

Public Consultation on the National Research and Innovation Strategy 2024-2026

1. Research and Innovation Strategy in Context

- 1.1 Introduction
- 1.2 Moving on to a Robust, Integrated and well Interlinked R&I ecosystem
- 1.3 Vision and Policy for R&I
- 1.4 Key Priorities of the Policy
- 1.5 Key Activities to build a Robust, Integrated and well Interlinked Research and Innovation Ecosystem

2. Research and Innovation Current Status

- 2.1 Introduction
- 2.2 Performance of the National Research System
- 2.3 Knowledge Transfer & Exploitation of Research Results
- 2.4 Business Environment & Performance of the National Innovation System
- 2.5 Workforce and Productivity
- 2.6 Extroversion and Internationalization of the National R&I Ecosystem
- 2.7 Cluster Formation

3. Strategy Pillars

- Pillar A: World-Class Institutions & Infrastructures for ground-breaking research
- Pillar B: Unleashing R&I in Businesses, Fuel Business Success
- Pillar C: People as drivers of growth for the Research and Innovation Ecosystem
- Pillar D: Becoming an R&I Leader within the EU and beyond
- Thematic Pillar: Targeted Investments to drive growth

1. Research & Innovation Strategy in Context

1.1 Introduction

The world is becoming a much more competitive place. Research, Innovation and Technology are leading this change. They offer solutions to some of the world's most pressing challenges and create the knowledge to tackle future ones.

The pace of innovation is faster nowadays and innovation happens in many more places than it used to. Consumers, citizens, businesses and Governments are in a constant cycle of adaptation. In this ever-evolving global setting the Cyprus Research and Innovation ecosystem needs to build on its strengths, capitalize on opportunities and be a key enabler of sustainable growth.

A holistic R&I strategy which addresses all elements required to develop a robust, integrated and well interlinked national ecosystem with increased contribution to the Cyprus economy and society is imperative.

This strategy is based on studies and strategies developed for the Cypriot Government, such as the Strategic Framework for Research and Innovation 2019-2023 "Innovate Cyprus", the long-term strategy of the Cypriot economy "Vision 2035", the Recovery and Resilience Plan "Cyprus Tomorrow", the "Cyprus Partnership Agreement THALIA 2021-2027", the "Digital Cyprus 2025" Strategy, and the new Investment Attraction Strategy. Furthermore, it takes into account EU policies, programs, guidelines, and frameworks, such as the European Research Area (ERA), the EU Framework Program for Research and Innovation "Horizon Europe 2021-2027," and the European Commission's Communication "A New European Innovation Agenda." The sectoral focus of the Strategy is based on priorities identified in the revised Smart Specialization Strategy 2030¹.

1.2 Moving on to a Robust, Integrated and well Interlinked R&I ecosystem

According to the European Innovation Scoreboard (EIS), Cyprus has gained significant ground in the past years, moving from the Moderate to the Strong Innovators category in 2022, maintaining its progress in 2023 and ranking 10th with performance at 105.4% of the EU average and a much higher performance rate than that of the EU (8.5%-points). Innovation performance marked a steady increase between 2016 and 2020 and a sharp acceleration in 2021, leading to a 45% performance increase in 2023. Steps forward are most evident in the attractive research systems, Linkages, and SMEs innovators dimensions.

Cyprus has also improved its position in the Global Innovation Index (GII) over the past years, steadily progressing to 28th place out of 132 economies in 2023. The country ranks 2nd in the Northern Africa and Western Asia (NAWA) region, securing a higher world rank in knowledge and technology outputs (23rd) and creative outputs (17th). Cyprus has achieved the highest per capita absorption of funding from the Horizon 2020 Program, tripling its national contribution to the EU. The country ranks first among countries securing funding for the creation of Centers of Excellence in Research, under the "Teaming for Excellence" Program of the European Framework Program (EFP).

¹ www.dmrid.gov.cy/dmrid/research.nsf/euprogramms04_el/euprogramms04_el?OpenDocument

1.3 Vision and Policy for R&I

Cyprus envisions itself becoming a regional powerhouse for Research, Innovation, Entrepreneurship, and High Technology. To fulfil this ambitious pursuit, Cyprus seeks to draw in investments, businesses, and talents, propelling itself towards a future where innovation thrives and opportunities abound.

The Research and Innovation Policy aspires to amplify the positive influence of R&I activities throughout the entire spectrum of social and economic endeavours. At the same time, it focuses on elevating Cyprus' role as a regional hub for research and innovation entrepreneurship and high-tech that attracts international and local investments and businesses. This is achieved through crafting of a comprehensive framework to manage and allocate state funding, alongside the implementation of a robust mechanism to measure performance and assess the overall socioeconomic impact of government expenditures in R&I.

1.4 Key Priorities of the Policy:

- 1. Optimizing Financial Instruments:** Judicious strategic utilization of Government direct funding and indirect support.
- 2. Championing Excellence in the Research and Innovation Ecosystem:** Nurturing an environment that fosters excellence in research and innovation, thus propelling Cyprus to the forefront of cutting-edge advancements in the focal sectors.
- 3. Fostering an International Hub:** Creating optimal conditions to attract global research talents, establish world-class research centres, incubate innovative enterprises with international significance and host multinational corporations.
- 4. Evaluating Impact and Periodic Policy Review:** Implementing a robust system for continuous impact assessment and periodic reviews, ensuring the policy remains relevant, effective, and aligned with the overarching vision.

1.5 Key Activities to build a Robust, Integrated and well Interlinked Research and Innovation Ecosystem

Unlocking the full potential of the research system is paramount for its future growth and its stronger integration into the national economy. The national strategy for R&I enables that by

- 1) Building research infrastructures and providing open access to strategic R&I partners enabling them to expand research capacity, accelerate technology transfer and facilitate collaboration between the various actors in the national ecosystem and beyond.
- 2) Elevating research organizations to world class institutions through enhanced participation in the European Framework Programme (EFP) for Research and Innovation and in particular its flagship programmes and collaborating in European Research Infrastructure Consortia.
- 3) Enhancing the absorptive capacity of businesses and mobilizing greater business R&D investments that lead to increased innovation capacity and the ability to commercialize new products and services in international markets.
- 4) Fuelling the creation and development of startups that can grow into scaleups and disrupt the international markets.
- 5) Developing strong enabling conditions for research and innovation to flourish, including a well skilled workforce, VC money and support structures that foster innovation and entrepreneurship.

- 6) Establishing clusters of deep expertise in key national priority areas where all actors of the national ecosystem swarm together to fast-track innovations into the market within industry benchmarked lifecycle.

National Monitoring & Evaluation Mechanism: To drive towards impact-based R&I funding a Monitoring & Evaluation mechanism is introduced for assessing the performance of Government funded R&I organizations and on a number of fields and govern the allocation of Government funding.

Impact assessment: The impact assessment mechanism becomes a critical tool in shaping policy. The collection of necessary data at the national level and their analysis, combined with comparative European and international references, to assess the impact delivered and guide the decision-making mechanism for the amendment of the policy/strategy.

2. Research and Innovation Current Status

2.1 Introduction

Over the last few years, the R&I ecosystem has grown and started to exhibit greater potential to contribute to the economic growth of the country. Today Cyprus has 12 universities (3 public, 9 private), 9 Research Institutes and Government Laboratories, as well as 7 Centres of Excellence. The ecosystem additionally comprises of innovative enterprises, more than 400 startups and scaleups, over 140 mid and large tech companies and around 4.000 entrepreneurs that contribute to the innovation activities of the country. Innovation support structures in place include more than 9 Incubators, Accelerators & VC Funds and 7 Innovation and Entrepreneurship Centres.

Cyprus is currently a 'Strong Innovator' in the European Innovation Scoreboard (EIS)² and its performance is improving over time. In the 2023 version of the EIS Cyprus performs at 105.4% of the EU average. The country ranks 28th out of 132 economies in the Global Innovation Index (GII).

Despite the significant improvement in its performance, Cyprus's R&D intensity remains far below the European average. In 2021, R&D investment stood at 0.83% of GDP³, far from the EU average of 2.26%. Both Public Expenditure on R&D (0.34% of GDP in 2021) and business enterprise expenditure on R&D (BERD 0.41% of GDP in 2021) remain well below the EU average of 0.76% and 1.49% respectively and hinder the country's ability to diversify its economy towards innovation-led activities.

2.2 Performance of the National Research System

The quality of the public research system is a point of strength. According to the European Innovation Scoreboard (EIS), Cyprus has the fifth most attractive research system in the European Union. It ranks first on Scientific Co-Publications at 175% ahead of the EU average. According to the Global Innovation Index (GII), the Scientific and Technical Articles per billion PPP\$ GDP stands at 42.7%. According to the EIS 2023, Cyprus ranks ninth in terms of scientific publications among the top-10% most cited publications worldwide as percentage of total publications of the country. Its ability to attract foreign doctorate students exceeds the EU average, however it ranks 14th out of all EU Member States.

The performance of Research Organizations (ROs) (Universities, Research Institutes and Centres of Excellence) in the EU's Framework Programme (EFP) for research and innovation, Horizon Europe, lags

² [ec_rtd_eis-country-profile-cy.pdf \(europa.eu\)](#)

³ CYSTAT, Eurostat

significantly behind the EU average. Cyprus ROs contribute 44.4% of the total funding secured in Horizon Europe as opposed to 59.6% of ROs across EU Member States⁴. Though performance statistics overall are satisfactory, Cyprus-based entities are faced with barriers for submitting proposals and securing funding. Main barriers include internationalization visibility of research performed at the national level, lack of incentives within institutions for competing in EFPs as well as lack of expert proposal writing capabilities, capacity in R&D and research excellence.⁵

Cyprus underperforms in the EFP European Research Council (ERC) flagship programme which funds excellent frontier research. For the period 2014-2022, the success rates for Starting Grants⁶ are significantly lower than the EU Average (4% vs. 13%). For the Consolidator Grants⁷ the success rates are comparable (12% vs. 14% EU Average). The data suggests that it takes significantly longer to nurture and develop young talent in Cyprus.

Notably, there have only been eleven proposals submitted in the period 2021-to-date for the Advanced Grants⁸ which suggests that experienced researchers have a limited interest in the programme. There have not been any successes in the programme since 2013.

In addition, there appears to be a lack of interest in the ERC Synergy Grants, for two to four researchers working together and bringing different skills and resources to tackle ambitious research problems for which there have been only 5 proposals in the past 3 years.

Finally, an analysis into the PhD countries of successful ERC applicants indicates that researchers in Cyprus who undertook their doctoral degree abroad are more successful than those that have received their PhD from a Higher Education Institution (HEI) in Cyprus. Specifically, out of 19 ERC Grantees (Framework Programme 7, Horizon 2020, Horizon Europe), only one ERC Grantee received their PhD from a CY HEI, 9 received their PhDs from the United Kingdom, 5 from the United States of America and the rest from France, Germany, Finland and Northern Ireland. The data therefore suggests that when it comes to competing for ERC Grants, there is added value in CY researchers undertaking research abroad, becoming familiar with other environments and collaborating with excellent researchers and teams in other countries.

At the same time, data from the Marie Skłodowska-Curie Actions (MSCA) Postdoctoral fellowships targeting researchers holding a PhD who wish to carry out their research activities abroad, acquire new skills and develop their careers indicates that Cyprus Higher Education Institutes are attractive to researchers currently working and residing abroad (both Cypriots and other nationals). Specifically, for the 2022 Call, Cyprus holds the 2nd highest average number of proposals per thousand researchers (FTEs), among EU countries with an average of 22 proposals per thousand FTEs researchers, second only to Malta (25 proposals per thousand FTEs) and well above countries with the most proposals submitted in total such as Spain, Italy, Germany and France.

The Cyprus research system consists of publicly funded and privately funded organizations. Significant gaps exist between the research capacity of these two types of organizations as evidenced by their performance in the competitive national funding programmes of the Research and Innovation Foundation (RIF) as well as their participation in the EFP. More specifically, according to data from the RIF, 45% of the total funding awarded in the period 2016-to-May 2023 was awarded to publicly funded

⁴ Horizon Dashboard Data Retrieved on 15/11/2023

⁵ Technopolis Report "Interim Evaluation of RESTART 2016-2020 and the CY participation in H2020", (November 2020)

⁶ Funds promising early-career researchers with 2 to 7 years of experience after obtaining their PhD

⁷ Funds for excellent researchers with 7 to 12 years of experience after their PhD

⁸ Funds established research leaders with over 12 years of experience and a recognised track record of research achievements.

ROs while only 7% was awarded to privately funded ROs. Strong competition for funding in national competitive programmes has hindered the participation of less prominent actors in the system and may have had a negative impact on the potential to enhance competitiveness among newer players, such as Private Universities, therefore limiting the ability to enhance research capacity and strengthen critical mass.

This is also reflected in the participation of private and public ROs in Horizon Europe whereby the privately funded ROs have secured significantly less than the publicly funded ROs (8.6% of the total funding secured by ROs).

Even more, in the national competitive funding programmes for research excellence of the RIF only 14% of proposals submitted in the period 2016-to-May 2023 had collaborations between publicly funded and privately funded ROs.

There are also a number of Government Research Laboratories, mainly departments which fall under different Ministries (eg. Ministry of Health, Ministry of Agriculture) and whose role is less recognized within the R&I system. Institutional failures identified in an independent study⁹ include references to limited funding for research in government laboratories as well as over-reliance on competitive funding because of a drastic reduction of resources (both human and financial), hindering the capacity of government laboratories to keep on contributing to R&D in areas of high socioeconomic importance in Cyprus, such as agri-food and health. Further issues are also identified with regards to the commercial exploitation of research results stemming out of government laboratories. The participation of public bodies in the EFP is extremely low at 2% of the total funding secured.

At the same time, Cyprus ROs and in particular the publicly funded organizations, have low success rates in leading consortia as Project Coordinators in proposals submitted to Pillar II of the Horizon Europe Programme, aiming to address global challenges and European industrial competitiveness through collaborative projects. Analysis of the Evaluation Summary Reports (ESRs) for proposals submitted since the beginning of Horizon Europe suggest weaknesses in the excellence criterion and in particular a misalignment with Work Programme objectives, a weak state of the art analysis and a lack of ambition of the proposed projects. Notably, 30 proposals were submitted by publicly funded universities and ROs acting as Project Coordinators since the launch of Horizon Europe, with only two managing to secure funding, none of which from the public universities. These numbers are in line with analysis performed for proposals submitted under Horizon 2020, where findings showed that unsuccessful proposals coordinated by Cyprus-based entities were in most cases related to a lack in thematic competence.

In terms of World Rankings, public and private universities alike have much room for improvement. Indicatively, only one public university is classified in the Top 401-500 of the Times Higher Education World Rankings for 2023. The same university is also the only one ranked in the Top 301-400 of the QS World University Rankings, thereby making Cyprus rank 71st in the corresponding indicator of the GII 2023. Especially in the case of the Times Higher Education rankings, research quality and output have a weighting of 30% towards each university's final score, another indication of the need for improvement in research outputs overall.

⁹ Technopolis Report "Interim Evaluation of RESTART 2016-2020 and the CY participation in H2020", (November 2020)

2.3 Knowledge Transfer & Exploitation of Research Results

Academia-enterprises collaboration has improved over the last few years but it still remains an area of potential further enhancement. The number of public-private co-publications is increasing as a proportion of total R&D publications (8.3% in 2021) and is now above the EU average (7.1%). Even more, according to the EIS the number of SMEs collaborating with others has significantly improved over the last few years (from 2% below the EU average in 2020 to 143.7 above the EU average in 2023) and stands in the first place amongst EU Member States.

Findings from a Policy Support Facility study (2020)¹⁰ highlighted that businesses are not properly benefiting from the research, laboratory and consulting services that universities and research institutes could offer. To date, the services offered are generally poorly structured, often lacking in visibility, and are frequently observed in an ad-hoc basis. There is a need for professionalization of services to make them more transparent for business.

There are also culture barriers within the ecosystem that significantly inhibit the development of sustainable academia-enterprises interaction as well as certain limitations or in some cases misperceptions of the institutional frameworks that govern academia-enterprises collaborations.

Enterprises absorptive capacity -their ability to acquire, assimilate and use external knowledge- is low. Demand by enterprises for research and consulting services offered by research institutions is limited. This is also evident by the low uptake of digital technologies where, as an example, only 2.6% of enterprises have adopted Artificial Intelligence solutions and 6.2% have adopted Big Data technology solutions. (Source: DESI). While there is significant research capacity in the research system on such technologies the uptake by enterprises remains very low. (Ref: Smart Specialization Strategy finding on ICT).

Cyprus hosts a small number of enterprises with exceptional performance in Pillar II of Horizon Europe, mainly participating as partners in international Consortia implementing collaborative projects. The enterprises have secured almost half of the total budget secured for the country. This presents an important opportunity to set the conditions for the effective use of knowledge generated and acquired in the framework of the funded projects within the Cypriot environment, encouraging the involved enterprises to actively disseminate and utilize knowledge in order to support the digital and green transition in the country and beyond.

Similarly, Cyprus hosts seven Centres of Excellence in strategic priority areas for the country. Their aim is to strengthen regional innovation excellence, create robust linkages between academia, businesses, government and civil society. Each Centre has advanced partners from more developed European R&I ecosystem. They present a significant opportunity to become key actors in knowledge and technology transfer and commercial exploitation of research results.

A primary condition to achieve this, is for national R&I funding to pursue a greater level of synergy with the EFPs from a thematic perspective,¹¹ since both the analysis of ESRs discussed above but also the overall low success rate of CY coordinators in Horizon Europe suggest that this remains challenge to this day.

¹⁰ "Optimal Utilisation of Research Laboratories of Organisations funded by the Government, by the Business Community"

¹¹ Technopolis Report "Interim Evaluation of RESTART 2016-2020 and the CY participation in H2020", (November 2020)

There is a rather weak protection of Intellectual Assets in the country with patent applications and PCT patent applications lagging significantly. According to the European Innovation Scoreboard Cyprus is 60% behind the EU average and 13% behind the EU average in Design Applications. According to the World Intellectual Patent Office (WIPO) data for 2021, Patents by Origin/bn PPP\$ GDP is at 1.9 and PCT patents by Origin/bn PPP\$ GDP is at 1.4.

Commercialisation of research results is at a low level. According to the World Trade Organization and United Nations Conference on Trade and Development, Intellectual Property Payments as a percentage of total trade is at 1.3. The vast majority of enterprises (87%) do not have R&D units or any internal R&D mechanisms (Source: RAI Consultants for RIF). As per the EIS, the innovation expenditure per person employed is at 68% behind the EU average.

2.4 Business Environment & Performance of the National Innovation System

As a small island nation economy Cyprus does not benefit from economies of scale. The national economy is heavily concentrated in five main sectors, namely construction, real estate services, travel and tourism, and wholesale and retail trade which make up 70% of the country's GDP. The outlook of some of the traditional sectors in terms of their potential for sustainable growth is now less positive than before. Traditional businesses, with little or no R&D activity, are presented with an opportunity but at the same time a strong need to innovate in order to be able to stay relevant, differentiate from competitors and excel in international markets with breakthrough products and services.

Some new sectors such as the ICT sector have been growing in recent years. Overall, there is a need for further diversification of the Cyprus economy as well as for actions to enhance its competitiveness. Extroversion is a main driver to enhance the competitiveness of the national economy.

Company demographics are also a major limitation. About 95% of local enterprises employ from 1 to 9 people, 4.4% from 10 to 49 people, while only 0.7% employ 50 to 249 and a mere 0.1% over 249 employees¹². Small Medium Enterprises (SMEs: 0-249 persons employed) contribute 75.5% to the Gross Value Add compared to 56% in the EU. SMEs employ 82.6% of all employees as opposed to the EU average of 67%¹³.

The small size and ownership and management structures¹⁴ of the majority of enterprises limit their ability to innovate, introduce new innovative products/services to the markets and compete internationally and as a result enhance their competitiveness and consequently contribute to the enhancement of the competitiveness of the national economy. The majority of local enterprises do not have the capacity and know-how to enter new markets, identify and exploit new business opportunities via international networks.

The very small number of large enterprises in Cyprus is mostly in the areas of wholesale and retail trade, accommodation and food services, as well as public administration. The presence of large enterprises is critical however because a) they can serve as important anchors by creating demand for intermediate inputs, b) they develop new technologies more readily through more formalised innovation activities and c) they can export more readily and enter new markets, showing the path for smaller companies.

¹² CYSTAT

¹³ European Commission 2023 SME Country Fact Sheet - CYPRUS

¹⁴ Cypriot SMEs are mainly family businesses, with very few people outside the family nucleus involved in their management

Traditional SMEs focus their efforts on running their core business rather than dedicating time and resources to develop new products and perform R&D&I. In recent years the number of enterprises in Cyprus that have introduced innovative products/services/processes to the market has increased¹⁵.

Most of the innovative startups in Cyprus are in Fintech (15%) followed by Life Sciences (7%), Retail Tech (7%), Entertainment/Media (7%), Human Resources (7%), Green Tech and CleanTech (5%), Data Analytics (4%), Manufacturing (4%)¹⁶. The Business model of innovative startups in Cyprus mainly appears to be B2B (53%), B2C (22%), B2B2C (17%)¹⁷.

The value of medium and high-tech exports, in national currency and current prices over total exports, has decreased slightly in recent years, currently standing at 18% below the EU average. High-tech exports account for a mere 0.9% of the total trade. ICT Services exports however has improved significantly and currently accounts for 17.6% of total trade. Through a series of measures and reforms the Cyprus Government aims to enhance Cyprus' position as an international business centre and redefine the country's growth model. Key interventions include simplified immigration and employment policies, attractive tax incentives and investor support to attract businesses in Cyprus, as well as measures making Cyprus a prime regional and global headquartering location for ICT companies, offering market access to more than 500 million EU citizens.

The size and composition of investments, gross fixed capital formation as a percentage of GDP, is below the Euro area average. As per the EC Country Report, 2023, investments are skewed mainly to sectors that do not enhance productivity. The level of productivity enhancing investment, including research and development, is still low. Investment in green and digital is still limited and the rise in interest rates poses challenges to the levels of investment going forward. There is a need to shift focus towards productive investments.

Access to funds continues to be a major challenge for SMEs including startups. There is limited access to financial instruments and risk funding from the private investors including Venture Capital firms. Venture Capital as a percentage of GDP stood at 0.028% in 2021 compared to the EU average of 0.07%¹⁸. This is hindering the creation and growth of scalable enterprises in innovative sectors as well as the capacity of existing businesses to innovate and grow. A main challenge faced by innovative startups in securing equity funding is the price gap, i.e. the difference between an entrepreneur's perception about the valuation of the business vs. the price offered by potential investors. Innovative startups end up refusing an offer by an equity investor mainly because they believe that the price offered by the investor is too low, or the management is not willing to provide the control that the investor' offer entails¹⁹. On the equity side, potential investors reject innovative startups mostly due to lack of credible financial information and not being convinced about the growth potential of the business plan. Lack of credible and proper financial information is something that appears to be an issue across all SMEs.

As far as enterprises are concerned, these create an overreliance on Government funding. In fact, surveys with applicants have shown that even with a reduced scale and less ambition, internal funding of a project idea that was not funded by the government was an option only for about one in four survey respondents, including SMEs and startups. Also, only about 5% of industry respondents

¹⁵ European Innovation Scoreboard

¹⁶ University of Cyprus, Centre for Entrepreneurship

¹⁷ University of Cyprus, Centre for Entrepreneurship

¹⁸ Invest Europe

¹⁹ Ernst & Young: Report to DG Reform and Ministry of Finance on Ex-ante Assessment and recommendations covering SME access to finance

proceeded with a project idea in cases when government funding was not secured²⁰. The Government of Cyprus has recently introduced an array of tax incentives to mobilize investments in startups, R&D, intellectual property but also attract talent in the country. Effective utilization of these incentives is expected to offer better enabling framework conditions for innovation and commercialization.

More recent investments in the form of grants as well as an array of Government incentives, including tax discounts and mobility schemes (VISAs) for talent, have resulted in a more vibrant innovation system consisting of about 400 startups and scaleups some of which have attracted VC investments and have taken products and services to international markets. According to McKinsey²¹, the market capitalization of Cyprus based startups and scaleups is 15% of the national GDP in 2022. Startups and scaleups have the potential to contribute significantly in the diversification of the national economy and the strengthening of its competitiveness and resilience.

At the same time, universities and ROs also have the opportunity to pursue an entrepreneurial mission themselves, providing research services to the public and private sector and establishing closer links with businesses aiming for continuous knowledge transfer and impactful synergies. Pursuit of stronger IP protection and commercialization, including licensing of IP and the creation of spin-offs will contribute to maximizing their impact on the business environment and innovation performance overall.

There are different types of innovation (e.g. Deeptech Innovation, Market Innovation, Social Innovation, Organizational, etc) currently supported (funding and support services) by several Government authorities such as the RIF and the Ministry of Energy Commerce and Industry. With regards to deep tech innovation, defined by the European Innovation Council as a technology that is based on cutting-edge scientific advances and discoveries, characterised by the need to stay at the technological forefront by constant interaction with new ideas and results from the lab²², analysis of participation in the RIF programmes suggests that deep tech founders/teams have limited commercial and entrepreneurial skills. These include understanding and means to access international markets that their innovations are addressing. There is a need to strengthen self-sustainable innovation support structures on the island to support local entrepreneurs on their entrepreneurial journey. It is noted that innovative startups tend to reach out to foreign incubators and accelerators for support and guidance²³.

Within a fairly short period of time deep tech startups have managed to launch products/services in the international markets. However, Cyprus' performance in the EFP Flagship Programme European Innovation Council (EIC) which funds breakthrough technologies and game changing innovations with the potential to scale up internationally and become market leaders is significantly lagging behind.

There is a low level of innovation and digitalisation and limited capacity building within enterprises. The use and integration of digital technology in Cyprus remains below the EU average, particularly in the public sector. Cyprus still has progress to make on the digital transition. It ranks among the lower half of countries in the Commission's Digital Economy and Society Index (DESI) for 2022.

²⁰ Technopolis Report "Interim Evaluation of RESTART 2016-2020 and the CY participation in H2020", (November 2020)

²¹ McKinsey – Reinventing our economy from within (Sep 2023)

²² [European Innovation Council Work Programme 2023](#)

²³ Ernst & Young: Report to DG Reform and Ministry of Finance on Ex-ante Assessment and recommendations covering SME access to finance

Green and sustainable growth is increasing only slowly and the country's potential to rely renewable energy is so far untapped. According to the EU Eco-innovation Scoreboard which measures the environmental innovation performance of EU Member States, Cyprus ranks in the Eco-Innovation Catching Up group, with a score of 94.65 compared to an EU average of 121.47.

To date the public sector has not used innovation procurement to drive adoption of innovative technologies. This may be down to a number of reasons including lack of understanding on how innovation can help transform the public sector and drive productivity and efficiencies. Even more, there are challenges linked with the use of innovation procurement for public procurement. Addressing such barriers to increase demand for innovation can play a crucial role in driving R&D and innovation in the public sector.

2.5 Workforce and Productivity

Weak human capital in science and technology is limiting Cyprus' capacity to create new knowledge and generate further innovation. The share of new graduates in science and engineering per thousand population aged 25-34 ranks amongst the lowest in Europe (9.57% in 2021, compared to the EU average of 20.23%). Even more, the number of doctorate graduates in STEM is lagging behind the EU average by 45%.

The number of researchers (FTE equivalent) is increasing over time but it remains well below the EU Researchers FTE per population (Cyprus 0.25% vs. EU 0.69%). The majority of researchers are employed in the higher education sector (39%), followed by the business sector (35%), the private non-profit sector (17%) and finally the government sector (8%).

Poor integration of scientific talent is evidenced by the very low share of researchers amongst public-sector employees per thousand active population (1.9% in 2020) and amongst private-sector employees (1.3% in 2020).

There are shortages on digital skills and the share of information communication technology specialists in the workforce is low. Only 3.7% of 245.709 registered CY professionals on LinkedIn state that they have advanced technology skills with the most widespread skills being in cloud (10%), advanced manufacturing (9.1%), and AI (7.6%).²⁴ Shortages have also increased in recent years on green transition relevant skills. These are creating bottlenecks in the transition to a net-zero economy.

The population with tertiary education is very high however there are significant misalignments of skills with the labour market. The country is 68% behind the EU ideal performance on qualified personnel skills matching²⁵. Participation in lifelong learning is below the EU average.

Persistently low productivity is affecting the country's competitiveness. Labour productivity is about 86% of the EU average in 2021. There is a need for upskilling and reskilling the workforce to make it fit for the future.

2.6 Extroversion & Internationalization of the National R&I Ecosystem

Internationalisation of the R&I ecosystem, enabling knowledge exchange and the creation of partnerships as well as the conduct of excellent R&I, centred around collaborative research, is on the

²⁴ Cyprus Smart Specialization Strategy 2030

²⁵ Cyprus 2022 scores and progress over time, [Cedefop, 2022](#)

rise with much room for further improvement. Government actions including targeted bilateral agreements in key priority areas with countries that have significant competitive advantages Cyprus cannot attain on its own are expected to contribute towards achieving greater extroversion.

Emphasis should be given to exploiting EFP funding for the advancement of state-of-the-art research and interdisciplinarity in Cyprus, talent development, and access to top research facilities. Cyprus should focus on developing deep expertise in priority areas to enhance EFP success in specific programs. In this respect, Cyprus has committed €18 million to co-finance the participation of the domestic R&I ecosystem in European Partnerships, aligning with the priority sectors outlined in the Smart Specialization Strategy.

Overall country representation in COST actions reached 64% in 2022, presenting a steady rise since 2016. Leadership positions (Chair & Vice Chair) were held by CY researchers in 30 COST actions, an important rise since 2021 where leadership positions were only held in 19 actions. This shows that there is potential for CY researchers to lead these actions and form closer ties with distinguished researchers abroad.

2.7 Cluster Formation

The creation of clusters gathering universities, research institutes, centres of excellence and businesses in the areas of digital technologies, innovative materials, agrifood, renewable energy, maritime, shipping space, health and the environment, demands efforts regarding the enhancement of collaboration culture among stakeholders. Technopolis suggests that there is also insufficient experience in interdisciplinary/intersectoral mission-oriented research.

Innovation is primarily created and its value is captured by enterprises. The capacity of existing enterprises to innovate as well as the creation of new market participants, such as startups, strengthen the competitiveness and resilience of the national economy and contribute towards its diversification. The knowledge that drives the creation of new startups or is exploited by existing enterprises in order to innovate stems out of the research system. Research output and optimal alignment between the research and innovation system is important.

For a national ecosystem to flourish the necessary enabling conditions in the form of institutional and regulatory frameworks, education, skilling, upskilling and reskilling of human capital, financial support and non-financial support, knowledge transfer and innovation support structures and networks must also be in place.

Moving Forward

An R&I strategy which addresses all elements required to develop a robust, integrated and well interlinked national ecosystem that has increased contribution to the national economy and society is imperative. Through stronger integration of all parts of the national ecosystem the collective effect of all parts working together is more impactful. The whole is greater than the sum of its parts.

3. Strategy Pillars

Pillar A: World-Class Institutions & Infrastructures for ground-breaking research

The primary goal of this Pillar is to develop internationally recognized Research Organizations that have the world-leading infrastructures in key strategic sectors, fostering high-quality research and establishing partnerships with other leading global organizations and research groups and attracting the best faculty, students and post-docs, thereby further enhance success in the European Framework Programme for R&I, particularly in flagship programmes of Pillars I, II and III as well as the EU Missions and European Partnerships.

Unlocking the full potential of the national research system (public and private universities, centres of excellence, Government laboratories, research institutes) is paramount for advancing knowledge and driving innovation. Achieving effective and efficient utilization of the research system involves taking advantage of the rich resources within these institutions.

The national strategy supports the optimal use of research infrastructures through a) developing the skills of researchers using the infrastructure, b) accelerating technology transfer among organizations, c) encouraging more cooperation and collaboration between translational research organizations, fundamental research organizations and businesses and d) creating awareness of the opportunities research organizations provide to local businesses thus providing a mechanism for accelerating collaborations.

Creating a dynamic ecosystem where knowledge flows freely in two directions – from research organizations to the business sector and other potential users of this knowledge and *vice versa*. It also requires active collaboration between research organizations and users and the flow of students, post-docs, and researchers acting as consultants into companies, government, and other users. This dynamic ecosystem approach ensures that the wealth of resources created in research organizations (e.g. research infrastructures, innovative tools, extensive publications, intellectual property, and skilled labour) is leveraged to its fullest potential to accelerate progress and innovation across diverse fields of the Cyprus economy and society. It also enhances and expands incentives for companies, non-profits, and other users to increase their support for those research organizations.

A key focus of this Pillar is to enhance collaboration through the sharing of research infrastructures. By making these facilities accessible, we empower researchers and industry professionals alike to conduct cutting-edge experiments and studies. This approach enhances efficiency and resource utilization, as it allows researchers, institutions and enterprises to access high-quality facilities and equipment that might be otherwise unaffordable or inaccessible. Research infrastructures become nodal points in ecosystem networks where researchers, product and service developers and funders such as foundations and venture capitalists can interact as they pursue their own projects. This collaborative environment can lead to groundbreaking discoveries and innovations, leveraging the collective knowledge and capabilities of various researchers and institutions. To enable this, incentives designed to maximize the utilization of research infrastructure through the professionalization of services provided by Ros, the Deputy Ministry's dedicated platform established to facilitate collaboration and access to research infrastructures and networking tools will be introduced.

At the national level the strategy also aims to address gaps in research capacity between different research organizations thus strengthening critical mass and contributing towards the development of a more unified, hence stronger, research system. It also serves to attract the best research talent to

our country, thereby upgrading Cypriot capability to addressing challenges and developing even deeper expertise in priorities areas.

Academia already plays a pivotal role in advancing research, transfer knowledge and technology and drive innovation. As hubs of research excellence, they cultivate talent, train future researchers and innovators, and foster interdisciplinary and cross-sectoral collaboration.

Through scientific publications, universities also contribute to the global body of knowledge, enhancing their academic reputation and promoting international collaboration. Their workshops, conferences, and seminars create platforms for continuous learning, ensuring ongoing innovation and societal progress. In essence, universities serve as dynamic intersections where research, innovation, and technology converge to shape the future. The process involves collaborative partnerships, industry collaborations, and initiatives that facilitate the exchange of expertise. Whether through internships, consultancy services, or joint research projects, universities actively contribute to solving practical challenges and driving innovation. The strategy enables leapfrogging forward into regional and global recognition as centre of innovation excellence.

Innovation requires more than great science, engineering, and invention. It requires the application of those research tools and result to social and economic challenges. To this end, three activities are critical:

- 1) Expanding industry-relevant skills and nurturing collaborative endeavours within research organizations, including providing relevant training to aspiring entrepreneurial researchers. These are the people who will carry knowledge and the spirit of innovation from Cypriot research organizations into Cypriot companies and other parts of our ecosystem.
- 2) Setting up and operating Technology Transfer Offices (TTOs) within research organizations to support and facilitate the various forms of knowledge, intellectual property and technology transfer to industry including the creation and support of spin-off companies. The amendment of the legislation that governs the set-up of spin-off companies by publicly funded Universities is expected to contribute towards that goal. Similarly, publicly funded research institutes and centres of excellence are expected to have technology transfer offices within their organizations. Technology Transfer Offices provides the boundary-spanning advocates and the legal mechanisms for moving university-generated knowledge into companies and agencies which will apply it for practical purposes. These boundary-spanning advocates also conduct the outreach needed for research organizations to better understand needs in industry and the larger Cypriot ecosystem and to complement industrial liaison offices to increase the inflow of sponsored research funding, donations, and other revenue into their research organization. Improving industrial outreach through stronger and even more meaningful linkages with industry, nationally and internationally, has the potential to deliver better alignment with real-world challenges.
- 3) Centres of Excellence and government laboratories bring practical perspectives and applied research on real-world applications that complementing the theoretical and more fundamental research advancements from academic institutions. Facilitating greater collaboration of the ecosystem with centres of excellence and government laboratories is a strategic move toward holistic research integration and sustainability. It better enables them to create critical technology that addresses challenges in their respective domains. It simultaneously provides a proving ground for the advanced technologies emerging from research organizations, making those technologies more attractive to industry. To address challenges faced by Government laboratories and also enhance the capacity of the public sector to carry out R&D work a central unit that drives public sector research and innovation projects and is also tasked with facilitating commercialization of research results and Government owned IP will be set up within the RIF.

Cyprus is planning for a Research System that,

1. Produces high quality and quantity of scientific publications and also Intellectual Property
2. Has strong intra-system linkages
3. Develops and enhances expertise ready in state-of-the-art subsectors
4. Supports national priorities and also has good degree of alignment with EFP topics
5. Can develop good research talent domestically and absorb good research talent from abroad and provide them with opportunities for growth.
6. Collaborates at international level and remains at the forefront of scientific developments
7. Is attractive to Cypriots and foreigners to work in and with.
8. Has stronger success in the EFP, especially flagship programs and taking leading roles in international collaborative projects.
9. Has strong linkages with enterprises both nationally and internationally focused on generating revenues from provision of services and their entrepreneurial activities.
10. Has Universities that rank high in prestigious world rankings
11. Has state-of-the-art infrastructures that are shared across all actors of the R&I ecosystem

Supporting the development of world-leading infrastructure in key strategic areas focused on creating market scale and market access, and then providing the support required to leverage that infrastructure as research organization for Cypriot ecosystem transformative resources is a strategy for becoming a regional innovation hub and a global center of innovation excellence.

Pillar B: Linking R&I with Businesses, Fuel Business Success

Integrating R&D and new product and service development into the value creation chain of businesses enables companies to anticipate and respond to changes, identify opportunities and proactively address challenges. Innovation is the tool that transforms uncertainty into strategic advantage thereby allowing companies to stay relevant and resilient.

At the same time, the dynamic business landscape, characterized by rapid technological advancements, shifting consumer preferences, and unpredictable market trends, creates significant opportunities for startups to develop game changing innovations, enter the market, disrupt and grow internationally. Startups are catalysts for growth locally and globally.

Innovation enters businesses in three primary ways. Research-intensive companies transform science and engineering advances made internally or licensed from research organizations into commercially viable technology. Companies engaged in new product development (NPD) take inventions and technology made internally or by others and deploy it to build commercially viable products and services. Other companies buy and incorporate innovations into their products and services to keep their market offerings competitive or to upgrade their internal processes as part of digital transformation and other quality and efficiency initiatives.

- **Support for established companies**

It is important to support the advance or R&D/NPD units in businesses in sectors of the Cypriot economy where these capabilities will provide competitive advantage in regional, European and global markets. Doing so requires targeted measures to build absorptive capacity through benchmarking

relevant global best practices and methods and providing the trainings through which these practices and methods can be acquired, adapted, and integrated into the value chains of Cyprus companies.

To Uplift BERD targeted funding schemes that take the form of blended finance, mixing public funding with private investments, in specific priority areas are needed to incentivize, de-risk and mobilize local businesses to implement more ambitious R&D/NPD projects. This will enhance, augment, and introduce future generations for the existing products/services they offer today and develop new, improved ones. Such schemes also serve as additional incentives for established businesses to tap into the knowledge and expertise of research organizations.

Stimulating investment in R&D/NPD is not sufficient for long-term sustainability of businesses. For that reason, the implementation of the national R&I strategy places a premium on inter-ministerial collaboration to ensure that investments in R&D/NPD can be followed up by financial and non-financial support to produce/manufacture and commercialize solutions.

- **Support the creation and development of startups and scaleups**

Policies and programs that meet the needs of startups can play a significant role towards its commercial success. The national R&I strategy aims to make more funding available for startups with high growth potential as well as scaleups both in the deeptech fields but also for market innovation.

Access to high-risk capital remains a challenge for innovative SMEs including startups and scaleups. The Government of Cyprus has introduced non-financial schemes to encourage investments in certified innovative companies. Furthermore, the operation of the Cyprus Equity Fund will address to a certain extent the gap in alternative financing for startups and innovative SMEs. Through the introduction of blended finance schemes, mixing public with private investments to fund technology and commercial activities, the RIF can take a leading role in the further development of the local VC market. Even more, leveraging these schemes to create significant deal-flow in Cyprus raises visibility of the national innovation system abroad as a place where VC money can find untapped opportunities with Cyprus based companies. The anticipated establishment of the National Promotional Agency will also help improve access to finance for SMEs.

The strategy also aims to support the development of self-sustainable innovation support structures such as incubators and accelerators offering high quality programs that cater for the needs of the local startup community and enhance their entrepreneurial and commercial skills. These are complemented by support services offered already by the RIF, such as the Innovation Factory Initiative that provides training to both entrepreneurs and intrapreneurs.

The strategy also aims to support the development of self-sustainable innovation support structures such as incubators and accelerators offering high quality programs that cater for the needs of the local startup community and enhance their entrepreneurial and commercial skills. These are complemented by support services offered already by the RIF, such as the Innovation Factory Initiative and the Central Knowledge Transfer Office that provides training to both entrepreneurs and intrapreneurs. Emphasis is placed on skills and capacities which create positive feedback loops which stimulate even more innovative behaviour in businesses. For example, robust intellectual property (IP) protection is fundamental for protecting the economic visibility of innovation and creativity requiring significant investments to productize.

- **Taking new or improved products and services to the markets**

Cyprus is a small island nation, it is a great place to build a minimum viable product, test it, develop it further and launch it into the markets offering best-in-class service in terms of both operational excellence and customer excellence. The national strategy aims to expand beyond support for innovation to also offer support schemes for production and competitive manufacturing, commercial activities and support to access international markets.

Enhancing the extroversion and internationalization of local businesses is key for economic growth. Support to access international markets and schemes that boost exports of mid- and high-tech products for key targeted sectors is also part of the strategy.

- **Diffusion and Adoption of Innovation in the Public Sector**

We encourage contracting authorities to employ demand-side measures such as pre-commercial procurement and innovation procurement to provide innovative SMEs an opportunity to compete and potentially secure contracts with the Government as their customer.

There are also significant opportunities for innovation SMEs, especially in key areas such as Digital and Green Transition to work with Government under dedicated schemes to support the migration to a more digital, greener ready society.

- **Attracting Investments and Firms to Cyprus**

Attracting investments and high-tech multinational companies contributes to Cyprus's efforts to become a regional hub for Research, Innovation, Entrepreneurship, and High Technology.

Having high-tech companies, startups, and multinational corporations conduct R&D in Cyprus will strengthen the scientific and technological foundation of the country while at the same time will inject the availability of high-risk capital and channels for the adoption of new technologies and enhance the ability of the labor market to absorb high-skilled human capital.

- **Creation of Clusters**

Universities, Research Institutes, Government Laboratories and Centres of Excellence have a significant role to play in stimulating innovation. In particular centres of excellence can act as nodal points around which thematic clusters could emerge. By leveraging on their ability to bridge the gap between more fundamental research and the need for closer-to-the-market innovations required by most businesses they can offer facilities, equipment and talent to businesses to foster innovation and entrepreneurship and catapult innovations into the market.

Even more, the creation of a national innovation district promoted by the Government will create a natural space where large enterprises, research organizations, startups and innovation support structures will co-exist and collaborate fostering innovation and entrepreneurship. Such an innovation district can act as a point of reference and has the potential to attract investments from abroad therefore raising further the visibility of Cyprus as a regional hub.

We are building a mature National Innovation System aiming to establish innovation as the base for sustainable development through,

1. The creation and development of innovative startups that grow into scaleups.
2. Increased participation of established businesses in R&D, Innovation and Commercialization.

3. Effective collaborations with the research system and within the innovation system.
4. Making Cyprus more attractive for VC investments
5. The provision of targeted non-financial incentives for established businesses and startups
6. High quality innovation support services to foster entrepreneurship/intrapreneurship
7. Formation of clusters in key priority areas
8. Supporting the extroversion and internationalization of Innovative Enterprises

The Deputy Ministry for Research Innovation and Digital Policy will collaborate with competent authorities to promote the creation of regulatory sandboxes such as the Regulatory Sandbox for FinTech ²⁶currently under development. The operation of such sandboxes could make Cyprus even more attractive for innovative companies that want to test technologies/prototypes/MVPs in the field with relatively easier/concise procedures.

Pillar C: People as drivers of growth for the Research and Innovation Ecosystem

The ability of the country to attract, grow and retain talent within the national research and innovation ecosystem and beyond underlies efforts to deliver the vision and strategy for R&I Cyprus. Building a workforce fit for the future requires strong collaboration with the Ministry of Education and all other stakeholders. It necessitates an integrated framework of political and financial tools. This framework aims to foster a pervasive culture of research throughout the economy, placing emphasis on training, cross-sector collaboration, and ensuring favorable working conditions.

The strategic approach underscores the significance of initiating early interventions and creating programs that develop skills of the future, nurture an entrepreneurial/intrapreneurial culture and a more cosmopolitan mindset in young talent. It starts from early education levels, towards equipping the generation after next with the skills essential for R&I and technology and demonstrating the significance of STEM and R&I in defining the future²⁷. A pivotal priority is also strategically supporting the upskilling and reskilling of the existing workforce, ensuring a dynamic ecosystem that thrives on innovation and productivity.

Aligned with the aim to enhance research and innovation capacity, is the attraction of foreign talent who want to work in Cyprus but also the repatriation of distinguished scientists from abroad. Acknowledging the rapid pace of technological evolution, the strategy further champions a continuous learning culture. Early skill development is viewed as an ongoing process that adapts to the ever-changing landscape. This commitment ensures that the next generation and the generation after next remains agile, resilient, and ready to lead R&I

A cornerstone of this strategy is the establishment of meaningful industry-academia collaboration that create the necessary conditions for curricula aligned with industry needs, providing students and post-doctoral researchers with practical, industry-relevant skills, offering training courses to facilitate upskilling and reskilling, ensuring graduates transition seamlessly into the workforce.

To maintain the research profession's appeal and sustainability, the career development and prospects of researchers are prioritized. This involves promoting the "European Charter for the Researcher and the Code of Conduct for the Recruitment of Researchers" among domestic organizations, adopting best practices, and creating an integrated framework. Implementing Gender Equality principles in R&I

²⁶ Cyprus Recovery and Resilience Plan 2021-2026 Component 3.3

²⁷ Cyprus Recovery and Resilience Plan 2021-2026 – Component 5.1, Reform 4 & 5

is also critical to ensure equal opportunities in terms of employment, training, and development, achieved through a Gender Equality Plan.

This comprehensive approach aims to enhance the R&I ecosystem in Cyprus, making it more appealing for both local and international talent, thereby enriching the country's capacity for innovation and its position as a leader in the global research community.

This strategy aims to:

1. Contribute to Increase the number of STEM PhD graduates to ensure availability of R&I talent as a key component for addressing the challenges of transformation, including but not limited to the digitalization and green transition.
2. Create more diverse career opportunities for PhD graduates and postdocs to retain them in the national R&I innovation ecosystem. Enhanced absorptive capacity and innovation capacity in businesses as well as opportunities in startups, including spinoffs, offer broader opportunities.
3. Support and nurture young talent to act as agents of change through provision of more opportunities to lead national research projects early on in their careers, instilling a more entrepreneurial/intrapreneurial culture through provision of trainings, upskilling on topics augmenting R&I activity, such as knowledge transfer, new product development, project management, commercialization, etc. and offering national and international mobility opportunities.
4. Springboard more leading experts in the EFP to leverage on their expertise to grow successes internationally, raise their own and their institution's prestige and consequently free up national funding to develop the next generation of leading experts.
5. Encourage and facilitate the mobility of researchers abroad to acquire knowledge and experiences which they share when they return to their institutions thus enhancing research excellence.
6. Accommodate also for the needs of newcomers into the innovation system so that the investment in people is directed better towards building skills that will in turn enhance capacity to innovate, commercialize and boost productivity.
7. Build stronger R&I and Technology communities. Create environments of 'many collisions, no frictions' for people from different parts of the national ecosystem and beyond to come together, learn from each other and align with new realities. Tapping into research, startup and business communities and leveraging on alumni networks that advocate for research organizations, startups and businesses throughout the country and to the rest of the world, we create cadres of ambassadors and champions in both the knowledge and intellectual marketplace of ideas and the economic marketplace of intellectual property, technology and product/services.
8. Promote more the existing array of Government incentives for talent so that we tap into a pool of expatriates but also foreign talent who wants to work in Cyprus. Such schemes can of course be used to repatriate distinguished researchers from abroad but also other prestigious staff.
9. Accommodate for the needs of the next generation and the generation after next by starting early to equip them with the skills of the future for R&I and Technology. This will be pursued through high-quality and high-caliber competitions/educational workshops, etc that help develop necessary skills for the future, mentorships and trainings that inspire young minds to become the scientists of tomorrow.
10. Enhance inter-ministerial collaboration to address the needs of the next generation for skills development concerning R&I and technology, as well as to attract high caliber researchers and talents from abroad.

Pillar D: Becoming an R&I Leader within the EU and beyond

Strengthening Cyprus' international, European, and regional relationships, both at the governmental and business levels, contributes to overcoming significant challenges such as the small market size and the lack of availability of highly specialized human resources. Therefore, the focus on cross-border and multilateral collaborations includes activities related to boosting the extroversion of the R&I ecosystem, fostering the exchange of technological expertise and jointly developing new technological solutions to address contemporary challenges.

Similarly, representation of the country in EU policy making and advisory bodies, European Research Infrastructures and Partnerships as well in Industry forums and Research Associations should also be enhanced. The key purpose should be to enhance the presence in international fora, making Cyprus visible, influencing and gaining insights on strategic research agendas. In turn, this is expected to allow for creation of critical mass and expertise in key areas, better collaboration links and greater success in EFPs.

Of utmost importance for the international dimension of the ecosystem is the alignment of the National with the European R&I policy and harmonization with the European Research Area (ERA) flagship priorities to ensure strong integration that breaks down barriers and promotes cross-border collaboration, knowledge exchange and collective addressing of challenges posed by the twin green and digital transition at the EU level, and amplifying access to research and innovation excellence across the union. Aligning national frameworks and incentives with European standards, ensures a cohesive approach, making the local R&I ecosystem more attractive on an international scale.

Cyprus has joined the EU Startup Network Alliance and has signed the declaration on the EU Startup National Standard of Excellence. Startups and Scaleups are key to Europe's future economy and society as highlighted in the Digital Decade Policy Program adopted in December 2021. We remain committed to stay abreast of developments at EU and international level and aim to quickly adapt and adopt to create early mover advantage which reinforces our position as a regional R&I hub.

Cyprus is establishing targeted bilateral agreements with countries possessing significant competitive advantages in key priority areas. Recognizing the global nature of the research and innovation market, international cooperation becomes crucial for developing and sustaining a world-class research and innovation system. Therefore, optimizing frameworks and incentives to attract international investments, talents and expertise becomes vital within this context.

Building a strong brand and positioning Cyprus as a 'Regional R&I Hub' is integral to our strategy. This involves proactive communication of our achievements, collaborations, and contributions to the R&I community. By cultivating a distinct identity and showcasing our capabilities, we aspire to attract international partnerships, investments, and recognition, solidifying our position as a regional leader in R&I.

Additionally, it is important for the advancement of the country's position as a R&I leader, to augment the capacity of the private sector to innovate by exploring opportunities for market uptake of research results, through the EFP actions such as the European Innovation Council (EIC) and the European Institute of Innovation and Technology (EIT). The active participation of the private sector in this innovation and transfer of knowledge programs, and the export of medium and high-tech products/services will broaden their access to network, funding, and expertise, enhancing the country's competitiveness on the global stage.

Outmost importance is given to fostering international research networks and collaborations and to tap into global knowledge and expertise. Establishing strong ties with global institutions, facilitates knowledge transfer, strengthens research capacities, and enhances the attractiveness of the country as a 'Regional R&I Hub' for international collaboration.

These networks and collaborations can act as a nexus for academia, industry, and government, fostering a more integrated approach to research and development. This synergy maximizes the impact of collective resources and expertise, potentially leading to more rapid and impactful advancements in various fields. It's a strategy that not only accelerates the pace of innovation but also ensures a more inclusive and comprehensive approach that acknowledges and harnesses the strength of collective effort and shared knowledge.

International networking and cooperation in the R&I ecosystem are achieved also through Cyprus' participation in international organizations, the EUREKA network, and the PRIMA organization operating in the context of the Mediterranean Region. International research and academic organizations networking is also promoted by Cyprus' participation in several European Research Infrastructure Consortiums (ESFRI).

This vision is to propel our country towards R&I leadership within the EU and beyond. Through integration, a supportive ecosystem, impactful exports, EFP success, and a strong brand, we aim to not only lead in innovation but also contribute meaningfully to the global R&I landscape.

Finally, a country's progress in R&I can be demonstrated by its rise in international rankings. Higher rankings not only attract international attention but also instil confidence in potential collaborators and investors. In addition, by fostering the RPOs excellence in world university rankings, will improve their industrial outreach and create strong linkages between academia and industry.

Thematic Pillar: Targeted Investments to drive growth

In "Vision 2035," Cyprus is projected to become a thriving and resilient economy at the crossroads between Europe and the Middle East, with high and increasing levels of productivity and competitiveness. The economic cycle will rely less on natural resources and will be supported by the principles of digitization and a green economy. The Cypriot economy will be more diversified, making economic growth more sustainable and thus more resilient to external or internal shocks. This vision serves as the starting point for the Smart Specialization Strategy (S3CY) in developing its goals and priorities.

Within the framework of the Smart Specialization Strategy, priority areas consist of 4 Pillars, 8 Priorities, with added value to the economy and society have been identified, categorized into four sections:

A. Technological Priority Areas

Digital Technologies

Existing capabilities in digital technologies can be utilized to develop innovative solutions in various economic activities, such as precision agriculture, water management, space technologies, or environmental monitoring. However, to reach and maintain the forefront of technology, Cyprus needs to develop skills and capabilities in emerging fields that are expected to transform digital technologies.

The widespread adoption of digital technologies creates significant opportunities for the rapidly growing Information and Communication Technologies (ICT) sector in the country.

Focus Areas for R&D in Digital Technologies:

- High-Performance Computing and Quantum Technologies
- Cybersecurity
- Digital Tourism
- Education, Culture, and Creative Industries
- Smart City Applications
- Advanced Manufacturing and Processing
- Acceleration of Testing and Demonstration

Innovative Materials

Additionally, Innovative Materials, as higher-cost and higher-performance substitutes for existing materials with improved characteristics, contribute significantly to various fields such as construction and maintenance of buildings, transportation, healthcare, etc., while facilitating recycling and reducing the need for rare raw materials. Although the number of companies in the materials sector in Cyprus is still small, there are significant opportunities for further development and exports, based on the needs of the industry.

Focus Areas for R&D in Innovative Materials:

- Development of new, safe, environmentally friendly, and commercially sustainable methods for recycling a wide range of composite materials and reusing secondary raw materials.
- Methods for processing nanomaterials and composite materials.
- Development of innovative materials with improved characteristics for industrial, construction, energy, and healthcare applications.
- Use of nanomaterials for geosensing and for the aerospace and space industries.
- Innovative materials for environmentally friendly buildings and buildings with better performance under challenging conditions (earthquakes, extreme environmental conditions).

B. Ecosystems - priorities of particular importance for the Cypriot ecosystem

The Agri-Food, Shipping, and Renewable Energy Ecosystems encompass economic activities that are significant for Cyprus. In these areas, R&D is essential for diversifying existing capabilities and allowing companies to specialize at various levels of knowledge complexity. It is noted that other sectors such as transportation, tourism, and construction will benefit from applications developed under different priorities.

Agri-Food

The Agri-Food sector (Agriculture, Livestock Farming, Aquaculture, Food, etc.) contributes to the development of the Cypriot economy and job creation through the development of digital and innovative solutions (e.g., smart irrigation equipment, geosensing) and products for domestic and international markets. The goal of research activities is to improve the competitiveness and resilience of the ecosystem, reduce its environmental footprint, create healthy and environmentally friendly food systems, and protect the country's natural resources. There is significant interest from Cypriot companies in areas closer to the market, such as water resource management, digitization of the sector, and food quality. Conversely, in areas related to the transformation of the system and the interaction of the industry with the environment, there is greater interest from research organizations.

Focus Areas for R&D in Agri-Food:

- Diversification and improvement of the competitiveness of the agri-food ecosystem.
- Support activities following agroecological principles to enhance resilience and sustainability of the agricultural system and reduce its environmental footprint.
- Mitigation of the impacts of climate change on the agri-food ecosystem.

Shipping

Shipping is a pillar of the Cypriot economy. The shipping ecosystem includes over 250 companies, employing approximately 9000 professionals, offering various maritime services: ownership, ship management, insurance, financing, fuel supply, maritime education, satellite and radio systems technology, etc. The growing demand for decarbonization technologies, the increasing need for better monitoring and optimization of ship operations, and the proximity to the large market of the Cypriot shipping industry offer significant opportunities for Cypriot entrepreneurs to develop innovative products and services. It is noted that shipping companies rely on their suppliers for the development and installation of technologies. However, a small number of Cypriot companies are developing products that could meet significant needs of the industry in satellite observation and monitoring, big data, and the Internet of Things (IoT) for data collection and analysis to optimize ship operations and develop advanced materials for ship components.

Focus Areas for R&D in Shipping:

- Digital technologies and Earth Observation for monitoring and decision-making.
- Decarbonization of ships.
- Equipment and tools for applications in shipping.

Renewable Energy

The Renewable Energy sector has the potential to contribute significantly to the development of Cyprus's economy and job creation. Cyprus has a strong natural advantage in solar and wind energy, given its climate, sunny days, and island location. However, it has one of the lowest shares of renewable energy in gross final energy consumption, which needs to reach 32% by 2030.

The R&D ecosystem of the country is involved in research projects for the development of new or optimized renewable energy technologies, with a focus on solar and solar thermal energy, innovative solutions for energy saving and building energy efficiency, and improvement of energy management systems. R&D relies heavily on advanced digital technologies such as Artificial Intelligence and the Internet of Things, aiming for better monitoring of energy production performance from various technologies, energy consumption, and the use of renewable energy in smart grids.

Focus Areas for R&D in Renewable Energy:

- Energy production technologies from renewable sources.
- Digital management and monitoring systems for energy production and distribution.
- Energy efficiency in urban areas.

C. Emerging Priorities/Ecosystems

Emerging ecosystems, currently encompassing only the Space sector, are characterized by increasing technological complexity. The development of new technological capabilities will be based on existing expertise in digital technologies and advanced materials (e.g., nanomaterials).

Space

In the Space sector, Cyprus has significant infrastructure for satellite communications and navigation, as well as other satellite-related activities (e.g., the launch of the first satellite by HELLAS SAT), although it has not yet reached a critical mass. In terms of Research and Development (R&D), domestic research organizations and companies focus on geospatial applications, with significant benefits for the environment and climate.

Cyprus has the opportunity to participate in programs such as ESA Optional ARTES Telecom, FUTURE EO, and GSTP, leveraging further opportunities offered by space technologies to address social challenges, emphasizing the commercialization of low Technology Readiness Level (TRL) research results.

Focus Areas for R&D in Space:

- Utilization and application of data generated by space infrastructure for future applications.
- Advanced materials for constructions and equipment used in geospatial facilities and spacecraft.
- Leveraging participation in programs of the European Space Agency (ESA) for commercialization of research results.

D. Enabling Domains (Enablers)

The domains of Health and Environment are deemed essential for the success of S3CY, given their impact on the country's society and economy. Most economic activities in Cyprus, including tourism, construction, energy, agriculture, and transportation, are directly linked to the environment and natural resources. Similarly, the productivity and creativity of the human workforce are related to their health.

Health

R&D in the Health sector aims to improve the quality of life and promote the economic development of Cyprus, addressing existing challenges in the domestic healthcare system, improving the diagnosis and treatment of diseases, and supporting the development of new products and services.

The R&D ecosystem in Health consists of various research organizations and Centers of Excellence, pharmaceutical companies with significant exports of pharmaceutical products, and a small number of companies producing nutraceutical and cosmeceutical products based on indigenous plants. The role of digital technologies such as Artificial Intelligence, the Internet of Things, and Blockchain is considered crucial in addressing issues related to data collection and analysis, as well as decision-making.

Focus Areas for R&D in Health:

- Clinical and Genetic Exploration and Treatment of Diseases
- Digital Health
- Innovative Products
- Promotion of public health and quality of life."

Environment

The relationship between the Environment and economic activity is direct and crucial. Investments in Research and Development (R&D) in the Environmental sector to address climate change and reduce air, water, and soil pollution will save costs for healthcare, cover damages to the food chain, etc. Simultaneously, opportunities are created in the R&D ecosystem (research organizations, Centers of

Excellence, and businesses) for the development of innovative products and services for monitoring and managing the environment and natural resources, as well as preventing and mitigating risks such as desertification. The accumulated research capacity of the ecosystem in blue growth, climate, and atmosphere, combined with technological capabilities in Cyprus such as geospatial analysis, big data analysis, and simulations, is expected to significantly contribute to environmental monitoring and decision-making.

Focus Areas for R&D in the Environment:

- Adaptation to climate change
- Monitoring and protection of the environment from economic and human activities
- "Greening" of industry and economic activities
- Management of natural resources and protection of biodiversity

The aim is S3CY is to achieve differentiation, specialization, and promotion of the level of the R&D ecosystem in priority areas, mainly through the increase and upgrade of research infrastructure, laboratories, etc. Furthermore, an increase in the number of Small and Medium-sized Enterprises (SMEs) participating in research proposals and adopting innovative solutions in products, processes, services, and methods is expected through the funding of high Technology Readiness Level (TRL) proposals and support for the commercialization of research results.