile is an export-oriented economy, with some 32 per cent of the country's GDP deriving from the export of goods and services[21] [22]. However, well over half of Chile's exports are raw materials; predominately copper, but also other materials, including iron ore and lithium. Chile is the second largest lithium exporter globally[23]. Chile believes that its cheap renewable energy prices, driven by abundant solar resources in the North of the country, will support the economy for more value-added manufacturing. Instead of exporting raw materials to be processed in other countries, Chile intends to leverage its human capital and cheap, easy access to these resources to manufacture value-added products at source and then ship them abroad. To do so, Chile plans to attract industrial capabilities from abroad, including China and the EU, to carry out processing and manufacturing of raw materials on-site. By collaborating with innovative companies with the required skills and knowledge, Chile plans to increase domestic innovation capacity, further upskill its workforce and enhance economic growth. Other examples of collaboration of climate innovation are found in green hydrogen, such as the Team Europe Initiative (TEI) on Green Hydrogen (GH2), a joint effort with Chile to develop the country's hydrogen economy and create jobs while providing green hydrogen imports to the EU[24].

Find international trade opportunities

Building international trade through collaboration with global innovation ecosystems is a good way to enhance the development and scaling of domestic innovation, especially for smaller economies with limited internal markets for cleantech.
Finland and Denmark are both heavily dependent on trade, with 40 per cent and 60 per cent of GDP, respectively, deriving from the export of goods and services[25]. Consequently,

21 World Bank (2021). Exports of goods and services (% of GDP) – Chile. https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?locations=CL

22 This is on par with the global average, but is substantially higher than the UK, U.S., and Japan

23 World Economic Forum (2023) Which countries produce the most lithium? https://www.weforum.org/agenda/2023/01/chart-countries-produce-lithium-world/#:~:text=The%20three%20largest%20producers%20of,3%20million%20tonnes%20by%202030

24 Chilean Delegation to the European Union (2022). Developing Chile's green hydrogen potential: Fast forward to carbon-neutrality. https://www.eeas.europa.eu/node/109785_es?s=192

25 World Bank (2021). Exports of goods and services (% of GDP) - Finland, Denmark. https://data.worldbank.org/

both countries take measures to guarantee that all infrastructure and services related to exports are well-established. In Finland, about 90 per cent of exports are transported by ship, and as a result, the country has invested heavily in good harbour networks and connections to facilitate trade. Similarly, Business Finland has a presence in 40-50 countries to attract talent and companies to move to Finland and promotes export and trade, engaging in networking and connecting companies locally and abroad. Denmark implements its own programmes to attract foreign companies, talent, investment and technology.

In Israel, the Innovation Authority and the Department of International Collaboration work together with research organizations, institutions, multinational companies, foreign innovation agencies and other relevant actors to promote innovation in Israel and abroad and support mutual needs shared by international innovation ecosystems. The Israel Innovation Authority also supports global companies and investors through various initiatives, including seed investment and technology innovation programmes.

The Japanese External Trade Organization (JETRO) is funded by the Japanese government to promote the internationalization of Japanese startups. The startups are mentored to explore product-market fit and accelerate the journey to market. Because the main challenges for Japanese startups comprise scaling and commercialization, JETRO works to engage international investors, including CVCs, who can offer both investment and market opportunities. They also work with international mentors to encourage founders to develop a global mindset. In a joint research project with the University of Tokyo, JETRO identified three success factors to create global minded startups: involvement of serial entrepreneurs, international mentors, and diversity in the founding team.

Create a level playing field with incumbents

China's national ETS serves as a fundamental component of the country's strategy to address climate change and pollution by putting a price on emissions and limiting the amount companies can pollute. Thereby, greener products become more competitive compared to their cheaper, more polluting alternatives. China learned how to develop a successful ETS through the EU, which has the world's longest-standing ETS. Representatives from both governments took part in ETS workshops which involved open discussions on innovation, research and science, and the EU sharing the keys to a successful ETS implementation with its Chinese counterparts.

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indicator/NE.EXP.GNFS.ZS?locations=FI-DK

III. Countries Demonstrating Measurable Success in Facilitating Opportunities for Women and Youth through Cleantech Innovation

This report refers to women aged 25 years and older who live and identify as female, and follows the United Nation's definition of youth as persons between the ages of 15 and 24 years.[26] Women are noticeably underrepresented in the cleantech industry. Although data on women in entrepreneurship are available more broadly, data on women in cleantech remain limited. Globally, just 5 per cent of private equity investment across industries is directed towards businesses founded by women[27]. This reflects the lacking gender parity in VC firms, where only 5.7 per cent of VC partners are women[28]. In 2021, cleantech ventures with at least one female founder received $26.1 million in private equity investment worldwide while male-founded cleantech businesses received $10 billion[29]. Between 2015 to 2021, there were only 62 women for every 100 men considered green talent[30]. Addressing this disparity is not only encouraged, but imperative for driving cleantech innovation that is relevant to all consumers and for fuelling a country's economy.

Companies with more women in leadership can expect to increase net profit by at least 6 per cent across industries[31]. Studies have shown that companies, whether cleantech or not, that have women in leadership or management positions have higher levels of innovation[32] and profit[33]. Ensuring success for women-led cleantech innovation will have profound economic and social benefits across ecosystems.

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26 United Nations. (2023). Global Issues: Youth. Retrieved from United Nations: https://www.un.org/en/global-issues/youth

27 Ibid.

28 Gourani, S. (2021, December 28). These Investors Want More Women to Become VCs. Retrieved from Forbes: https://www.forbes.com/sites/soulaimagourani/2021/12/28/these-investors-want-more-women-%20to-become-vcs/?sh=72d8b2bd5de1

29 Furness, V. (2022, April 28). Clean tech: Are females excluded from green economy? Retrieved from Capital Monitor: https://capitalmonitor.ai/asset-class/equity/clean-tech-females-green-economy/

30 LinkedIn. (2022). Global Green Skills Report 2022. LinkedIn Economic Graph.

31 Ibid.

32 Lorenzo, R. et al. (2017) The Mix That Matters: Innovation Through Diversity. Boston Consulting Group. https://www.bcg.com/publications/2017/people-organization-leadership-talent-innovation-through-diversity-mix-that-matters

33 Noland, M., Moran, T., and Kotschwar, B. (2016) Is Gender Diversity Profitable? Evidence from a Global Survey. Working Papers 16-3. Peterson Institute for International Economics. https://www.piie.com/publications/working-papers/gender-diversity-profitable-evidence-global-survey

The current situation is attributable to deficiencies including lack of training opportunities, mentorship, workplace support, and both conscious and unconscious bias. Barriers to achieving gender parity in the STEM field range from high cost of education and qualifications, limited opportunity to attend training, family commitments, workplace bias and scarcity of mentors. Progress is visible in national priorities, private sector initiatives, and resulting women-led cleantech businesses emerging in each country.

As countries evaluate their economic development plans, innovation for climate adaptation and resilience are becoming a top priority. Including more women in STEM disciplines would ensure that the shortage of skilled workers in STEM-related industries globally could be alleviated. Filling this gap by including women and youth in the cleantech workforce is the only way countries will capitalize on the transition to net zero. Cleantech represents the future, and green skills will be well-renumerated. With a projected 24 million new jobs set to open in the green economy, countries must afford women the same economic advantages and opportunities as men[34]. Women and youth offer unique perspectives on important issues, including climate and how it affects them and their communities, meaning these populations can bring innovative ideas to the cleantech sector. The effects of climate change disproportionately impact women, youth and vulnerable communities so it is imperative to include them in the solutions.

Governments are pairing new climate policies and commitments with incentives to engage youth in STEM education, in opportunities for R&D, and growing a culture of entrepreneurship. If women and youth who wish to pursue a cleantech career feel there is no space for them to do so in their home countries, and if they have the means to go abroad to do so, they will. This means they will build clean technology overseas instead of at home, which is a missed opportunity for any economy. The following countries have produced successful women- or youth-led cleantech startups or MSMEs that have been successful on the world stage (as determined by the rankings detailed in the methodology section). The profiles in this section detail the successful outcomes which are specific to each country. The next section analyses the factors that have contributed to this success.

Argentina

Female-founded enterprises in Argentina are recognized on the Cleantech 50 to Watch, a list of up-and-coming private innovation companies in clean technology published annually[35]. In 2019, 41 of the 63 science, technology and innovation projects had a female director. The country continues to work with international and national governing bodies to achieve a higher standard for women and youth inclusion in cleantech.

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34 International Labour Organization. (2018). Greening with jobs – World Employment and Social Outlook 2018. Retrieved from International Labour Organization: https://www.ilo.org/global/research/global-reports/%20weso/greening-with-jobs/lang--en/index.htm

35 Cleantech Group. (2022). 2022 Cleantech 50 to Watch. Retrieved from i3 Connect: https://i3connect. com/50_to_watch

The national policies and programmes for women and youth inclusion in Argentina's cleantech sector offer valuable insights into how this success has been achieved. The quality and access to education in Argentina sets the country apart for youth development. In Buenos Aires, 40 per cent of youth hold a college degree[36]. Prestigious public universities such as the University of Buenos Aires, the highest ranked university in Latin America, offer citizens as well as international students from Brazil, Paraguay, Uruguay and Venezuela free enrolment. For this reason, Argentina ranks as the top student destination in Latin America[37]. Since 2017, university enrolment rates have been higher for female students than male students[38]. Female researchers in Argentina's public sector have achieved parity, with over 70 per cent of female tertiary graduates with a degree in natural sciences, mathematics and statistics[39].

In addition to the country's success in education initiatives, there is also a high output of entrepreneurial activities. Argentina has established networks, programmes, and policies aimed at empowering women and youth entrepreneurs to join the renewable energy sector.

Canada

Canada is ranked third globally for women entrepreneurship with close to 30 per cent of businesses in the country being women-owned. Government-funded accelerators provide resources, incentives and networking opportunities to help female founders turn their ideas into viable businesses. The country has mandated a national priority for increasing the participation of women in the cleantech sector[40]. Directives within Canada's policy and investment sector are not only requiring a boost in cleantech innovation, but are also requiring gender balance in the innovation community. Coordinated efforts between government agencies are catalyzing data collection and policymaking processes.

India

India ranks third for number of female founders, with an estimated 1,108 female founders across all sectors[41]. Bangalore, India, where the average deal size for women is over $5 million, is among the top ten cities in the world where women receive the largest average deal size[42]. As the government of India is ramping up its renewable energy transition, the Ministry of New and Renewable Energy has emphasized the importance of women

36 Startup Genome. (2022, December). Argentina - Buenos Aires. Retrieved from Startup Genome: https://startup-genome.com/ecosystems/buenos-aires

37 Ibid.

38 Bello, A. (2020). Women In Science, Technology, Engineering and Mathematics (STEM) In the Latin America and The Caribbean Region. Montevideo: UN Women.

39 Ibid.

40 Mastercard. (2022). The Mastercard Index of Women Entrepreneurs. March: Mastercard.

41 Ibid.

42 Startup Genome. (2021, August 26). Gender Disparity within Global Venture Capitalist Investments. Retrieved from Startup Genome: https://startupgenome.com/articles/gender-gap

participation. Regional governments create exclusive schemes for women to access capital and business support for building innovative ventures. In India, the share of female students who have completed a bachelors, masters or doctoral level degree in the engineering field is among the highest in the world[43].

Malaysia

Malaysia is among the top ten countries with the highest percentage of female founders[44]. Key stakeholder collaboration between Malaysia's government ministries is advancing cleantech entrepreneurship activities for women and youth. In 2013, the government introduced its National Policy on Science, Technology and Innovation as a strategic reform initiative for socio-economic transformation and inclusive growth to promote inclusion of these priority groups within the cleantech sector[45]. National accelerators funnel young engineers into entrepreneurial career paths and drive innovation in science and technology.

New Zealand

New Zealand ranks second in the top countries for women in business, with the country's strong support of entrepreneurial conditions and high quality of governance[46]. Women own three of every 10 businesses in the country[47]. National policy initiatives through the Ministry of Business, Innovation and Employment (MBIE) prioritize funding for women and youth, as well as the indigenous Māori population.

United Kingdom

In the UK, one in three entrepreneurs are women. In 2021, although the number of applications for bank financing was significantly lower for women than men, the success rates of approved applications was nearly equal, with 91 per cent of female-led applications approved, compared to 90 per cent for male-led applications[48]. A push for data collection and transparency on funding access for women determined that access to VC networks

43 IEA. (2019, February). Women working in the rooftop solar sector. Retrieved from IEA: https://www.iea.org/reports/women-working-in-the%20rooftop-solar-sector

44 Startup Genome. (2021, August 26). Gender Disparity within Global Venture Capitalist Investments. Retrieved from Startup Genome: https://startupgenome.com/articles/gender-gap

45 Prime Minister's Office of Malaysia. (2013). National Policy on Science, Technology &Innovation (NPSTI). Kuala Lumpur: Government of Malaysia.

46 Mastercard. (2022). The Mastercard Index of Women Entrepreneurs. March: Mastercard.

47 Women Entrepreneur India. (2022, October 8). 6 Best Countries for Women Entrepreneurs. Retrieved from Women Entrepreneur India: https://www.womenentrepreneurindia.com/viewpoint/experts-column/6-best-countries-for-women-entrepreneurs-nwid-2450.html#:~:text=According%20to%20ACG%20Inc.%E2%80%99s,and%20%20Sweden%20in%20the%20list

48 Department for Business, Energy & Industrial Strategy. (2022, June 28). Report shows progress in boosting investment in UK's women entrepreneurs. Retrieved from gov.uk: https://www.gov.uk/government/news/report-shows-progress-in-boosting-investment-in-uks-women-entrepreneurs

is crucial. The government has partnered with the private sector to encourage venture capital dedicated to priority groups as well as legislation to reduce barriers and address biases for women entrepreneurs.

United States

In the last five years, the number of jobs in the country's cleantech sector increased by 237 per cent, providing not only an opportunity but a need for women and youth inclusion in the talent pool[49]. The United States has the highest number of female founders globally, with over 10,353 female founders across all industries[50]. The country hosts a variety of funding mechanisms, accelerators and awards to recognize women, youth and minority founders' achievements in cleantech innovation. State-funded accelerators bridge the transition between research and development at universities to internship programmes at MSMEs to facilitate green jobs. Furthermore, top universities, such as Harvard University, are producing research on gender diversity in the cleantech industry with an intersectional lens on many topics[51]. Government agencies such as the U.S. Department of Energy are committed to breaking down barriers for girls in STEM education and creating pathways for women into leadership positions[52].

49 LinkedIn. (2022). Global Green Skills Report 2022. LinkedIn Economic Graph.

50 Startup Genome. (2021, August 26). Gender Disparity within Global Venture Capitalist Investments. Retrieved from Startup Genome: https://startupgenome.com/articles/gender-gap

51 Harvard Kennedy School Women and Public Policy Program. (2023). 297 studies aiming to close gender gaps. Retrieved from Gender Action Portal: https://gap.hks.harvard.edu/search?topic=1816

52 U.S. Department of Energy. (2023). Women in Energy. Retrieved from U.S. Department of Energy: https://www.energy.gov/women-energy

IV. Characteristics of Effective Cleantech Innovation Ecosystems that Provide Opportunities for Women and Youth

Types of interventions implemented by countries that have demonstrated measurable success

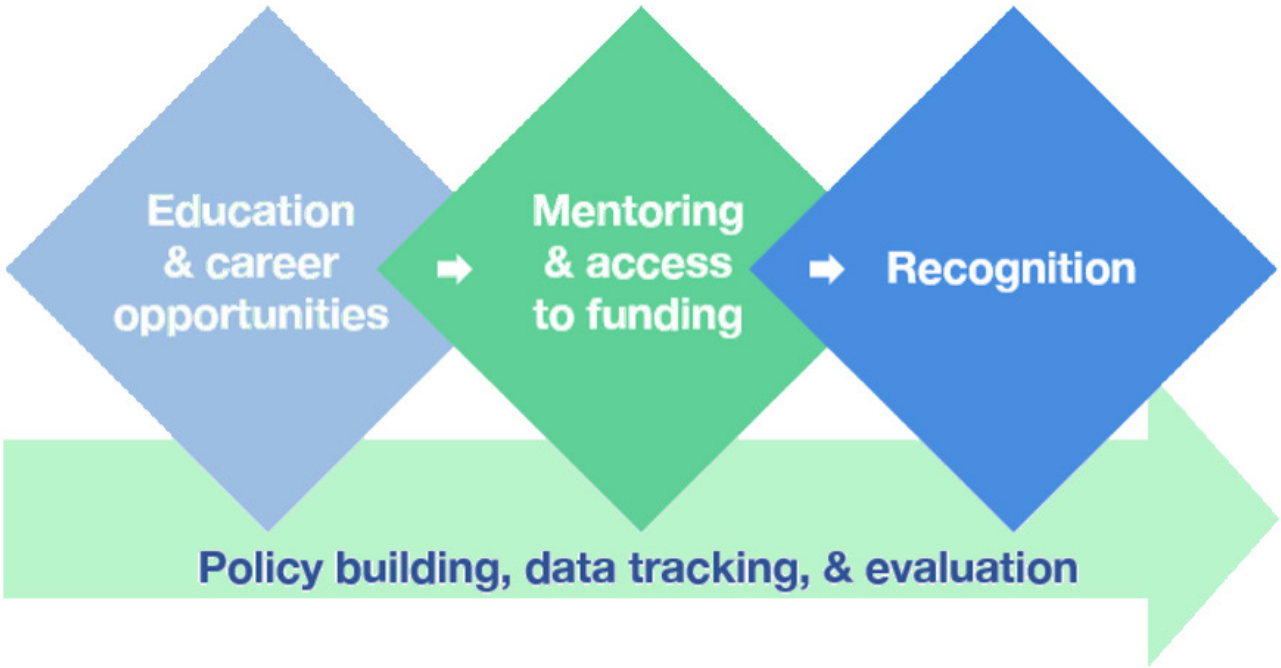

Figure 3: Interventions to provide increased opportunities for women and youth

Countries that have implemented policies and programmes that successfully promote gender equality and youth inclusion first identify the root causes for inequality and discrimination, and then take action to promote access and dismantle barriers. Countries with higher levels of female representation in the cleantech industry successfully promote access to STEM education, ensure advancement of women to decision-making roles, enlist public administration and private industry to co-create opportunities, use gender statistics and studies to understand policy gaps, prevent gender-based violence through a proactive approach, and work to eliminate gender stereotypes and roles.

Figure 3 summarizes these steps. The next sections analyse these steps in more detail, providing examples of policies and programmes which successful countries have implemented to achieve measurable results.

Policy Building, Data Tracking and Evaluation

Coordinate action in data tracking, policy building, monitoring and evaluation across ministries with a business, innovation and gender and youth focus

National policies in Argentina protecting women's rights and fostering involvement in cleantech business activity cover issues such as employment access, capacity development, gender identity, female quotas in the labour force, and gender-based violence. Argentina's government has committed to derive 20 per cent of the country's energy from renewable resources by 2025, which will increase local production and open employment opportunities where women can assume technical, professional and decision-making roles[53]. National non-profits such as the Association of Women in Sustainable Energy (AMES) Argentina are capitalizing on this climate target and job growth to ensure women are included in these employment opportunities. AMES is working with the Inter-American Development Bank (IDB) to facilitate collaboration between government departments. The organizations have called on the National Directorate of Electricity Generation under the Ministry of Energy, National Directorate of Gender and Economy under the Ministry of Economy, the Chamber of Renewable Energies, the National Institute of Industrial Technology, the Chamber of Industrialists of Projects and Engineering of Capital Goods, Center for the Study of Energy Regulatory Activity, Argentine Wind Energy Association, and the Association of Electric Power Generators of the Argentine Republic to close existing gender gaps in the cleantech sector through inclusive policy and data tracking on gender equity in cleantech[54].

The Government of India hosts online events where government officials, CEOs, CMDs, NGOs, industry leaders, banking institutions and international organizations collaborate to identify and create pathways for women in cleantech. At these events which involve over 200 attendees, women entrepreneurs have a platform to share their success stories, and the impact of how regular trainings and capacity development efforts are improving outcomes. Results of the collaboration include the allocation of public funds to women and providing exclusive co-working spaces at incubation centres for women-led startups[55].

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53 Global Wind Energy Council. (2019, August 21). AMES to promote gender equality in Argentina's renewable energy sector. Retrieved from Global Wind Energy Council: https://gwec.net/ames-to-promote-gender-equality-in-argentinas-renewable-energy-sector/

54 Beaujon Marín, A., López Soto, D., & Magdalena Méndez, F. (2022). Género y Energía en Argentina: La participación de las mujeres en el sector de generación eléctrica. Banco Interamericano de Desarrollo.

55 Jacob, S. (2022, December 30). Tamil Nadu starts packages for green tech, rural impact, women-led start-ups. Retrieved from Business Standard: https://www.business-standard.com/article/economy-policy/tamil-nadu-starts-

Government ministries focused on women and youth inclusion are the Ministry of New and Renewable Energy and the Ministry of Women and Child Development, which work together to progress these opportunities.

Malaysia's coordination of key ministries is driving opportunities for cleantech entrepreneurs. The Malaysia Digital Economic Cooperation (MDEC) under the Ministry of Entrepreneurial Development, Ministry of Environment and Water, Ministry of Youth and Sport, and Ministry of Women and Children have collaborated closely[56]. In 2018, key ministries in Malaysia conducted an extensive assessment initiative to identify gaps in data on the SDGs related to gender equity. The resulting initiatives were a combined effort by the ministries to run programmes to increase leadership competencies among women, starting with youth, which resulted in 1,051 participants in the Women Directors Programme, and 1,286 participants in leadership programmes[57].

Education and Career Opportunities

Promote access to high quality science, technology, engineering and math (STEM) education and green jobs

Public universities in Argentina offer tuition-free undergraduate programmes, resulting in over 40 per cent of youth in the capital of Buenos Aires holding a college degree. The city has over 50 esteemed universities with affordable education, attracting international students as the highest-ranking student destination in Latin America[58]. The University of Buenos Aires enrols 300,000 students and is the highest ranked university in South America. The extensive access to high-quality education and a culture of entrepreneurship in the country positions youth in Argentina for success in developing cleantech ventures.

Owing to efforts from the Engineering Accreditation Council (EAC) in partnership with Malaysia's institutions of higher learning, 365 engineering degree programmes have been accredited since 2000. This has resulted in a robust talent pool of 172,900 young graduate engineers and over 15,000 professional engineers as of December 2022[59]. Universities filter students into national accelerator programmes to create job prospects in entrepreneurship

packages-for-green-tech-rural-impact-women-led-startups-122123000782_1.html

56 Ministry Of Women, Family And Community Development. (2020). Malaysia Progress Report 2014- 2019. Kuala Lumpur: Government of Malaysia.

57 Ibid.

58 Startup Genome. (2022, December). Argentina - Buenos Aires. Retrieved from Startup Genome: https://startup-genome.com/ecosystems/buenos-aires

59 Malaysian Global Innovation & Creativity Center (MaGIC). (2021). Transitioning to Greater Impact Annual Report 2021. Kuala Lumpur: MaGIC.

for the country's young engineers and innovators. Malaysia's successful coordinated action between the government, universities and private sector offers valuable insights.

New Zealand's non-profit KiwiNet offers multiple programmes to support innovation and entrepreneurship for both women and youth. The organization's Investment Committee and Pipeline Committee partner with 19 universities and research organizations to source researchers with commercially viable technology and pool funding to bring these discoveries to market. The Spin-Out Programme gives university students and researchers the necessary tools and knowledge to turn successful research discoveries into investment-ready companies. Corporate partners and KiwiNet commercial mentors guide entrepreneurs with viable technologies on how to connect with investors and secure venture capital[60].

In Kenya, free access to STEM education for girls and women in technical schools has been transformational for women entering the cleantech workforce. The government of Kenya is working with IGOs such as UNESCO, the World Bank and USAID, among others, to measure gaps in women in STEM to implement mentoring and sponsorship programmes throughout girls' education. Technical schools and extracurricular programmes such as the UNESCO/GoK STEM mentorship programme have increased the participation of girls and women moving on to careers in this field[61]. Women in Tech and Women in Energy programmes in the country encourage companies to hire female graduates, creating immediate opportunities for female graduates to enter the cleantech workforce. These companies succeed when senior leadership has committed to gender equality in hiring, using data to link a diversity and inclusion strategy to business growth strategy, and develop a workplace culture committed to inclusion and empowerment of female colleagues[62].

Allow for flexible working arrangements and set up a public social security system to cover personnel costs such as parental leave and childcare

Recognizing that primary care responsibilities are the greatest barrier for female entrepreneurs, the UK's government is ramping up support systems for entrepreneurs who are parents. The government has already committed £6 billion in childcare support to eligible working parents of 3 and 4-year-olds to receive free childcare, and is working to expand free childcare to all children under 5 years old[63]. Although this will cost several

60 KiwiNet. (2022). 2022 Annual Report. Hamilton: KiwiNet.

61 Karanja, F. N. (2021). Unlocking the Potential of Girls in STEM in Kenya: An Assessment Report on the Impact of the UNESCO/GoK STEM Mentorship Programme. Nairobi: UNESCO.

62 International Bank for Reconstruction and Development; The World Bank. (2020). Stepping Up Women's STEM Careers in Infrastructure: An Overview of Promising Approaches. Washington, DC: The World Bank.

63 BBC. (2023, March 15). Free childcare expanded to try to help parents back to work. Retrieved from BBC: https://www.bbc.com/news/uk-politics-64959611

billion pounds, the economy is expected to benefit up to £10 billion from the estimated 60,000 parents who would re-join the workforce. [64] Other initiatives include a Tax-Free Childcare law, which provides up to £ 2000 per child per year to support families and a Universal Credit, which extends the tax credits to meet up to 85 per cent of childcare costs[65].

Address biases towards women and youth in the workforce

Livelihoods Kenya is a social enterprise in Kenya focused on addressing biases towards women and youth who are affected by poverty. The non-profit empowers women and youth in slums to take ownership of sales distribution channels of clean energy products in slum communities. The programme has generated an estimated 2,332 jobs through training, job creation and product distribution. Pillars of outreach, training, employment and access to cleantech products and networks support the women and youth in Kenya's urban slums to become agents of change in their communities. Over 67 per cent of participants in the Livelihoods Kenya workforce are women. Additionally, while around 30 per cent of staff have been promoted from a sales role to a management position, around 50 per cent of the sales agents move on to start their own business[66].

Mentoring and Access to Funding

Create ringfenced funding sources and mentoring for women and youth

In 2018, the Canadian government established a three-year financing scheme for women entrepreneurs totalling CAD$1.4 billion, called the Women Entrepreneurship Fund. An additional CAD$200 million was allocated to invest in women-led technology firms. Canada set a target to double the country's women-owned businesses by 2025 through a CAD$30 million fund for female entrepreneurs, and an additional CAD$2.5 million specifically for indigenous women-owned businesses[67].

India has established several funding schemes to increase women entrepreneurs' access to capital. The state of Tamil Nadu has supplied over $16.2 million in loans and $4 million in subsidies to over 1,558 women entrepreneurs under the Prime Minister's Employment Generation Programme (PMEGP)[68]. Recently, Tamil Nadu Startup and Innovation Mission

64 Ibid.

65 Ibid.

66 Livelihoods Kenya. (2021, May 10). What Does Livelyhoods Mean? Retrieved from Livelihoods Kenya: https://www.livelyhoods.org/what#how-we-work-section

67 Superscript. (2020, March 19). 7 top global fempreneur inititatives. Retrieved from Superscript: https://gosuperscript.com/news-and-resources/7-female-entrepreneur-initiatives-from-across-the-globe/

68 The Hindu. (2022, December 29). Tamil Nadu women are the frontrunners in entrepreneurship. Here's why .

(StartupTN), announced the Tamil Nadu Startup Seed Grant Fund (TANSEED). The TANSEED scheme has resulted in a 50 per cent increase in grant funding for special category start-ups, mandating 25 per cent to women-founded and 10 per cent to rural-based green technology ventures[69]. Within the TANSEED fund is the Tamil Angels platform where angel investments are focused on women-led startups. To qualify for this funding, the startup must be either women-owned or women must have at least 75 per cent equity in the venture[70]. Other funding opportunities for India's women entrepreneurs include the New Swarnima Scheme, Tamilnad Mercantile Bank Ltd, Centre for Entrepreneurship Development, Women Entrepreneurs Welfare Association and Women Entrepreneurs India[71].

Entrepreneurs in New Zealand can take advantage of government-funded programmes such as the Resurgence Support Payment Scheme, Wage Subsidies, Small Business Cash Flow Loan Scheme, Business Finance Guarantee Scheme and Debt Hibernation. New Zealand's government has recognized a need for legal reparations and capacity development for the indigenous Māori people. The Te Ara Paerangi Future Pathways is a programme through the Ministry of Business, Innovation and Employment which provides opportunities for Māori science and technology researchers to receive national and international investment[72]. New Zealand also has a dedicated Ministry of Māori Development, with a Māori Enterprise team to support with capacity development in business management, finance, strategy, marketing and sales, risk assessment and digital capability. The Ministry's progressive procurement initiative offering support and priority for government procurement processes to Māori-owned enterprises is also included in this initiative[73].

In the UK, the Treasury department is addressing barriers through legislation to increase funding for women-led businesses, improve family care support and establish local networks of entrepreneurs and mentors to make entrepreneurship more accessible to women. In 2019, the HM Treasury commissioned the country's top female executive, Alison Rose, to publish a review of the state of female entrepreneurship in the country. From this review, the HM Treasury and the Department for Business Energy and Industrial Strategy for Small Business established the Investing in Women Code (IIWC). The IIWC

Retrieved from The Hindu: https://www.thehindu.com/brandhub/tamil-nadu-women-are-the-frontrunners-in-entrepreneurship-heres-why/article66316383.ece

69 Jacob, S. (2022, December 30). Tamil Nadu starts packages for green tech, rural impact, women-led start-ups. Retrieved from Business Standard: https://www.business-standard.com/article/economy-policy/tamil-nadu-starts-packages-for-green-tech-rural-impact-women-led-startups-122123000782_1.html

70 Ibid.

71 SheAtWork. (2023, February). Tamil Nadu. Retrieved from SheAtWork: https://sheatwork.com/government-schemes-india/tamil-nadu/

72 Ministry of Business, Innovation & Employment. (2023, February). Te Ara Paerangi - Future Pathways. Retrieved from Ministry of Business, Innovation & Employment: https://www.mbie.govt.nz/science-and-technology/science-and-innovation/agencies-policies-and-budget-initiatives/te-ara-paerangi-future-pathways/#:~:text=In%20%20December%202022%2C%20MBIE%20released,to%20implement%20the%20reform%20programme

73 Ministry of Māori Development. (2023, February). Pakihi Māori – Māori Enterprise. Retrieved from Ministry of Māori Development: https://www.tpk.govt.nz/en/nga-putea-me-nga-ratonga/maori-enterprise

is a commitment from all organizations that finance entrepreneurs to support female founders with access to business tools, resources and finance[74]. The initiative serves as a tool for the public and private sector to understand barriers female entrepreneurs face through open-source data to benchmark the funding disparities for female founders. As a result, several UK-based VCs and angel firms are directing money to women founders. Some of the prominent investors with female-dedicated funds and female- focused funding networks are Angel Academe, Angel Investment Network, Astia, BBG Ventures, The British Business Bank, Cartier Women's Initiative, Catalyst at Large, Diversity VC, Female Founders Fund, Femstreet, Girl Geeks with Transmit Start-Ups, Global Invest Her, Jane VC, and Voulez Capital[75].

Strengthen pathways towards decision-making positions in government, financial institutions and corporations for women and youth through leadership training, mentoring and networking

One notable initiative in Argentina supporting young women in the cleantech sector is **Chicas en Tecnología**. The organization not only influences policy to reduce gender barriers in the technology sector, but also offers free, online programmes, workshops and events. Chicas en Tecnología takes a youth-centred approach, inviting youth to share experiences and strategize ways to motivate more girls to choose STEM education and career paths. Their semi-annual event, Girl Leaders in Technology, includes workshops, panels, talks and networking opportunities with women leaders who share their journeys and experiences in the technology industry to inspire young women to join the field[76].

The Canadian non-profit, **MaRS**, launched an accelerator with federal funding from Natural Resources Canada (NRCan) specifically for women-led startups. Government funding included a $1 million prize incentive and a stipend for the six women selected for the first group. The Toronto-based **RBC Women in Cleantech Accelerator** has attracted groups of up to 10 women-led startups across the country from as far west as British Columbia to as far east as Newfoundland.

The organization found that it is important to source groups of entrepreneurs at a similar technology readiness level (TRL) stage, extend the programme to two years for earlier stage companies to succeed in the market, and provide community and networking support. Further government support included matching entrepreneurs with federal government national labs to conduct R&D and prototyping with in-kind lab equipment and research

74 HM Treasury. (2019). The Ali son Rose Review of Female Entrepreneurship: government response. London: HM Treasury.

75 Superscript. (2021, September 28). 15 female-focused VC opportunities (UK). Retrieved from Superscript: https://gosuperscript.com/news-and-resources/15-female-focused-vc-opportunities-uk/

76 Chicas en Tecnología. (2023, February). Chicas Lideres TEC. Retrieved from Chicas en Tecnología: https://chicasentecnologia.org/chicasliderestec/

facilities. With the success of this initiative, the accelerator is now privately funded, but maintains the matching of entrepreneurs to national labs.

The state of Tamil Nadu in southeast India is the leading ecosystem for women entrepreneurs in the country. This can be attributed to the high female representation in government, as 11 of the 20 mayors are women[77]. Consequently, the state is establishing benefits and capacity development programmes for startups with a women founder or co-founder.

In addition to the Spin-Out Programme, New Zealand's KiwiNet runs the Women in Leadership Development (WILD) Programme and Emerging Innovator Programme for priority groups to access pre-seed accelerator funding and a chance to win one of the annual Research Commercialization Awards (KiwiNet Annual Report 2022). The WILD Programme aims to overcome barriers to career progression and retention for women in science and innovation. Each year, the WILD Programme supports a group of 10 women with STEM backgrounds in gaining leadership, governance and decision-making experience. This programme offers coaching from experts at KiwiNet and Brandon Capital Partners and peer-to-peer learning. An additional opportunity offers hands-on leadership and governance experience through participation in board meetings of successful companies while receiving mentorship from a director on the board (WILD). Over 40 per cent of participants have demonstrated career progression since the start of the WILD Programme in 2019 (KiwiNet Annual Report)[78]. The Emerging Innovator Programme helps early-stage startups and provides participants with commercial mentors, coaching on media engagement and training for pitching to investors. The Rewa Ake Programme is included in the curriculum, which is a free three-day online course focusing on customer engagement and discovery for entrepreneurs. Topics range from customer discovery, customer segmentation, customer conversations and active listening, marketing language and positioning, developing questions and seeking feedback[79].

77 The Hindu. (2022, December 29). Tamil Nadu women are the frontrunners in entrepreneurship. Here's why . Retrieved from The Hindu: https://www.thehindu.com/brandhub/tamil-nadu-women-are-the-frontrunners-in-entrepreneurship-heres-why/article66316383.ece

78 KiwiNet. (2022). 2022 Annual Report. Hamilton: KiwiNet.

79 Ibid.

Recognition for Achievements

Create platforms for women and youth to recognize achievements in innovation through awards and publicity

Canada's leading sustainable economy news outlet, Corporate Knights, selects and publishes the Top 30 Under 30 Sustainability Leaders. Nominations are open to the public; winners are reviewed and selected by a panel of industry-leading judges. The list is a curated selection of outstanding youth-leading cleantech innovation initiatives[80].

The Kenyan non-profit Ongoza offers a two-year programme of customized weekly business advisory networking opportunities, and debt financing for young female entrepreneurs to scale their environmental enterprises. The Ongoza Business Acceleration Programme for Women In Climate provides business development training and mentorship, connections to climate-related funding opportunities, and an additional $5,000 reward to the two highest performing entrepreneurs in the programme. While the incubation structure is highly valuable and replicable, the non-profit also hosts a national summit where young leaders in cleantech from across the country unite with a political platform to amplify the voice of women and young entrepreneurs in policy dialogue[81]. Awards presented at the annual GreenBiz event showcase the women and youth dedicated to net zero. The Women in Sustainability Leadership Awards (WSLA) recognizes women leaders dedicated to environmental preservation, social justice and equity. Winners are Fortune 500 executives, politicians, inventors, professors and women business owners. The WSLA is awarded to ten women each year who then join the WSLA Alumnae Group to create a network of women supporting each other in their careers and ambitions[82]. The Emerging Leaders programme by GreenBiz is a group of the next generation of Black, Indigenous and people of colour (BIPOC) leaders in sustainable business[83]. Recipients of these awards gain exposure and recognition to over 1,800 sustainable business leaders from corporations, government, non-profits, startups and academia who attend the event in-person and online.

Startup India is a government initiative aimed at building a culture of entrepreneurship and

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80 Vasil, A., & Robinson, A. (2022, November 2). The fight for a better tomorrow: Canada's top 30 under 30 sustainability leaders of 2022. Retrieved from Corporate Knights: https://www.corporateknights.com/%20rankings/30-under-30-rankings/2022-30-under-30/top-30-under-30-sustainability-leaders-of-2022/

81 Ongoza. (2022, May 1). Ongoza Business Acceleration Program For Women In Climate. Retrieved from MoveMeBack: https://www.movemeback.com/experiences/ongoza-ongoza-business-acceleration-program-for-women-in-climate

82 Women in Sustainability Leadership Awards. (2023, February 16). Honoring Leadership. Retrieved from Women in Sustainability Leadership Awards: https://www.wsla.global/

83 GreenBiz. (2023, February). GreenBiz 23. Retrieved from GreenBiz: https://www.greenbiz.com/events/greenbiz/2023

an inclusive innovation ecosystem. The Department for Promotion of Industry and Internal Trade under the Ministry of Commerce and Industry created Startup India as an accessible platform with information on funding, schemes and policies, resources for challenges, procurement and capacity development, as well as a hub for key stakeholders to network and drive innovation. The website has a Startup India Showcase where investors can learn more about India's top start- ups[84]. The Startup Showcase offers startups visibility, credibility, networking, and access to pilot opportunities with government and corporate buyers[85].

Conclusion

The innovation policy framework of GCIP Pillar 2 compiles insights from countries with successful models of cleantech innovation policy as well as countries with similar regional and economic qualities as GCIP partner countries. These best practices are presented and analysed to identify mechanisms for growing ecosystems focused on early-stage innovation, demonstration and commercialization, and scaling and internationalization of clean technologies. Women and youth are priority groups to include in policy-building to ensure economic benefits and inclusion of these population groups, and address barriers to enter and succeed in the cleantech sector. PEEs in GCIP partner countries should refer to the national priorities they identified for growing cleantech innovation in their respective country, and use this framework to replicate best practices and implement the proper mechanisms for building policy that drives cleantech innovation.

84 https://www.startupindia.gov.in/content/sih/en/startup_india_showcase.html

85 Ibid.

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