NATIONAL RESEARCH AND INNOVATION PLAN 2023-2027

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MALTA'S NATIONAL RESEARCH AND INNOVATION STRATEGIC PLAN 2023-2027

GOVERNMENT OF MALTA

MINISTRY FOR EDUCATION, SPORT, YOUTH, RESEARCH AND INNOVATION

PARLIAMENTARY SECRETARIAT FOR YOUTH, RESEARCH AND INNOVATION

Xjenza

The Malta Council for Science & Technology

Contents

Foreword by

Hon. Clifton Grima

Minister for Education, Sport, Youth, Research and Innovation

It is with great pleasure that we unveil the new National R&I Strategic Plan, and I look forward to seeing it enhance Malta's potential as a hub of innovation. Our government has made it clear in our electoral manifesto that we are committed to putting R&I at the forefront of Malta's future growth and prosperity, and this Strategic Plan will be instrumental in achieving that goal over the next few years.

Research is not a standalone sector, but rather a catalyst for economic growth and social wellbeing across all industries including agriculture, transportation, tourism, and healthcare. The ability to conduct cutting-edge research and have the infrastructure in place for it to impact the economy and society as a whole is a fundamental necessity for knowledge-driven economies.

Malta already has the capacity for innovation in several global niches such as key digital technologies, maritime, aquaculture, medicine and smart manufacturing. By augmenting our capabilities in this regard, we are directly investing in our present welfare as well as our future prospects.

Our administration has already taken significant strides in this direction, including our recommitment to the 2% target. Although this is an ambitious goal, it is a necessary step in transforming our economic landscape, improving productivity, and achieving our sustainable development and energy targets. Despite the challenges we face due to the COVID-19 pandemic and the ongoing conflict in Ukraine, we remain steadfast in our commitment to this target.

However, achieving a 2% target for R&D spending requires a comprehensive overhaul of our entire system. It's not just about pouring more money into R&D, although that is a necessary component. We need to create job opportunities for researchers in both the public and private sectors, foster collaboration between academia and business, stimulate demand for research and innovation, invest in and maintain research infrastructure, and leverage Malta's vast network of researchers abroad to collaborate with their counterparts on the island. We need to build an enabling ecosystem that will allow research and innovation to thrive over the long term.

Beyond the act of investing, consolidating the several critical actors across the existing R&I landscape into a cohesive and vibrant ecosystem is also a vital and necessary step. Properly synchronised, Malta's R&I framework will be better than the sum of its parts, allowing all actors to benefit from each other's capacities. This ecosystem, when properly realised and concretised, will be at the heart of Malta's economy and a vital force towards retaining and augmenting our competitivity in the global market.

We must take a long-term view to truly embed R&I in the local economy. We cannot focus on short-term gains and low-hanging fruit. We need a stable, sustained commitment to invest in research and innovation while fully integrating them into our economic and social fabric. Let this Strategic Plan be the starting point for discussions on how to best integrate R&I into our local economic and social narrative.

We must understand the challenges, prepare for them, and pave the way for a robust knowledge-based economy post-COVID. I invite all stakeholders to join us in building Malta's potential for research and innovation.

Foreword by

Hon. Keith Azzopardi Tanti

Parliamentary Secretary for Youth, Research and Innovation

The value of research extends far beyond its basic function of expanding human knowledge. While there is no doubt that the intrinsic value of research is undeniable, the role that research can play in enhancing a society's competitiveness and quality of life is equally significant. Science has the power to make a meaningful contribution to our society, and it is hence imperative that we work towards bringing science closer to the people.

As we launch this strategy, we are provided with a roadmap to improve Malta's R&I performance over the next few years. This strategy builds on the outcomes of the PSF Peer Review conducted in 2019 and places a strong emphasis on improved governance, increased opportunities, and better support structures for our research community. We welcome this approach and acknowledge that it is a much-needed step in the right direction.

While Malta's existing R&I landscape has contributed impressive results, it has yet to consolidate into a cohesive framework that includes industry, policymakers and academia in way where all benefit from each other's input and access to vitally important research data. The principles of Knowledge Valorisation and Evidence-informed Policymaking should be at the heart of the nation's R&I ecosystem.

However, it is equally essential that we empower our citizens with the necessary tools to understand, appreciate, and participate in research and innovation. Esplora, Malta's Interactive Science Centre, has been a significant force in this regard. It offers visitors an engaging, interactive approach to science and embodies the concept of bringing science closer to the people. The centre promotes citizen science, in which ordinary people become active participants in research by making observations and taking measurements, thereby transforming them from passive consumers into active contributors. The importance of bringing science and citizens closer cannot be overstated.

It is critical to acknowledge that there is more that the government can do beyond providing funding to raise the profile of R&I in Malta and bring it closer to the people. The government has an important role to play in this regard by mainstreaming R&I in public policy. As this strategy advocates, the government has several levers it can pull, such as public procurement and the employment of doctorate holders in the public sector.

We are also in the process of implementing Malta's first National Open Access Policy, which aims to disseminate and valorise research results more openly. By doing so, we hope to provide students, researchers, and citizens with unhindered access to new knowledge without delays.

What excites me most about this strategy is its comprehensive approach to R&I as a holistic field. I welcome the focus on strengthening governance, developing the local ecosystem to provide more local opportunities, and increasing directionality, so that R&I can truly become keys to reaching the country's environmental, social, and economic objectives. We look forward to working collaboratively with our stakeholders to establish a healthy and vibrant R&I ecosystem in Malta, one that will benefit all of our citizens and pave the way for a prosperous future.

Foreword by
Mr Silvio Scerri
Chief Executive Officer, MCST

Science, technology, research and innovation are increasingly woven into our everyday existence. From advances in artificial intelligence to the latest pharmaceutical discoveries, Research and Innovation (R&I) colour our present and shape our future. The Malta Council for Science and Technology (MCST) has been the voice of research, science, technology and innovation in Malta for over 30 years. It has been instrumental in developing strategies, advising government and building a portfolio of funding instruments, as well as bringing science closer to the public. Over the years, R&I in Malta has come a long way, with EU membership being a turning point that heavily increased its prominence and visibility in the national landscape. However, much still remains to be done. Having recently taken over the reins of this institution, I can confidently say that MCST is a vital pillar in the realisation of Malta's ambitions for sustainable growth. R&I will play a critical steering role in our country's green, digital and knowledge-based economic transition. Research and Innovation being indispensable elements in this regard, I look forward to the Council's enhanced role in this drive towards a future-proofed and innovative Malta.

This aim of this Strategic Plan remains that of building an enabling framework for both research and innovation, with a vision to embed them at the heart of the Maltese economy and society, and spurring knowledge-driven and value-added growth, with priority to quality of life, resilience and sustainability. The vision remains largely in line with that of previous plans but takes into consideration the experiences gained from recent major events, namely the COVID-19 pandemic and the war in Ukraine.

The Peer Review of Malta's R&I system, undertaken in 2018-2019 with the assistance of the EU's Policy Support Facility, provided the backbone for this new Strategic Plan. This was a comprehensive, much-welcomed exercise that shed light on Malta's potential, and how it can be fully unlocked with the right funding, resources, collaboration and networking. Indeed, the insights and reflections provided by the exercise laid the groundwork for this Strategic Plan's mission to reform and restructure Malta's R&I ecosystem, so that it can reach its full potential.

In line with the Peer Review report, this Strategic Plan seeks to put in place the structures necessary to enable the implementation of the recommendations of the Peer Review, including increased funding, more collaboration, reducing fragmentation and effective internationalisation. The COVID-19 pandemic has highlighted, if such highlighting was ever necessary, the crucial role of R&I in enabling adaptation and prosperity. This, coupled with the European drive towards the Green and Digital transitions make this a great time for Malta to ingrain R&I in its policy-making and economic fabric. This Strategy provides the means to achieve this.

I must underline the fact that, at MCST, we do not work in isolation and therefore it is only natural that this strategic plan will not be implemented in isolation either. As the Peer Review repeatedly recommends, we need all hands on deck, working in unison, to translate this Plan's vision into reality. We need strong bridges of communication across government and with all stakeholders, because our country can reap the benefits of this Plan only if and when our collective vision is aligned to its objectives. We believe that, by working together, we can make a lasting impact and secure a bright future for Malta. I look forward to the realisation of this Plan.

Executive Summary

Looking back over the past few years, 2020 undoubtedly marked a watershed year. Due to the emerging socio-economic climate and the uncertainty of the impact on the R&I ecosystem in the coming years, policies need to have greater flexibility and in-built timely responses to disruptive events. Indeed, the pandemic opened up opportunities for R&I which may in themselves prove urgent and compelling in the short-term, but this should not occur at the expense of other existent and equally important medium to long-term priorities in R&I.

This forward-looking Strategic Plan draws on our contemporary context as well as performance and progress on the goals set in the previous Strategy. In Part 1, the Plan starts by providing an overview of Malta's performance on key economic and R&I indicators and its participation in key EU and international programmes. The main trends and findings together with the implementation status of the National R&I Strategy (2014-2020) are summarised in a SWOT analysis. The implications of the COVID-19 pandemic from an economic, technological and political/policy perspective are identified together with the impact on RTDI policy. Current trends in the R&I indicators are signalling a level of disruption to the R&I ecosystem, however the full extent and implications are as yet uncertain.

This strategic plan also coincides with the completion of three key EU Policy Support Facility exercises, namely the R&I monitoring system, the Peer Review of the National R&I system and the design of the Open Access Policy. This plan is complemented by the main insights, findings and recommendations from these exercises, in particular, the Peer Review, to focus on actions required to introduce the necessary changes in implementing structures and mechanisms. The aim is that by 2027 these structures and mechanisms will be fully operational, thus allowing a stronger and more coordinated R&I system to evolve over the ensuing years. These are described in more detail in relevant sections of the Plan.

The Strategic Plan highlights the need to ensure that the enabling governance framework and resources are in place for an expanded role for R&I as a driver of economic development and in enabling green and digital transitions. The Plan underlines the urgent need to use R&I effectively to increase the resilience of our economy, public services, business and society. This is in turn dependent on the championing of R&I at the highest levels in Government. This Plan gives priority to putting in place effective structures and a robust policy design, addressing five main overarching goals: governance and priority-setting, enhanced directionality, local ecosystem development for enhanced performance in the private sector, mainstreaming R&I in public policy and strengthening implementation structures.

It is imperative and a precondition for this Strategic Plan to work, that R&I is prioritised in the national economic development roadmap and the national annual budget cycles, through appropriate budgetary allocations discussed and agreed upon with Ministry responsible for finance and other relevant stakeholders.

1

Introduction and Background

In this introductory section, the aim is to provide an overview of Malta's performance on key economic and R&I indicators and its participation in key international programmes. The main trends and findings together with the implementation status of the previous National R&I Strategy are summarised in a SWOT analysis . The implications of the COVID-19 pandemic from an economic, technological and policy perspective are identified together with the impact on RTDI policy.

This being said, it would be useful to first define the main operative terms on which this Strategic Plan is built; namely "*Research*" and "*Innovation*".

This document uses the definition of *Research* laid out by the Frascati Manual (OECD). It is defined as "*creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge."*[1] *Moreover, the activities must be "novel, creative, uncertain, systematic, transferable and/or reproducible."*[2]

Innovation is defined according to the Oslo Manual (OECD) as follows; "*An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)."*[3] *Innovation activities are defined as "all developmental, financial and commercial activities undertaken by a firm that are intended to result in an innovation for the firm."*[4]

1.1. Economic climate

Malta's economy, although constrained by its small size, benefitted up to the first quarter of 2020 from a stable and vibrant economic climate and further, albeit modest, investment in research and innovation. The underpinnings of this growth related, among others, to a structural shift towards high value-added industry as well as services (e.g. professional and scientific activities, information and communication

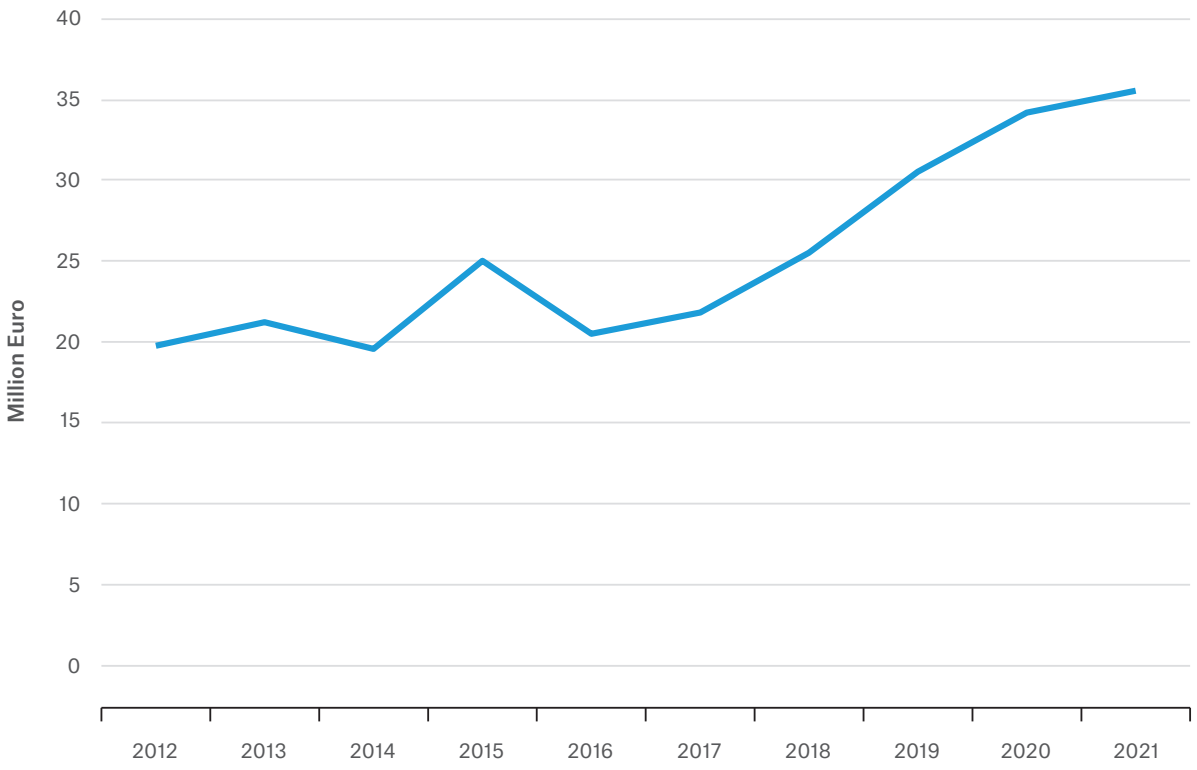
1 OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris.

2 Ibid

3 OECD/Eurostat (2018), Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg.

4 Ibid

Government budget allocations for R&D (GBARD)



services, tourism)[5]. With employment growing by 43% between 2013 and 2020, large inflows of both intra- and extra-EU workers (amounting in total to 35% of the labour force) have been catering for fast-growing demand.

The onset of the COVID-19 pandemic in 2020 disrupted the global economy significantly, with declines in demand as well as supply due to lockdowns. This disruption is having a marked impact on open economies like Malta in terms of net export performance. Overall real GDP contracted by 6.99% in 2020 and a key sector hard hit by the pandemic was the tourism industry with negative knock-on effects on the wholesale and retail trade, transportation, storage, accommodation and food services sector. This being said, data for 2021 shows a general positive trend in economic activity in terms of gross value added[6].

Malta's GDP registered a significant drop in 2020 due to the pandemic. However, data for 2021 indicates a significant recovery, with a growth rate of 11.3% in GDP compared to 2020.

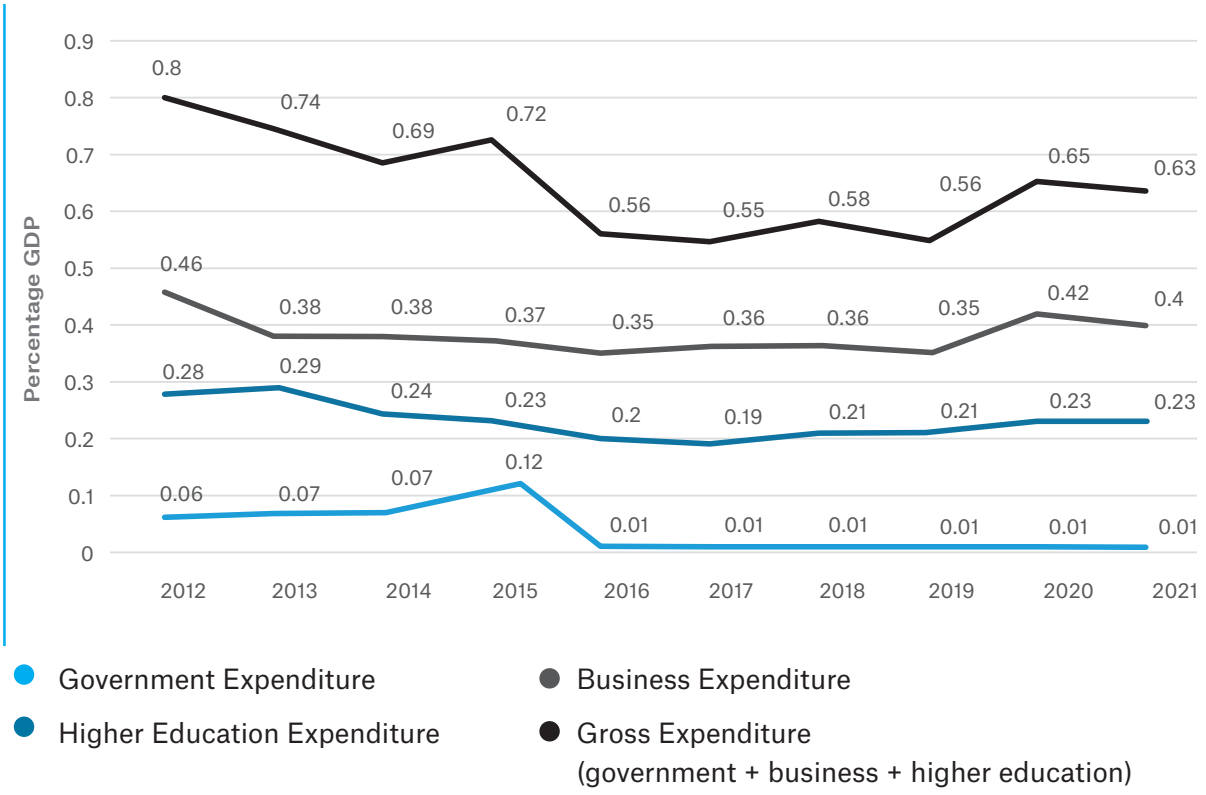
Over the same period, GVA increased by 11.6 % in nominal terms primarily due to Services activities (9.2%), as well as Industry (0.2%) and Construction (0.2%). The increase in services derives from the following sectors: Transportation and storage, Accommodation and food service activities, Wholesale and retail trade, Repair of motor vehicles and motorcycles, and Information and communication activities[7]. The Central Bank of Malta expects the growth of Malta's

5 Source: Eurostat. https://ec.europa.eu/eurostat/databrowser/view/NAMA_10_A10__custom_375575/default/table?lang=en. [Accessed 12.9.2022]

6 https://ec.europa.eu/eurostat/databrowser/view/NAMA_10_A10__custom_3350399/default/table?lang=en [Accessed 25.8.2022]

7 https://ec.europa.eu/eurostat/databrowser/view/NAMA_10_A10__custom_3350399/default/table?lang=en [Accessed 25.8.2022]

Gross expenditure on R&D as a percentage of GDP, Malta.



gross domestic product (GDP) to moderate significantly from 6.8% in 2022 to 3.7% in 2023 and 3.6% in 2024. Compared to the previous projections, the Bank's latest forecast represents an increase of 1.6% in 2022, a downward revision of 0.8% in 2023, and of 0.1% in 2024. The downward revisions reflect the strong pick-up in inflationary pressures as well as a further deterioration in the international economic environment.

The impact of the COVID-19 pandemic on the labour market has been relatively limited and government's wage supplement and business support measures have helped to maintain a level of consumption. Employment grew by 1.5% in real terms in the first quarter of 2022 when compared to the same data for the previous year. Employment growth in 2022 is set to moderate from 5.4% to 3.3% 2023. The unemployment rate is projected to stand at 3.0% in 2023, from 3.1% in 2022.[8]

8 https://www.centralbankmalta.org/economic-projections [Accessed on 13.03.23]

It is important that the shift in government expenditure towards financial support packages to reduce the impact of the pandemic and the inflationary pressures brought about by the war in Ukraine on the economy does not result in reduced opportunities to sustain and increase government expenditure on R&I. In 2021, Government budget allocations for R&D (GBARD) amounted to €35.3 million, increasing by €1.5 million when compared to 2020[9].

1.2 Malta's R&I performance

The National R&I Monitoring Report 2019-2020[10] tracks implementation of the National R&I Strategy 2014-2020 and Action Plan 2015-2020 based on seven headline indicators and targets. Of the seven headline targets, two have

9 https://nso.gov.mt/en/News_Releases/Documents/2022/07/News2022_125.pdf. [Accessed 01.09.3022]

10 http://mcst.gov.mt/wp-content/uploads/2020/02/onitoring-Report-2018-compressed-compressed_compressed_reduce-1.pdf [accessed on 29.09.21]

been achieved: in 2019 the number of PhD holders as a percentage of active population nearly doubled from 2016 in real terms, and the number of researchers (expressed in full-time equivalents, FTE) target was surpassed in 2018 and continued to increase in 2019. The target for employment in knowledge-intensive activities as a percentage of total employment[11] is close to being achieved as well. The indicator for innovation expenditure (as a percentage of GDP) reflects overall moderate progress with innovation expenditure increasing by €89 million from 2014, reaching €175 million by 2018. The indicator for enterprises with innovation activity initially improved steadily from 2006 to 2012, reaching 47.8% by 2012. However it has since experienced a decline to 37.6% in 2018[12].

Available data indicates that progress towards achieving the national 2% target for GERD (in line with the 3% Europe 2020 target) has been slow. After initially peaking at 0.80% in 2012, GERD has since declined to 0.67% in 2020. However expenditure increased by €26.7 million in real terms[13].

Percentage increases have been rather small since R&D expenditure has not mirrored Malta's significant GDP growth over the past years.

In real terms, R&D expenditure in 2021 amounted to €95.3 million, or 0.64% of GDP. In 2021, the Business Enterprise reported a slight decrease in R&D expenditure compared to 2020, from 0.42% to 0.40%. On the other hand, the Government sector and the Higher Education sector expenditure remained stable. At 70.8%, labour costs represented the bulk of total R&D expenditure, whereas Capital expenditure amounted to 10.9% of the total[14].

The breakdown of 2020 R&D expenditure by basic research (48.5 %), applied research (27.6 %) and experimental development (23.9%) remained largely similar to the previous year[15]. The majority of R&D activity in engineering and technology as well as natural sciences was undertaken in business enterprises, whereas research in relation to medical and social sciences was mainly carried out by the Higher Education sector. In 2020, foreign funds for R&D amounted to €7.08 million[16], representing a very marginal increase over 2019.

In 2021, the number of total R&D personnel (in FTE) remained stable when compared to 2020. The latest available gender-disaggregated data (for 2020) indicates that females accounted for 29.1% of total R&D employment (in FTE). The available 2021 data also indicates that the highest R&D employment was recorded in the Business Enterprise sector (1179 FTE), followed by the Higher Education sector (664 FTE)[17].

As a small country, Malta is highly exposed to a global context that is becoming increasingly volatile and prone to systemic crisis. Consequently, the extent and effectiveness of its internationalisation approach in R&I is crucial. Despite some caveats, international scoreboards and rankings help to provide an important benchmark for assessing and ensuring the comprehensiveness and effectiveness of national R&I policies and strategies. As for the current state of play, Malta's R&I policy continues to be shaped primarily by the current research and innovation drive of the European Union (EU) and the implementation of the European Research and Innovation Area.

The EU Innovation Scoreboard (EIS) provides insights on Malta's performance in R&I benchmarks with other EU member states on a number of key indicators. The EIS 2022[18] indicates an overall

11 % employment in KIA for 2021 in the highest % yet at 42.8% (break in series was noted on eurostat for this figure in 2021) target is 55%. https://ec.europa.eu/eurostat/databrowser/bookmark/1c58796c-28cb-4d59-b026-21dffea7160d?lang=en

12 This data draws on the Community Innovation Survey which is carried out every 2 years with latest data available for 2018.

13 https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do. [Accessed: 12.9.2022]

14 https://ec.europa.eu/eurostat/databrowser/view/RD_E_GERDCOST_custom_5682253/default/table?lang=en

15 https://ec.europa.eu/eurostat/databrowser/view/RD_E_GERDACT_custom_5682602/default/table?lang=en

16 https://ec.europa.eu/eurostat/databrowser/view/RD_E_GERDACT_custom_5682602/default/table?lang=en

17 https://ec.europa.eu/eurostat/databrowser/view/RD_P_PERSOCC_custom_5683370/default/table?lang=en

18 https://ec.europa.eu/assets/rtd/eis/2022/ec_rtd_eis-country-profile-mt.pdf . [Accessed on 13.03.2023]

decline in performance from 2021 to 2022, with Malta ranking among the eight Member States whose performance declined together with Estonia, France, Germany, Italy, Latvia, Luxembourg, and Romania, with performance declining strongest in Estonia. Ranked among the moderate innovators with above EU average performance, Malta was among six Member States whose performance improved between 5% and 10% points between 2015 and 2022: Spain (8.6%), Germany (7.4%), Hungary (7.1%), Ireland (7.1%), Malta (6.7%) and Portugal (6.4%). This can be attributed to strong improvements in human resources, linkages and in particular attractive research systems with the highest rate of performance increase from 2015 to 2022 (64.1%). Malta is strong on Use of information technologies and Digitalisation. Malta recorded the best performance on Attractive Research systems.

Compared to the EU benchmark, Malta excels on three indicators namely International scientific co-publications, Foreign doctorate students, and Innovative SMEs collaborating with others. However, Malta's performance on finance and support, employment impacts and firm investments experienced a strong decline. Malta remains very weak in relation to R&D expenditure in the public sector and government support for business R&D.

The World Economic Forum's Global Competitiveness Report 2019[19] ranked Malta first globally in terms of macro-economic stability from among 141 countries. Other positive rankings relate to ICT adoption (25), health care (26), labour market (31), financial system (32), skills (33), and innovation capability (37). The lowest rankings are on business dynamism (74) and market size (120). In terms of overall performance, Malta went down two places from 36 to 38 when compared to 2018.

Malta's participation in the EU's Horizon 2020 Programme (2014-2020) has resulted in 192 grant agreements amounting to €37.36 million and 260 local beneficiaries[20]. Malta's success rate in FP7 was 19% compared to 21.7% for all Member States. In H2020, Malta's success reached 13.9% compared to an overall success rate for all MS of 15.3%. Cyprus, a state with a similar GERD and number of researchers to Malta, significantly increased the number of applications in H2020 and managed to secure considerably higher levels of funding compared to Malta. There are a number of factors which account for this, however a key success factor has been its effective use of the H2020 Widening programme targeting the EU-13 low-performing countries, in particular a high number of TEAMING projects, co-funded through Structural Funds. Similarly, Estonia has made effective use of the ERA-CHAIR programme. Malta has participated in one Teaming project (Phase 1) and 7 Twinning projects (4 projects by MCAST and 3 by the University of Malta). The Teaming programme requires significant matching funds by government or accessible Structural Funds. Malta's first success in the ERA-Chair's programme was only registered at the end of 2022 when the University of Malta was awarded a €2.5 million grant for an ERA Chair in bioinformatics.

Similarly, Malta's participation in the partnerships and joint programming initiatives which depend on own funds and the joining of national R&I programmes has over the years been constrained by insufficient local funding. These partnerships have now become a significant component of the Horizon Europe programme. Malta is now participating actively in a small select number of partnerships in Horizon Europe as well as in 183 COST Actions i.e. 73% of all running COST actions. 50% of researchers from Malta participating in COST actions are female. Key contributions included participation in actions looking at water isotopes in the critical zone: from groundwater recharge to plant transpiration; the European network for gynaecological rare cancer research; plastics monitoring detection remediation recovery; language in the human-machine era; and epigenetic mechanisms of crop adaptation to climate change, among others.

19 The WEF Global Competitiveness Report 2020 did not include country rankings.

20 https://webgate.ec.europa.eu/dashboard/sense/app/98dcd94d-ca66-4ce0-865b-48ffe7f19f35/sheet/KVdtQ/state/analysis [Accessed 14.9.22]

Malta's R&I performance attests to a mixed level of effectiveness in the implementation of the National R&I Strategy (2014-2020). The main strengths and weaknesses are summarised below, together with a forward look at emerging opportunities and threats.

Strengths: Malta's dynamism in economic restructuring and growth is potentially a key enabler for an enhanced R&I drive in the public and private sector. The impressive pre-pandemic increase in professional, scientific, technical, administrative and support service activities by €167.5 million, or 10%, highlights the current and growing potential of this sector. This structural shift towards higher value-added sectors is opening important employment opportunities in knowledge-intensive sectors. Pre-pandemic, a more enabling economic environment for R&I was gradually falling into place through important advances in promoting a science culture and new funding programmes.

Weaknesses: Even if one takes into account inherent constraints of small size and limited absorptive capacity, there is evidence that the potential for growth in Malta's R&I system is not being fully exploited. The system suffers from under-investment as indicated by Malta's weak progress on GERD and innovation expenditure. Investments in R&D and innovation are lagging behind the growth in GDP. This under-investment translates into weaknesses in R&I performance due to insufficient funding to support broader participation in European and international R&I initiatives and collaborations. Malta lags behind other small Member States like Estonia and Cyprus in terms of funding obtained from the EU Horizon 2020 Programme. The demand for RDI products, processes and services and the related delivery structures, including public infrastructures and R&I intensive start-ups, remain insufficiently developed. Despite advances in promoting a popular science culture and science communication, the extent of public awareness of R&I and science literacy remains limited. The use of scientific advice and evidence-based policy and its mainstreaming throughout government is improving but remains limited.

Opportunities: The most viable opportunities which Malta as a small but more agile player can exploit, relate to its potential to proactively shift and restructure its economy towards new high value-added sectors. The EU's Next Gen Strategy and the EU Green Deal drive are expected to open up important opportunities for Malta in the digital and green economy. The limitations of the local market mean that local enterprises and start-ups need to increasingly address European and international markets and to receive targeted support for this purpose. The diaspora of Maltese experts, researchers and entrepreneurs based in innovation hotspots overseas, represent an opportunity to draw on their expertise and contacts to promote Malta's R&I internationalisation drive. Malta's potential in showcasing and test-bedding new R&I initiatives including social, health, educational and frugal innovation, could be further exploited, particularly in light of new opportunities opening up. In turn this calls for improved networking opportunities at the international level.

Threats: Positive trends in increased professional scientific activity and the rise in employment in knowledge-intensive sectors are potentially at risk. The mismatch in terms of the growing number of researchers and PhDs and the under- investment in R&I by the public and private sectors could increase the risk of brain drain, in particular among early-stage researchers. Career opportunities and conditions for PhDs in government and the private sector are not on par with academia. The COVID-19 pandemic and the war in Ukraine have highlighted the vulnerability of the economy to external hazards as well as the resulting international economic, political and financial instability. Key economic sectors such as manufacturing and tourism, suffered from reduced demand and consumption during the worst times of the pandemic. The war in Ukraine has proven to be another major shock to the economy with major disruption to the supply of raw materials. This has resulted in increased volatility and a general sense of uncertainty of prospects in time and extent of economic recovery. The deeper disruption underway of current structures and transition towards more sustainable living, while positive in themselves, will also create

change and upheaval in the system. Major changes at EU level related to Brexit, and in particular the European Research and Innovation Area could impact negatively on Malta's R&I ecosystem. The R&I ecosystem is challenged by this new situation both in terms of positioning itself to contribute effectively to the economy and due to potential disruptions in terms of availability of resources both financial and human and a slowing down of ongoing R&I initiatives.

1.3 Main Findings of the EU PSF Peer Review

In 2018, at the request of the Maltese Government, specifically under the auspices of the then Office of the Parliamentary Secretary for Financial Services, Digital Economy and Innovation, the European Commission's Policy Support Facility under Horizon 2020, appointed a panel of experts and peer reviewers, to undertake a Peer Review of the national research and innovation system. The Review was aimed at eliciting an external and independent view on a central question: Does the country have adequate policies, structures and resources, as well as measures and instruments to sustain its future as a knowledge-based economy? The Review was in support of Malta's efforts in Research and Innovation (R&I) capacity building, improving the dynamics of the R&I system and enhancing the efficiency of current public investments in R&I. The objective of the Peer Review of the Maltese R&I System was to provide recommendations primarily to inform the design of the next National R&I Strategy Plan (post) 2020.

The review was launched in July 2018 in Brussels and entailed two fact-finding visits to Malta by the Panel in October 2018 and January 2019, when the Panel interviewed 72 representatives of 25 organisations covering all parts of the Maltese research and innovation system. An online survey with University of Malta PhD and MPhil students was also carried out. A final dissemination event to launch the final Panel report was held at Villa Bighi in June 2019 where the key policy makers were present.

The Panel's findings centre on a number of clear messages on the state of health of the R&I ecosystem. While the report described the economy as thriving and remarked on advances in selected areas of research and innovation, it highlighted the fact that "Malta is at the bottom end of the EU28 table on overall R&D investment and sits in last place for government R&D spending in particular." Thus, a key recommendation by the Panel is that both the public and private sector need to invest significantly in research, development and innovation.

Other key findings relate to:

- the lack of an R&I champion at the highest governmental level
- insufficient transparency and strategic changes in how resources are allocated
- the lack of an independent 'consultative forum' representing all relevant stakeholders of the research and innovation system
- a highly fragmented portfolio of policy instruments with the responsible agencies having no clear view on complementarity with others in the system.
- lack of an assessment mechanism for the effectiveness of policy instruments or the policy mix as a whole, from an outcome-based perspective
- the lack of a channel for competitive funding of basic and applied research aimed at developing researchers' potential.

The PSF Final Report[21] recommendations are structured in four main clusters of policy messages. The main headlines are presented in Table 1 below. Over the last year, the recommendations have been analysed with a view to identifying an effective means to address them through ongoing and new policy initiatives. This document serves to validate those initiatives and to provide a comprehensive view of how the key recommendations are being implemented. Thus, in each section of this Plan, reference is made to the relevant Panel recommendation and the follow-up action which is specified.

While these recommendations were made pre-COVID-19, they remain valid and have indeed become more urgent.

21 https://ec.europa.eu/research-and-innovation/en/statistics/policy-support-facility/peer-review-maltese-research-and-innovation-system. [Accessed on 25.2.2021]

A Summary Overview of the EU PSF Panel Recommendations 2019

I. Embedding research and innovation in Malta's development strategy

At the highest governmental level, one minister should lead on R&I, an 'R&I champion', ensuring greater ownership, coordination and transparency at governmental and agency level, as well as higher public investment to implement Malta's National Research and Innovation Strategy. Malta should maintain one comprehensive national strategy, covering both research and innovation. This strategy should be linked to Malta's economic and enterprise development strategy. R&I matters should be assigned to a parliamentary committee. Malta should establish a Consultative Forum, acting independently, ensuring the participation of stakeholders at both the policy design and implementation stages. The position of the Malta Council for Science and Technology (MCST) in the system should be reinforced and clarified. Cooperation and a clear division of work should be achieved between Malta Enterprise (ME) and MCST. Due to the dominant role of the European Structural and Investment Funds (ESIF) in funding research infrastructure, it is important that future sustainability of these investments is ensured by the appropriate national policies. The updated RIS3 to be developed by MCST for the next programming period should rely on a continuous consultation process, in which the to-be established Consultative Forum would play a key role. More synergies should be achieved between funding instruments. Monitoring and evaluations of Maltese programmes and support schemes should be carried out on a systematic basis by independent entities, with their results shared at the highest level and fed into the policy cycle. More transparency should be achieved with respect to the various actions put in place to implement the (current and next) National R&I Strategies.

II. Improving framework conditions for public research

Malta should set up a fund to support curiosity-driven research of international quality with both project and personal grants. The Fusion Programme should offer a new funding line directed to Higher Education Institutions (HEIs) and public sector institutions only, with no requirement for industry participation, for research projects in oriented programmes in top-down selected fields. More cooperation between UoM and MCAST based on a clear concept and division of work in particular with regard to the third mission, will create an attractive environment for companies and students. Open Fab Lab-types of platforms for open innovation could be considered. To ensure that investments in research infrastructure bear fruit, it is necessary to secure funding for the personnel involved in teaching and research activities, as well as for the maintenance of their equipment and facilities. Malta should develop an attractive system to support talented individuals from primary school up to the highest university level. To increase research capacity in public research, the first step should be to increase human resources, including increased long-term support for doctoral students. A more proactive policy to attract global talent can have positive impacts on the availability of qualified human resources for the business sector, as well as for the public research sector.

III. Incentivising research and innovation in the private sector and stimulating public–private partnerships

Malta should develop an attractive R&D ecosystem based on the availability of a skilled workforce, appropriate public incentives, and an effective fabric of R&D collaboration between and within public and private sectors. Malta should significantly streamline, simplify and clarify its landscape of funding schemes available to innovative enterprises. Support to non-technological and other types of innovation (marketing, organisational, design, etc.) should be enhanced. More proactive management modes in the form of account management within ME and MCST and cross-agency referral of companies need to be developed. The respective roles of direct grants and R&D tax credits for companies need clarification, with a particular focus on small and medium-sized enterprise (SME) requirements. The aim should be to create a fully integrated and easy-to-navigate support system for start-ups. There is a need to further investigate the suitability and relevance of public-private partnerships and inter-sectoral mobility schemes.

IV. Fostering internationalisation of the Maltese research and innovation system

It is crucial that Malta further reinforces international, multilateral and bilateral collaboration as a key element of its research and innovation strategy. Malta can tap more into opportunities for international R&D collaboration including Horizon Europe and create dedicated budgets.
e.g. through the next Operational Programme

Strategic discussions on policy approaches post–COVID–19 pandemic have identified a number of key emerging trends relevant for R&I policy

Malta's response to the EU PSF Review

In the years following the Review, work has focused on identifying which recommendations to prioritise both in terms of timing and logical order. Progress has been achieved in terms of new/revised structures and programmes and the policy mix as a whole. Key milestones in addressing PSF recommendations are listed in the table at the bottom of this page.

1.4 The impact of the COVID–19 pandemic

Strategic discussions on post-COVID 19 pandemic policy approaches have identified a number of key emerging trends relevant for R&I policy. The National Post-Pandemic Strategy, launched in mid-2021 by the Ministry for Research and Innovation and the coordination of the post-COVID 19 Strategy highlight the rapid spread and acceleration of automation, AI and related technologies, the reinvention of business models, upheaval for the tourism and travel industry, reconfiguration of supply chains with near and reshoring, and remote working and structural change to global job markets.

The key trends and drivers relevant for the Malta R&I context have been mapped below with the related implications in terms of required policy intervention. The extent to which these trends and drivers will persist, increase or fade and how they will interact, in the coming years highlights the level of difficulty and uncertainty in designing appropriate policy interventions. There are decisions to be taken on how to position the strategy effectively in terms of deploying R&I in support of the country's priorities, including the economic development strategy, addressing gaps and opportunities; while keeping on track the progress made to date to strengthen the R&I ecosystem and significantly boost and upscale R&I activity. The question is not whether to focus more on one or the other but to achieve an appropriate balance. Due to the debates regarding certain drivers, an effort has been made to focus on those with clearer and visible impacts as well as those measures, that, if implemented, provide a more enabling environment.

The focus here is primarily on current economic, political and technological trends and drivers of relevance to the R&I strategy.

Sub-themes	Key Milestones
I	• Increased visibility of the National RIS3 Strategy and refocusing of areas the evaluation of FUSION and the setting up of the FUSION Basic Research Fund
II.	• FUSION support for SME proposals which obtain seal of excellence
III.	• Targeted measures to increase both public and private sector investment in RTDI activity
IV.	• Reinforcing the internationalisation role of MCST with the setting-up of a dedicated Unit

Current economic, political and technological trends and drivers of relevance to the R&I strategy

Emerging Trends and Drivers	R&I Policy Dimension
Economic	

The onset of the COVID-19 pandemic in early 2020 brought large parts of the economy to a standstill in a short space of time, resulting in increased unemployment, reduced revenues and increased costs of securing goods and supplies. The hardest hit were the hospitality, travel, tourism and leisure sector as well as small enterprises and the self-employed, all key sectors for the Maltese economy.

Other sectors such as manufacturing, education, public services and utilities, media, retail, logistics, agriculture and fisheries had to rapidly make the transition towards safe, where possible online cost-efficient operations, while safeguarding their workers' long-term employment and security. Government priorities shifted to retaining employment and ensuring a basic wage for all.

The start of the war in Ukraine in February 2022 dealt another blow to the global economic and geopolitical systems with the displacement of millions of refugees, supply chain shocks in many sectors and skyrocketing fuel costs.

In light of these developments, the following R&I-related priorities are expected to emerge more strongly:

- The need for diversification of the economy to reduce reliance on affected sectors and supply chains;
- upgrading of affected sectors to innovate and adapt to new situations;
- facilitating new start-ups including social enterprises or philanthropic ventures to touch the ground quickly – supporting them to raise investment capital quickly with less red-tape; more crowdfunding;
- increased investment in resilience technologies

The situation remains fluid and will need to be monitored over the course of this Strategy, however the underlying trend is towards enhanced use of digital technologies to increase the resilience of key sectors of the economy, and the reconfiguration of supply chains. The pandemic has highlighted the growing reliance of economy and society on ICT and the need for investments in digitisation of key services. This needs to be underpinned by investments in the development of digital technologies and AI. The pandemic and the Ukraine war have both underlined the need for a level of self-sufficiency in providing for basic societal needs. It has indeed become imperative to build economic and societal resilience and enhance anticipation and preparedness. In ensuring that we are better prepared for external shocks, the Plan, in line with the National Post-Pandemic Strategy, recommends investing in and taking advantage of state-of-the-art technologies in a range of sectors, ranging from environment, transport, food and agriculture, water and energy. This indicates several areas of economic opportunity and implies complementary and coordinated investments in technologies, competencies, capabilities and infrastructure.

The related impact on R&I-related challenges and opportunities is significant and entails coordinated public-private sector investment in applied R&I to boost economic development.

Emerging Trends and Drivers	R&I Policy Dimension
Economic	

Diversification and/or upgrading the economy requires a greater emphasis on internationalisation to tap into industry and a re-evaluation of just-in-time manufacturing. These measures could include the following;

- reconfiguration and streamlining of international/regional supply chains to reduce delays; onshoring related production capabilities where feasible, and/or finding alternative reliable suppliers;
- rapid pivoting of business models;
- investment in remote working models;
- workforce redeployment, reskilling and care
- possible acceleration of labour-replacing automation by firms.

R&I support measures could typically focus on (i) supporting high tech niches and related ventures and start-ups; and (ii) injecting technological innovation into existing niches which are not traditionally R&D dependent and related private entities.

The transition to new economy and towards Industry 4.0 depends on investments in applied R&I, in particular interconnectivity, automation, machine learning, and real-time data. The challenge is to provide an enabling environment to support this transition, focusing on relevant niche areas. Complementary approaches will entail internationalisation efforts to attract the relevant talent and foreign firms that fit this profile, along with support for innovative start-ups and local firms, striving to diversify.

This flags the need for substantial investments in smart manufacturing, low carbon and circular economy approaches, enhanced use of ICT and AI for secure on-line business operations and targeted innovations to address energy challenges and concerns.

Technological

The COVID-19 pandemic highlighted the importance of technology and scientific research and innovation as a means for addressing crises and for ensuring anticipation and preparedness. Scientific advice became key in providing a more robust evidence base for policy-making and for reassuring public concern. Such advice depends on state-of-the-art expertise supported by investments in RTDI, to enable effective decision-making and to provide solutions in the form of vaccines and preventive healthcare.

Other key trends and drivers:

- increasing connectivity, convergence and automation;
- the vulnerability of the STI system brought about by systemic under-funding;
- potentially disruptive effects of big data and AI.
- enhanced robust technologies for online living and shopping;
- RTDI targeting resilience in food safety, security, and energy.

The RTDI policy challenges call for an effective policy mix of supply side and demand side measures in response to this rapidly evolving environment:

- investments in applied R&I, technology and innovation in support of basic human needs and quality of life, using public procurement for innovation and competitive funding.
- building on the experiences of the past few years to strengthen delivery of public services through RTDI, including the digitisation and online delivery of such services including healthcare, digital governance, electronic voting, anticipatory governance and foresight.
- supporting firms to rethink their business through RTDI.
- Investing in energy security technology such as more resilient energy sources, energy-based systems and clean energy.
- Supporting innovation in the Education sector including continued investment in online learning where appropriate.
- Investments in RTDI to ensure economic, business, societal and government resilience and anticipation.

Countries and enterprises that were geared up for the digital economy coped better during the pandemic. Indeed, COVID-19 hastened the drive towards digitalisation and the momentum gained is expected to be maintained. The war in Ukraine has hastened the drive towards alternative sources of fuel but also the drive towards innovative energy solutions. Self-sufficiency in green energy has taken on increased prominence at EU level since the war broke out.[22]

22 https://sciencebusiness.net/news/ukraine-war-prompts-eu-speed-work-critical-technologies-gabriel-says [accessed on 23rd June 2022]

Emerging Trends and Drivers	R&I Policy Dimension
Political	

Key emerging political trends of particular relevance to R&I include:

- Increase in the importance of strategic bilateral and regional cooperation;
- Role of science and scientific experts in policymaking are under greater scrutiny together with a shift towards more transparent governance and open, participatory engagement with scientific methods and insights;
- innovative modes of collaboration between the public and private sectors;
- Growing concern on the potential onset of other crises, triggered by climate change, highlight the need for urgent action on the environment and SDGs.

The impact of these trends on R&I policy is significant, opening up a number of challenges and opportunities. This calls for combined efforts to develop own R&I resources and facilities, with a strong internationalisation drive to cooperate with countries with similar R&I interests. The following are key emerging features of EU R&I policy which are envisaged to have a knock-on effect on national R&I policy:

- New directionality of EU Green Deal and the need for mission-oriented approaches to address green and digital transitions;
- Recovery measures to support Business R&I and entrepreneurship, including support for redeploying R&I;
- Re-shoring production capacity and supply chains for critical assets.

The need for an effective science policy and governance system has grown in importance as a means for:

- better anticipating and managing the growing incidence of systemic crisis;
- provision of robust and timely science policy advice to the highest level of government and Parliament;
- enhanced policy coordination across government;
- nurturing R&I literacy at all levels of society.

The trends and drivers outlined above are having a significant impact on the R&I landscape and ecosystem and highlight potential areas where government intervention may be considered and could prove beneficial, if appropriately targeted.

1.5 The way forward

As of the launch of this Strategic Plan, we find ourselves in a critical pivot in modern history due to the deep, disruptive and lasting effects of the COVID-19 pandemic and the war in Ukraine. Given the uncertainty of the socio-economic climate and its impact on the R&I ecosystem in the coming years, policies need to have greater flexibility and in-built timely responses to events, both negative and positive.

This being said, while the pandemic opened up opportunities for R&I which may in themselves prove urgent and compelling in the short-term, this should not occur at the expense of persistent and equally important medium to long-term priorities in R&I pre-pandemic.

This strategic plan follows up on three key EU Policy Support Facility exercises that Malta benefitted from, aimed at improving the R&I monitoring system, the peer review of the national R&I system and the design of the Open Access policy respectively. This plan aims to use the collective insights and recommendations from these exercises, in particular the peer review, to focus on actions required to introduce the necessary changes in implementing structures and mechanisms. The aim is that by the end of 2027 these structures and mechanisms will be fully operational, thus allowing a stronger and more coordinated R&I system to evolve. These are described in more detail in relevant sections of the Plan.

2

National Strategic Plan 2023-2027

2.1 Vision and Mission

The R&I policy vision embedded within the national R&I Strategy 2014-2020 remains to-date valid and highly relevant, as is the rationale for policy intervention, namely, to ensure that R&I, appropriately resourced and deployed, is firmly embedded in the Maltese economy. This Plan makes a stronger emphasis in the vision on embedding R&I in society and making R&I part of the 'national narrative'. The impacts of the COVID-19 pandemic and the upheaval caused by the war in Ukraine, in particular the drop in disposable income and the possible onset of a worldwide recession, highlight the need to ensure that the construction of Malta's economy is based on closer synergy between the economy and R&I. This is a window of opportunity to design and build a resilient R&I-enabled knowledge economy with priority given to quality of life and sustainability.

In order to achieve this vision, there is a need to proceed with implementation of a number of recommended reforms to R&I governance and championing which were identified by the EU PSF Peer Review of the national R&I system. The embedding of R&I in the national economic strategy was one of the key recommendations. In this context the Strategic Plan builds on the emphasis on R&I found within the National

	2014-2020 Strategy	Post-2023-2027 Strategy
Vision	To embed research and innovation at the heart of the Maltese economy to spur knowledge-driven and value-added growth and to sustain improvements in the quality of life	To embed research and innovation at the heart of the Maltese economy and society to spur knowledge-driven and value-added growth with priority to quality of life, resilience and sustainability.
Strategic mission	Building and sustaining the R&I enabling framework	To build a robust R&I enabling framework, sustained through growing investments in public and private sector R&I, with a Mission orientation up to 2027, dedicated to the twin green and digital transitions.

Economic Vision 2021-2031[23] to "support and promote ongoing investment in research, innovation, creativity, and human resource development". In particular, the embedding of R&I in the Economic Vision's strategic sector plans through increased R&I investments will dovetail with efforts to add value, boost intellectual capital and factor in green and digital transitions. In line with this Economic Vision, this Strategic Plan thus aims to ensure that the enabling governance framework and resources are in place for the expanded role for R&I as a driver of economic development and in enabling green and digital transitions.

This Strategic Plan is designed to ensure a lasting impact on the national R&I landscape as long as adequate levels of resources are attributed for its correct and timely implementation. It is imperative and a precondition for this Strategic Plan to work, that R&I is prioritised in the national budget, the national economic roadmap and by the relevant government and public entities. The pandemic has highlighted the urgent need to use R&I effectively to increase the resilience of our economy, public services, business and society. This is where the championing of R&I at the highest levels takes on critical importance.

This Plan sets a mission for the 2023-2027 Strategy to ensure that the targets for increasing public and private sector R&I investments are met, with an emphasis on green and digital transitions. The current situation highlights the need to unlock multi-level policies and a wider range of investment approaches and to target these more strategically to address key needs, gaps, challenges and opportunities which have come to the fore and take on greater urgency in the current situation. This Plan underlines the fact that the 2020 Strategy's mission of sustaining the R&I enabling framework remains highly valid and pressing. The main aim is to ensure the keeping of policy efforts on track in terms of addressing the continuing longer-term challenges facing the R&I ecosystem. The Plan recommends that a multipronged approach is piloted up to 2027 through five main goals and related clusters of measures and actions. Finally, ensuring that all bodies tasked with the governance and championing of R&I are gender-balanced and allow for the representation of different social identities will be vital in cultivating an inclusive and unbiased R&I ecosystem.

Five over-arching goals

In the current dynamic policy context, the economy and the R&I ecosystem call for a more flexible, yet targeted policy design. This Plan gives priority to putting in place effective structures and a robust policy design, addressing five main overarching goals: governance, directionality and complementarities with RIS3, local ecosystem development for enhanced performance in the private sector, mainstreaming R&I and strengthening implementation structures.

The 2023 to 2027 period will be used to focus efforts on strengthening and improving the effectiveness of the national R&I ecosystem. The main drive is to address gaps in the R&I chain, reduce fragmentation and ensure more evidence-informed policies by embedding timely science policy advice and expertise in government.

23 https://economicvision.mimcol.com.mt/ [accessed on 16.08.21]

Goal 1: Strengthening R&I governance and Priority-setting

2.2 Goal 1: Strengthening R&I governance and Priority-setting

This Strategic Plan highlights the need for government to take action on the PSF Final Report with an emphasis on recommendations relating to governance and championing of R&I, requiring the highest level of government approval and support. These need to be given attention as a matter of priority since they allow effective implementation of the remaining recommendations. This will provide the basis for effective co-design and implementation of a coordinated R&I plan embedded in Malta's development strategy.

Recommendation 1.1: Implementation of the PSF Recommendations on Governance and Championing of R&I

This Plan recommends that, based on the recommendations of the PSF Peer Review as well as feedback received through public consultation, a thorough upscaling and streamlining of Malta's R&I governance is undertaken at both the strategic and operational levels.

The concept and role of the R&I Champion should be legally enshrined. MCST's status should be appropriately strengthened, both legally and through the required increase in resources necessary to fulfill its extended remit. The operational details of MCST's extended remit are further detailed under Recommendation 5.2.

This Plan recommends that the process described above is given priority at the start of the implementation period of this Strategic Plan, with a timeline of six months for its envisaged completion.

Recommendation 1.2: Improved oversight, coherence and synergy of funding instruments

PSF Finding: The funding instruments for research and innovation are dispersed across several funding bodies. As a result, there is neither an overall view nor a clear responsibility over the policy mix. Agencies and funding bodies are designing their instruments separately, without a clear view on complementarity with others in the system. They seem to have few incentives to monitor/evaluate them and eventually change them for the higher efficiency of the system as a whole. More synergies should be achieved.

The Plan supports the PSF Peer Review Recommendation for action to address the current fragmentation and lack of oversight in the implementation of different R&I funding instruments by agencies and funding bodies. The Plan recommends that in order to improve coherence and synergy between national funding instruments, the new governance structures are appropriately empowered to take on overall responsibility for ensuring coherence and effectiveness of the policy mix and related R&I funding instruments

The R&I Champion, a role invested into the Minister/Parliamentary Secretary responsible for Research and Innovation, is tasked with the overall directionality and oversight of public investments in this sector.

Moreover, the diversity of funding instruments and their tailored roles in supporting the R&I ecosystem should be consolidated into a single coherent framework in order to ensure that different crucial actors and projects are supported according to the needs of the specific targets. The facilitation of a holistic portfolio of synergised R&I funding instruments across ministries will ensure that duplicated efforts are avoided, funding gaps tackled and that R&I actors benefit from a holistic and comprehensive level of support.

Recommendation 1.3: Develop and streamline R&I Priority-setting

To date the process for national R&I priority-setting has been based formally on the Smart Specialisation Strategy development process and the RIS3 priorities have been used as reference points for national R&I funding instruments. In addition, more top-down and often ad-hoc initiatives undertaken by Ministries and other public entities in their areas of competence have emerged over time.

In recent years, a number of Ministries have forged ahead with developing and extending R&I and related capacity-building initiatives in their area of responsibility/competence including:

- Ministry for the Economy, European Funds and Lands: digital economy, AI Strategy as implemented by MDIA
- Ministry for the Environment, Energy and Enterprise: National Strategy for Research and Innovation in Energy and Water, as implemented by the Energy and Water Agency
- Ministry for Health: health information and research
- Ministry for Education, Sports, Youth, Research and Innovation: Science and Technology and Research and Innovation institutional grants and the European Social Fund
- Ministry for The National Heritage, The Arts and Local Government: National Research Agenda for Cultural Heritage (NARCH)[24] and participation in E-RIHS

These initiatives are significant on three levels. Firstly, they help to set the government policy direction in the respective sectors and therefore de facto define R&I priorities. This may entail direct focus on pressing national needs (societal, environmental, legislative) and/or identifying emerging economic opportunities and specific niches. Secondly, they help to unlock much needed resources for implementing policies and related measures. By engaging specialised human resources, opening up enhanced networking and partnership opportunities, and providing/earmarking dedicated resources and funding for R&I, such initiatives contribute to and help to increase the public sector investment in R&I. Thirdly, they validate the role of R&I in the delivery of public services and can help to promote public awareness of the importance of R&I. In this respect, they need to be acknowledged, encouraged and supported. This being said, this approach to R&I funding increases the risk of fragmentation and thus no effort should be spared in pursuit of synergies and coordination.

In this context, the EU PSF Report highlighted the importance of ensuring a closer connection between the national R&I and economic development strategies and advocated more joined-up approaches between public entities responsible for rolling out complementary R&I initiatives, including funding programmes. Similarly in the drive to ensure coherence in national approaches, the PSF Report was keen to ensure that the smart specialisation priorities form an integral part of the national R&I priorities.

24 As of the drafting of this Strategic Plan, the NARCH is currently under development.

In order to build on these recommendations, the Strategic Plan highlights the need for a more comprehensive and streamlined approach to national R&I priority- setting by capturing the R&I directionality evident and underway in a number of Ministries. This will help to ensure increased coherence, critical mass and synergy of efforts and resources. The following approach is based on the current state of play, incorporating the systematic RIS approach which involves desk-based research (intelligence-gathering), the entrepreneurial discovery process and intensive consultations with the quadruple helix.

The Strategic Plan recommends that the following new elements are factored in more systematically:

- Dedicated and regular consultations with those in the Ministries involved in the shaping of strategies and initiatives for inputs on current and emerging top-down priorities;
- Rationalisation of the top-down and bottom-up inputs, to exploit synergies of efforts and resources, and provide advice on the feasibility of particular niche areas and required approaches and investments;
- Based on a flexible smart specialisation approach, the targeted list of R&I priorities and niches may be fine-tuned over time based on iterations and policy learning;
- In view of finite resources, efforts will be made to address the scope for consolidation, through joint studies, shared expertise and knowledge transfer across Ministries.

Recommendation 1.4: Increasing knowledge sharing across the Government's scientific class

Several Ministries already employ Chief Scientific Officers to provide thematic technical policy advice in the area of responsibility of the Ministry in question. In line with the rationale provided above and in order to develop a more systematic and coherent approach to national R&I priority-setting, it is recommended that an informal group of Chief Scientific Officers (CSOs) is brought together to explore ways in which they could help guide the evolution of national R&I priorities.

CSOs can provide expert advice on the identification of niche areas and emerging cross-sectoral opportunities. Bringing them together, initially in an informal setting, should provide an opportunity for increased coordination of resources and efforts across Ministries to allow a joint approach.

The informal group of CSOs will be set up by MCST, who will be tasked with facilitating the group's discussion on its possible role in helping to shape R&I priorities and the coordination of their operationalisation across Government.

Goal 2: Local ecosystem development

2.3 Goal 2: Local ecosystem development

The goal of upscaling efforts to boost local ecosystem development remains a key national challenge in the medium to long- term. The current emphasis is on achieving a local ecosystem of high international repute and profile. Malta has its share of world-class researchers and high research excellence, and it is important that our R&I ecosystem is on a par with other small European countries in providing the enabling framework conditions for R&I to continue to flourish. Given past fluctuations in investments and performance, it is important to ensure that current levels of R&I investments are at least maintained and to invest further by building on areas of improvement and addressing deficiencies and shortfalls in performance. Remaining weaknesses and gaps requiring support are identified in Table 2.3.1, but the Plan focuses on the actions to be prioritised and implemented up to 2027.

This section focuses on actions targeting academia, public-private linkages, support structures and internationalisation and actions targeting industry. Actions specifically relating to government and public entities will be addressed in section 2.5 as part of the goal to mainstream R&I.

Table 2.3.1: Areas requiring Action – summary table

Sector	Support required
Government and public entities	Increase in R&I activity Increased engagement of PhD holders Increased Science Literacy
General public	Increased science awareness and public engagement through citizen science campaigns
Academia	Support for basic research Increased support for funding of scholarships/fellowships for doctoral students and postdoctoral researchers Career advice linked to R&I Increased and more structured cooperation with industry
Micro-enterprises and SMEs	Dedicated support for micro-enterprises Support for SME innovation Support for Start-ups Support for non-technological and other types of innovation (marketing, organisational, design, etc.) Entrepreneurship training Networking opportunities
Large Enterprise and FDIs	Improved targeting of factors underpinning the attraction of foreign R&I including an assessment of fiscal incentives, State-aid schemes and IP rules Support for enterprise innovation
Cross-cutting requirements across different sectors	Increased investment and access to R&I infrastructures Strategic internationalisation More widespread open science practices Increased use of procurement as a tool for R&I Strategic use of legislative tools to support innovation[25] Enhance the potential and capabilities for knowledge valorisation

25 Malta currently participates in the first Innovation Deal on water, an instrument launched at European level with the aim to help innovators overcome perceived regulatory barriers to innovation, and to promote better regulation. The aim is to shift from the conventional treatment of urban waste water to using it as a water resource. An MBR (Anaerobic Membrane Technology) accelerates treated water reuse for irrigation by facilitating the extraction of energy and nutrients. https://ec.europa.eu/info/research-and-innovation/law-and-regulations/innovation-friendly-legislation/identifying-barriers/signed-innovation-deals_en#wastewater [Accessed on 29.09.21]

The EU PSF Peer Review Panel highlighted the fact that policies for strengthening the R&I ecosystem and improving its dynamics go beyond the issue of resolving the serious under-investment in R&I. The Panel expressed concerns on:

- firstly, the policy mix, in relation to gaps in the range and resourcing of instruments and the lack of a monitoring system to track the effectiveness of the overall approach; and
- secondly, the fragmentation and lack of complementarity in policy approaches led by the responsible public entities, in terms of design and implementation.

The PSF Peer Review Panel's overview of funding instruments available to local beneficiaries, highlights Malta's fragmented policy mix and the deficiencies in terms of level, type, transparency and accessibility of funding. The Figure 2.3.1 below provides an overview of current supply / demand measures offered in Malta. A clear skew towards supply-side measures is noticeable.

The main challenges identified for the period 2023-2027 , stemming from the PSF Peer Review and as evidenced by the above schematic, are:

i. Addressing gaps, fragmentation and inefficiencies in the overall policy mix with an emphasis on:
   - Improving framework conditions for public research
   - Leveraging private sector R&I
   - Building R&I capabilities and competencies
   - Investing in relevant R&I infrastructure
   - Expanding internationalisation efforts

ii. Monitoring the policy mix and iteration
   - Enhance policy intelligence-gathering through dedicated facilities
   - Reduce fragmentation through policy communities/networks of practice
   - Use monitoring and evaluation systematically to improve policy design
   - Increased focus on demand-side measures, using both procurement for innovation and standards/regulations as tools for increasing the demand for innovation.

These challenges have been integrated as key goals in this Strategic Plan and addressed through a dedicated set of recommendations aimed at tackling remaining gaps in the policy mix, in particular on the demand side but also in terms of insufficient scale of investments in existing measures. In order to improve the dynamics/networking in the ecosystem and reduce fragmentation, there are proposals to tap the potential of PhDs and post docs in the public sector, consideration of the possible setting up of a policy lab and a policy community of practice initially in the area of R&I funding.

These recommendations are elaborated in more detail in the next sections.

2.3.1 Improve framework conditions

The framework conditions for R&I are a key enabling factor in incentivising public and private sector R&I investments, both national and through FDI. In turn this helps to attract and mobilise young researchers to take up careers in R&I and to find opportunities for advancement in Malta. This emphasis on the framework conditions remains a key priority in our strategic approach up to 2027 and beyond.

These challenges have been integrated as key goals in this Strategic Plan and addressed through a dedicated set of recommendations

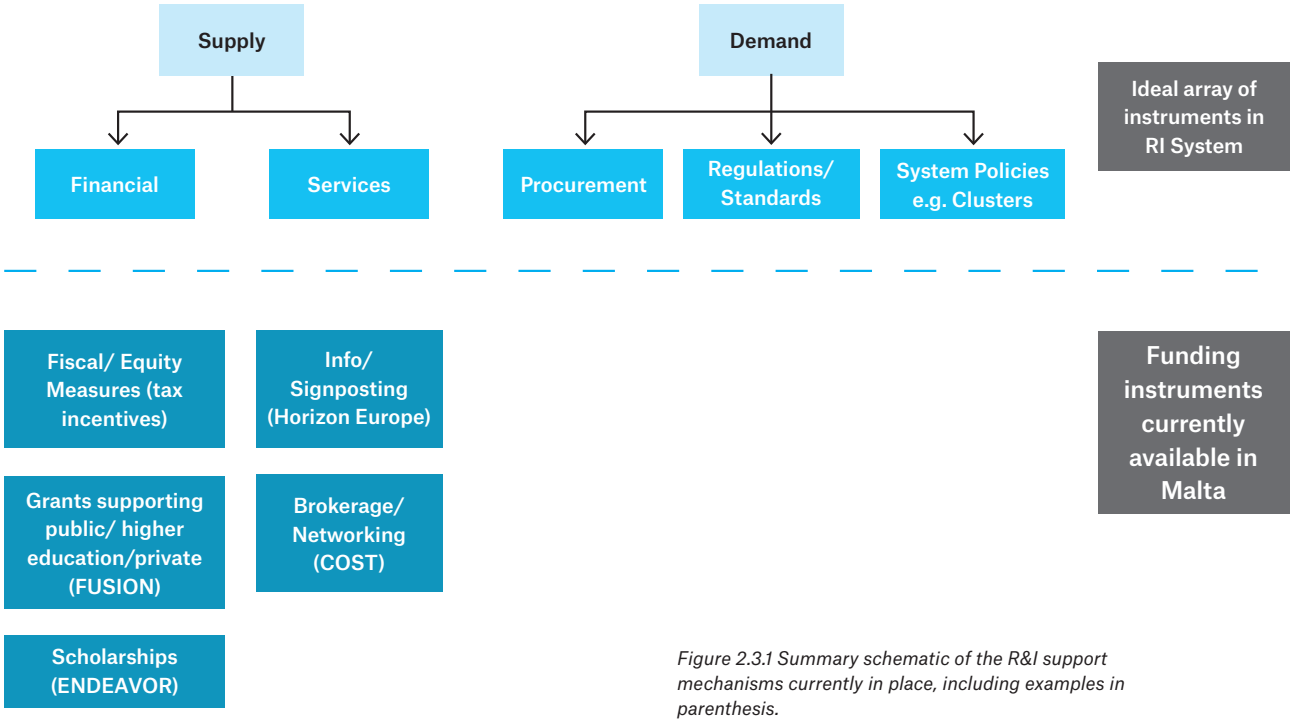


Figure 2.3.1 Summary schematic of the R&I support mechanisms currently in place, including examples in parenthesis.

The PSF Peer Review Report makes a number of recommendations for improving the framework conditions for public research. These include concerted efforts to:

- set up a fund to support curiosity-driven research of international quality with both project and personal grants, and subsequently link the fund to the ERC Mentoring Scheme.
- build more cooperation between UM and MCAST based on a clear concept and division of work in particular with regard to the third mission (engagement with industry and society).
- ensure that investments in research infrastructure bear fruit, secure funding for the personnel involved in teaching and research activities, as well as for the maintenance of their equipment and facilities.
- develop an attractive system to support talented individuals from primary school up to the highest university level.
- increase research capacity in public research, increase the human resources, including increased long-term support for doctoral students.
- launch a more proactive policy to attract global talent allowing positive impacts on the availability of qualified human resources for the business sector, as well as for the public research sector.
- develop and support innovation clusters around “pockets of excellence” of successful research performing organisations within both the public and private sectors.

The PSF Peer Review Report highlights the fact that R&I remains constrained due to 'salient under-investment'. Indeed, while Malta experienced a number of years of very good economic growth since the setting of the 2020 GERD target, this was not reflected in the equivalent increase in R&D investments in real terms. Increases in R&D expenditure throughout these years fell severely short of what was required to achieve the GERD target set. Indeed, Malta has failed to achieve the original target of reaching 2% GERD by 2020.

Recommendation 2.1: Iterative co-design of Public R&I Funding and Measures

The Plan recommends the development of a comprehensive 'live' plan of public funding of R&I and related measures, co-designed by all relevant stakeholders. This plan will help to flag under-investments, gaps and/or resources deficiencies affecting the R&I ecosystem. Updates of the plan will be prepared on an annual basis and include a forward look (planned measures 12 months ahead) based on consultations with key programme owners. The plan is to be submitted to the Minister responsible for research with a set of recommendations on revision/upscaling of existing programmes and funding and the plans for introduction of new measures as required.

Key priorities for inclusion in the plan are:

- co-design of the required set of public incentives, regulations conducive to innovation, and for developing an effective fabric for R&D
- ensuring synergies with other Strategic Plans such as the UM's Strategic Plan 2020-2025
- increased funding for basic research
- increased funding for research which is close to market – including improved support for accessing EU R&I funding
- mapping and development of participation within R&I infrastructures
- improved signposting to assist researchers, innovators and entrepreneurs in knowing which schemes would be most applicable for their needs and the steps towards accessing them

The plan would provide direction on an appropriate incremental funding envelope for R&I by year and help to define the required investments in human resources and infrastructure. Concerns over absorptive capacity will need to be given due attention.

2.3.2 Increase performance and maintain higher R&D funding levels

The PSF exercise highlighted the importance of regular reviews of the R&I ecosystem per se but also a means for improving the system's performance. The Report emphasises the importance of monitoring and evaluation. Regular monitoring and periodic evaluations provide a sound basis for reviews such as the PSF exercise. They serve as a check on whether we, as a nation, are falling behind on our targets, including R&D funding levels.

Recommendation 2.2: Supporting careers in research and human resources in R&I

The presence of a healthy core of researchers and associated professionals will be vital in the strengthening of Malta's R&I ecosystem. With this in mind, the Strategic Plan notes that supporting the HR capacity of the ecosystem while making the career path attractive enough to avoid brain drain are essential pillars for its vision of a nation that is capable of both research excellence and cutting-edge innovation. To these ends, the Strategic Plan recommends that as part of the co-design of public R&I funding and measures, consideration is given to the following issues:

- identifying difficulties experienced by researchers throughout the span of their careers and devising support accordingly
- enhancing, diversifying and rationalising scholarship funding mechanisms
- mapping out career paths beyond academia so that researchers may benefit from opportunities that arise via entrepreneurship, industry and the public sector
- supporting HR capacity in professions that enable R&I such as knowledge valorisation and research support careers

Recommendation 2.3: Towards regular monitoring to health-check the R&I system
It is recommended that the R&I political champion takes on the overall responsibility for health-checking the R&I system at regular intervals. This will entail embedding appropriate structures and mechanisms and investing in the required capacities and skills, within the Malta Council for Science and Technology.

This will require:

i. ensuring an effective oversight of the R&I system in terms of outputs and impacts;
ii. developing the current monitoring system prepared by MCST into a monitoring report, presenting the findings on monitoring/ evaluation and a dedicated set of recommendations. In time, and subject to the availability of requisite resources, this could upgraded into a fully-fledged monitoring instrument; ideally a Biennial R&I Performance Tool.

2.1.3 Develop a stronger, more targeted internationalisation drive

The goal to advance towards a world class ecosystem highlights the need for a more strategic approach to internationalisation. In 2019, a dedicated unit and team was set up at MCST to strengthen internationalisation and efforts have focused on developing strategic bilateral and multilateral partnerships in R&I and contributing effectively to key European and international initiatives. This concurs with the EU PSF report recommendation to reinforce international, multilateral and bilateral collaboration as a key element of the R&I strategy.

It is highlighted at the outset that the internationalisation pillar needs to be appropriately resourced as this determines its scope, effectiveness and sustainability. Resources are required for three main types of activity:

- to fulfil existing commitments to international, European and bilateral programmes and initiatives;
- to enter into new commitments: to enable participation in relevant programmes
- and initiatives, including international fora where key policies/programmes/ initiatives are being designed or launched;
- to undertake performance and impact assessment: to monitor and evaluate initiatives from a national perspective.

In the context of this Plan, the internationalisation pillar plays four main roles:

- A directional role in gearing internationalisation efforts in a coherent way to address key European and national societal challenges, including the SDGs, EU Green Deal;
- An instrumental role (internationalisation for R&I Policy) in supporting the implementation of the Strategic Plan, the RIS3 Strategy, and Malta's participation in Horizon Europe;
- A policy complementary and support role (internationalisation in support of foreign policy) in supporting the country's current diplomatic drive at international level;
- A functional role - internationalisation for science/ education/economic/enterprise/health/ environment policy). These roles impose certain priorities on the internationalisation approach which can constrain the room for manoeuvre.

Recommendation 2.4: Adoption of a more strategic drive to internationalisation
This Strategic Plan calls for an enhanced internationalisation drive based on a more strategic approach and informed by lessons learnt to date. It is recommended that the MCST Internationalisation Unit which has ably taken the lead in implementing this strategic drive, works with key stakeholders at different levels to co-design an effective structure and plan of action. The aim is to ensure an appropriate balance of the four main roles of internationalisation.

This concurs with the EU PSF report recommendation to reinforce international, multilateral and bilateral collaboration as a key element of the R&I strategy

In particular, initiatives to valorise Malta's extensive international network of researchers and innovators via the global diaspora should be explored.

2.3.4 Leveraging private sector R&I

The 2022 EU SBA (Small Business Act) Factsheet for Malta highlights a below EU average performance on skills, circular economy and business environment.[26] Progress has been made on several fronts, in particular entrepreneurship, and digitalisation. However, further efforts are recommended towards simplification through streamlining administrative procedures and data sharing, promoting a more positive attitude towards failed entrepreneurs, and policy action to encourage local industry to take advantage of opportunities to develop eco-friendly products.

26 https://ec.europa.eu/docsroom/documents/50697 [Accessed on 25.8.2022]

Table 2.3.2: Innovative enterprises having cooperation arrangements by size class: 2018–2020

	Size class: employed persons			
	10-49	50-249	250+	Total
Total innovative enterprises	628	174	41	843
No cooperation arrangement	533	144	22	699
At least one cooperation arrangement	95	30	19	144
Private business enterprises outside the enterprise group only	42	12	8	62
Enterprises within the enterprise group only	3	2	-	5
Private business enterprises outside the enterprise group and enterprises within the enterprise group only	19	3	3	25
Private business enterprises outside the enterprise group and universities or other higher education institutes only	6	2	2	10
Universities or other higher education institutes, government or public research institutes, clients or customers from the public sector and non-profit organisations only	3	3	-	6
Combination of multiple cooperation partners	22	8	6	36

The most recent Malta Community Innovation Survey[27] covering the three-year period 2018-2020 indicates that technological innovation expenditure increased slightly from €175 million in 2018 to €178 million in 2020. However, the number of enterprises (employing at least 10 persons) undertaking innovation action decreased from 865 enterprises (2016-18) to 843 enterprises (2018-2020). 56% of innovative enterprises were engaged in Business Process Innovation, whilst 35% were engaged in both product and business process innovation.

The top three constraints to innovate cited by enterprises are excessive competition in the market (113 enterprises), and exorbitant innovation costs (109 enterprises). A comparative analysis of small, medium and large firms provides important insights into the extent of cooperation arrangements (Table 2.3.2), the acquisition of knowledge, technical services and intellectual property rights. This analysis highlights the need for better targeted efforts to understand and address company needs and ambitions, in particular small firms.

27 https://nso.gov.mt/en/News_Releases/Documents/2022/09/News2022_157.pdf [Accessed 01.09.2022]

A growing challenge identified in the EU PSF Peer Review which requires particular attention is the under-investment in R&I by the private sector. Based on separate consultations with small and large firms, which helped to identify key shortcomings, the EU PSF Panel made a number of important recommendations on ways of leveraging private sector R&I, namely

- Applied research with mandatory university-enterprise collaboration needs to be reinforced, notably through intersectoral mobility schemes, such as Knowledge Transfer Partnerships (KTPs)
- Build an effective fabric for public-private R&I collaboration
- Support schemes for start-ups and innovative enterprises should be fully integrated into an 'easy-to-navigate' innovation support system.
- R&I Grants and tax credits need to be better tailored to micro and small enterprises
- Public procurement of R&I

The PSF Report flags a key issue of fragmentation and recommends that Malta should significantly streamline, simplify and clarify its landscape of funding schemes available to innovative enterprises, and deliver them in a more proactive mode and with a clear account management.

In concurring with the PSF Peer Review recommendations, this Plan highlights the need for setting up appropriate R&I enabling structures close and accessible to industry that can provide the necessary space and support on a more permanent basis. While acknowledging the invaluable support provided by key one-stop structures and facilities such as Business First, particularly in helping entrepreneurs set up and run their business, the aim here to support the shift towards innovation and R&I activity requires dedicated facilities providing access to domain-specific expertise and advice. The consultations with industry and the support providers highlight the need for the support provided to be tailored and specialised for the following four main categories of business:

- Micro-businesses (0-9 persons employed)
- Small firms (10-49 persons employed)
- Medium-sized enterprises (50-249 persons employed)
- Large enterprise /FDIs (250+ persons employed)

Recommendation 2.5: Tailored industry support and interagency collaboration

This Strategic Plan prioritised the launch/ piloting of a more differentiated approach to support and leverage private sector R&I, while underscoring the importance of interagency collaboration in order to better guide FDIs and local businesses towards R&I funding opportunities, both through national programmes and Horizon Europe.

The approach encompasses:

- intelligence-gathering/study on emerging factors for attracting R&I-intensive FDIs
- dedicated support to microbusiness with innovation potential through a *Technology Transfer and Innovation* Hub;
- specialised R&I support facility for SMEs;

While each initiative will depend on dedicated domain expertise, the initiatives can be based in the same location, in order, to ensure resource efficiency, to pool expertise and optimised learning. The aim is to leverage EU funds to set these up. Each of these initiatives will be described in more detail in the following recommendations.

Recommendation 2.6: Consider the execution of a study to understand the factors underpinning (i) the attractiveness of R&I intensive FDI to Malta and (ii) the upscaling of R&I activity in local firms particularly in relation to digital, green and social innovation.

This Strategic Plan recommends that in parallel with a more bespoke approach to supporting microenterprises and SMEs described below, an in-depth analysis is considered to better understand the factors underpinning private sector R&I investments, both foreign and local. The study would ideally combine two levels of analysis. The first part would focus on the factors that attract FDI to relocate their R&I activities to Malta and the modalities through which this takes place.

It goes without saying that attracting FDI in general terms is based on a multitude of factors[28] and largely depends on the overall economic, social and political climate. Indeed, the EY Malta Attractiveness Survey 2022 identifies corporate taxation as the top attractiveness parameter, and this attractiveness has improved slightly with 69% of companies believing that their long-term future is in Malta. This being said, the number of entities with a 'yes' reply has been declining. On the other hand, the retention of specialised personnel has remained high whilst finding the required skills has its difficulties. The stability and transparency of the political, legal and regulatory environment has also increased by 14% points since 2021[29]. Within the above context, the rationale for the analysis proposed by this strategic plan is to delve deeper specifically into the factors that would improve Malta's attractiveness for R&I set up or relocation, with the aim of developing strategic approaches.

Having developed a more in-depth overview of the global context and potential for FDI R&I investments into Malta, the second part of the study would ideally focus on the potential and underpinning factors for local firms to upscale their R&I activities in this context. Particular priority would be given to emerging opportunities in digital, green and social innovation and collaborative partnerships between FDIs and local firms.

It is recommended that, should this Recommendation be actioned, MCST would lead the development of this analysis in co-ownership, and co-implementation with Malta Enterprise and in consultation with the Malta Chamber of Commerce, Enterprise and Industry. It is recommended that this intelligence-gathering study would be undertaken as a first step in the implementation of this Strategic Plan, so that all private sector actions are informed by the findings.

28 http://www.maltaenterprise.com/why-malta. [accessed on 18.08.21]

29 https://www.ey.com/en_mt/articles/malta-attractiveness-survey-2022 [Accessed on 13.03.2023]

Recommendation 2.7: Dedicated support for Micro-businesses with innovation potential

Firms with up to 9 employees account for 93.1% of all private enterprises, covering a range of industry sectors, and spanning from limited awareness of innovation opportunities to a level of in-house innovation. Innovative start-ups which fall in this latter category are the exception to the rule. Innovation is a major challenge for the majority of micro-businesses. For those businesses interested in upscaling or making the transition towards a more innovative product, process and/or service, this would entail a high investment in hand-holding and support to decide on the appropriate innovation pathway and to secure the relevant sources in terms of expertise, skills, technology/innovation development, training as well as funding.

This Plan recommends the setting up of a Technology Transfer and Innovation Hub dedicated to micro-businesses with innovation potential (as distinct from University R&I start-ups supported through the Knowledge Transfer Office). Its main remit is to help channel a range of public support including upskilling/reskilling, upscaling, upgrading existing operations through innovation, technology, digitisation, automation and business transition. The aim is to enable micro-business to identify, plan and embark on appropriate innovation pathways (e.g. green/ digital transition). The Hub could prepare the ground for taking this forward, through the provision of a fine-tuned package of support. In order for the Hub to provide a high-quality level of support, it needs to be appropriately resourced so that it can co-design its support on a sound evidence base, dedicated intelligence-gathering and monitoring/evaluation. The Hub could be funded through Structural Funds and could utilise existing space at the Life Sciences Park. It is recommended that the lead entity in spearheading this initiative would be Malta Enterprise. It is envisaged that the University's Knowledge Transfer Office and the Technology Transfer and Innovation Hub would play distinct but potentially complementary roles.

Recommendation 2.8: Specialised R&I support facility for SMEs

Firms with 10-49 employees, accounting for 5.6 % of the private sector, operate in a range of sectors and cover the spectrum from little to no innovation activity to a limited level of R&I activity. The small enterprises responding to the CIS indicate that they have limited cooperation activity and their acquisition of technical services is primarily from private business enterprise. Small firms with innovation or R&I potential that are keen to invest in R&I, to upscale and/or undergo a business sector /green/digital transition require specialized support.

This highlights the need for a specialized R&I support facility to provide small enterprises with easier access to networking and support in relation to acquiring technology and R&I -related expertise, skills and services. This Facility will be appropriately resourced so that it can co-design its support on a sound evidence base, dedicated intelligence-gathering and monitoring/evaluation. It is recommended that the lead entity in spearheading this initiative is Malta Enterprise.

Small firms with innovation or R&I potential that are keen to invest in R&I, to upscale and/or undergo a business sector /green/ digital transition require specialized support

Recommendation 2.9: Launch of a Pilot KTP Scheme

Knowledge Transfer Partnerships (KTPs) provide an opportunity to boost business-academia collaboration by harnessing the fresh intellect of a recent (post-)graduate to tackle a real-time innovation challenge faced by a local firm, in turn benefitting from direct industry experience. The recommendation to set up Knowledge Transfer Partnerships (KTPs) to "facilitate the transfer of knowledge developed or improved in academic institutions towards successful commercialization" dates back to the Malta Industrial Policy 2012. Plans for a Malta KTP scheme have been in the pipeline for a number of years on the initiative of Malta Enterprise.

The EU PSF Report highlighted the importance of proceeding with implementation of this scheme, building on related experience in other countries. Business-academia collaborations in R&I are currently incentivized primarily through the MCST Fusion Programme which is oversubscribed and often results in limited business (co-) leadership of such initiatives. The knowledge transfer process is thus restricted in scope and scale given the small percentage of companies benefitting from the Programme. The Innovation Scoreboard highlights the limited evidence of such collaborations in terms of industry-academia co-publications. The recent growing number of PhDs opens up increased opportunities for launching industry-academia partnerships based on the best talent available.

The Strategic Plan supports the KTP initiative currently under consideration by Malta Enterprise and urges its operationalization by mid-2024.

Goal 3: Enhanced directionality through “Missions” and RIS3

2.4 Goal 3: Enhanced directionality through "Missions" and RIS3

The EU PSF Review called for a closer embedding of R&I in the development of the national economic strategy. This Plan highlights the need for designing an appropriate mechanism for achieving this closer linkage and ensuring coherence of policy approaches across government, reducing fragmentation. It is envisaged that in the first instance, the introduction of a new directionality in R&I investments through a mission-oriented approach[30] will allow closer synergies between R&I and the economic development and recovery process. The current crisis has further highlighted the need for a mission-oriented approach in support of the economy and society's response to external shocks and existential threats.

In the context of the increasing directionality of EU policy (such as the Green Deal, the Next Gen Strategy, the EU's Strategic Energy Technologies Plan) and targets (particularly the EU collective target to achieve climate neutrality by 2050) as well as national policy (such as the consultation document on the National Economic Vision 2021-2031), this Plan recommends the embedding of a new directionality in national R&I policy and investments. This can be achieved through a targeted focus on a set of well-defined missions which contribute through research and/or innovation to resolving key economic and societal challenges, including environment and climate change, health, competitiveness and security. This increased directionality of policy efforts towards the green transition, enhanced policy coherence and consideration of a missions-based approach in R&I, will also allow Malta to play an enhanced role in line with overarching EU policy, but also in the single market with other member states and their own R&I strategies.

Given the need for strategic direction and inter-sectoral synergies, the Strategic Plan recommends that the Ministry responsible for R&I takes the lead responsibility for the implementation of a mission-oriented approach and for the selection of national missions, drawing on the support of the informal group of Chief Scientific Officers and presenting the proposed national missions for Ministerial approval. In this context, securing the support of the relevant Ministry/Ministries responsible for taking the lead and championing the mission at an operational level will be instrumental.

Recommendation 3.1: Launch of a pilot national mission

It is recommended that the launch of a pilot mission is approved by mid-2024, with clear responsibility assigned at the appropriate level for deploying the mission. The pilot mission will be used to trial the approach so that after 2024 a minimum of one mission per 18-month period is launched. The plan for each mission will need to define, inter alia, the appropriate mechanisms and necessary funding measures for addressing each mission. This may range from PPPs to supply and demand-side measures, including R&I funding, innovation procurement, and prizes.

The missions may fall within the areas identified in the Smart Specialization Strategy but it is important to also look beyond these areas. This can be undertaken through priority-setting exercises, horizon scanning and foresight activities using domain experts; or calls for expression of interest to identify demand and

30 Mission-oriented policies are defined by Mazzucato as systemic public policies drawing on frontier knowledge to attain specific goals - "big science deployed to meet big problems". https://op.europa.eu/en/publication-detail/-/publication/5b2811d1-16be-11e8-9253-01aa75ed71a1/language-en [accessed on 28.09.21]

supply including local research players (public and private). A priority-setting exercise could allow effective consultation with relevant stakeholders, including proposers, clients and funders. Resources permitting, foreign experts could be considered to help with the design and implement the selection process. An appropriate level of granularity and economic viability needs to be achieved in defining each mission.

The main criteria for selection of the missions are that they address an economic/societal challenge and constitute a response to a pressing need and/or a window of opportunity. This can relate to a niche area where Malta has a comparative advantage or an area of national priority in deficit of the required innovation/R&I capability. Such missions should be based on a long-term vision with the aim of reaping lasting gains for the economy.

Recommendation 3.2: Green and Digital directionality

The green and digital transitions are expected to open up key opportunities for the EU to revitalise the economy and assert itself as a global leader in these areas by targeting R&I investments and setting global standards. The new directionality of the EU's Green Deal imposes and gives priority to green and digital R&I investments. It is a clear example of where national action needs to be taken against the risk of Malta losing out on the opportunities which are opening, as well as the expectations and demands that will be expected of Malta to comply with the requirements emanating from the EU's Green Deal and the Digital Compass.

The Strategic Plan highlights the need for a strong R&I drive in support of green, digital, health and energy transitions in line with the country's needs and priorities. This drive will draw on the current policy mix but also identify and build on ongoing initiatives at national and local level and in relevant sectors with an emphasis on:

- Developing public private sector partnerships;
- Building technological and innovation competencies including training and skills development;
- Upscaling successful pilots;
- Incentivising green digital initiatives;
- Deploying innovation procurement, including green procurement.

The links with the RIS Strategy need to be given particular attention as a means for leveraging local industry-driven and community initiatives and capacities. The RIS3 thematic committees can play a critical role in advising the Ministry responsible for research on actions to ensure alignment and compliance through national standards to drive innovation. This will ensure that Malta does not miss out on major transitions that are key for societal and economic well-being and resilience.

Recommendation 3.3: Complementarities and synergies with RIS3

The Strategic Plan is concerned with ensuring that the broader R&I policy mix can be appropriately fine-tuned and targeted to support the RIS3 strategy. A key challenge in implementing smart specialisation strategies is in moving beyond a declared vision, strategy and set of priorities towards defining the appropriate policy mix and realigning support measures accordingly, including funding priorities. Effective RIS strategies rely on a dynamic co-ordination, experimentation and refinement of policy interventions over time to ensure a good fit with the local context and the capacity and needs of local players.

The RIS3 2021-2027 is co-designed through an open, participatory process based on entrepreneurial discovery and consultations with local stakeholders. It identifies a core set of bottom-up thematic priorities and related needs for innovation-driven and market-oriented development. The selection of priorities is geared towards niche areas with strong existing and/or emerging R&I, economic and market potential, and the support of local enterprises and researchers.

In parallel, this Strategic Plan is seeking to identify and address a broader set of overarching R&I challenges and priorities which are facing the country as a whole. This includes both public and private sector needs and opportunities and they span from the medium to long-term, thus requiring sustained investments. The Strategic Plan and the RIS3 Strategy are thus distinct but complementary R&I policy development approaches. The Strategic Plan draws on the important insights and resources which the RIS3 process unlocks through bottom-up consultations which prioritise the experience and expertise of individual enterprises and researchers. In turn the Strategic Plan aims to support this process by unlocking complementary, more top-down policy initiatives and resources at national and international level.

To effectively achieve the synergy between both R&I strategies for post-2020 (the Strategic Plan and the RIS3), the new R&I governnance framework, including the existing RIS3 Committees, will play an essential role. Through their oversight, synergies will be identified, and complementarity will be ensured. Moreover, with the establishment of the thematic committees, stakeholders will remain engaged in the entrepreneurial discovery process (bottom-up approach) and will be feeding the monitoring bodies with up-to-date information and to further identify the needs of the R&I ecosystem, which the R&I Strategic Plan will strive to address. This process will seek to follow an enabling complementarity logic between the RIS3 and the national Strategic Plan's missions.

The Strategic Plan and the RIS3 Strategy are distinct but complementary R&I policy development approaches

Goal 4: Mainstreaming R&I in public policy

2.5 Goal 4: Mainstreaming R&I in public policy

This section focuses on the need to mainstream R&I into the public sector as a basis for building resilience, anticipation and rapid response in public policy. The aim is to ensure science literacy, broad science awareness and engagement, as well as more robust policy making through the embedding of R&I. A number of actions which will be piloted up to 2027 relate to public procurement for innovation, incentivising PhD public sector employment, building R&I capacity/ capability and skills and mainstreaming gender in R&I.

2.5.1 Deploy R&I and public procurement for innovation in key policy areas

The impact of the COVID-19 pandemic across key government policy areas (in particular health, industry, trade, employment, education and tourism) placed these systems under strain. In doing so, it has highlighted the importance of ensuring improved resilience through the support of public policy goals. The public sector needs to embark on a comprehensive process of mainstreaming R&I through appropriate consideration of how R&I can help to upgrade and render more robust and resilient the delivery of public goods and services. The digitisation of key sectors such as the public health sector is one example, however the public sector needs to be in a position to access and implement the latest advances in R&I. This requires, inter alia, changes in public procurement towards innovative and green procurement, based less on economical and more on innovation-friendly criteria.

In ensuring that we are better prepared for future crises, the Plan recommends investing in and taking advantage of state-of-the-art technologies in a range of public policy areas including health, environment, transport, food and agriculture, water and energy. This indicates several areas of economic opportunity which require R&I if they are to be fully valorised. These imply complementary and coordinated investments in technologies, competencies, capabilities and infrastructure. Demand-side policies are less widely used, however government can play a catalytic role by introducing regulation to steer the direction of industry efforts, for example in tackling emissions. Public procurement can play an important role in this respect, potentially leading to R&I capacity building in firms. In Malta, while important inroads have been made in e-procurement and green public procurement[31], public procurement for innovation has not been given equal prominence. This constitutes an important missed opportunity and needs to be given priority, despite the barriers and challenges of implementing this policy instrument in a small country context and more specifically to support national R&I and RIS3 strategies. A recent OECD study[32] on public procurement in Malta identified innovation procurement as an important priority.

This Plan recommends in particular a stronger government-wide emphasis and investment in research and innovation in the public sector in the ratio of goods and services purchased that meet innovation criteria (e.g. purchased through PCP, first introduction into domestic market etc).

31 https://meae.gov.mt/mt/Public_Consultations/MSDEC/Documents/Green%20Public%20Procurement%20National%20Action%20Plan.pdf [accessed on 16.08.21]

32 https://www.oecd.org/gov/public-procurement/country- projects/malta-contracts-department/ [accessed on 16.08.21]

Recommendation 4.1: Pilot action on Public Procurement for innovation

This Strategic Plan highlights the need for a pilot action to promote enhanced use of public procurement for innovation government-wide. It recommends coordination between ministries to ensure a holistic government approach. In this context, an important first step will entail identifying and tackling common barriers and obstacles, seeking and obtaining technical guidance[33], identifying success stories[34], targeting niche opportunities, specialised training and appropriate expertise, including access to external advice and support. Since the potential for this form of public procurement lies across all ministries, it is recommended that the Ministry responsible for research and the Ministry responsible for public procurement lead this effort jointly. Broad support across Government will however be required and procurement opportunities identified that have the potential to enhance capabilities or reduce costs/ needs for subsidisation.

2.5.2 Incentivise public service and public sector employment of doctorate holders

In order to build resilience and robust evidence-based public policy design and implementation, the country needs to ensure that the best brains are attracted to take up careers in the public service/ sector. Public delivery systems need to be better equipped both in terms of the latest technical infrastructure and support, and through the best talent and highly qualified human resources, including an in-house core of research staff, postgraduates and PhDs in key policy areas. The aim should be to ensure a high level of preparedness for handling the onset of such crises and to develop an anticipatory function to ensure a rapid and effective response.

Such capacity is equally important for enabling major green and digital transitions underway. The implementation of such transitions depends on having in place highly qualified PhDs and technicians able to identify, access, adapt and implement the appropriate R&I and technologies. The public sector needs to be appropriately equipped to develop more resilient public delivery systems and to drive the use of applied R&I to support key sectors of the economy.

A recent MCST survey of PhDs in Malta identified a number of disincentives for their take-up of employment in the public sector, including the underpayment of doctorate holders in public research institutes compared to HEIs and inferior employment conditions. The same study also highlighted a perceived lack of transparency in the employment of PhDs particularly in HEIs[35].

Recommendation 4.2: Increasing the transparency and attractiveness of PhD public sector employment

This Plan recommends the launch of a dedicated government review on PhD public sector employment.

The Review aims are:

- To undertake a needs assessment of shortfalls in public sector expertise in R&I, particularly in relation to the twin green and digital transitions and make recommendations on the more strategic use of the government scholarship scheme to address gaps in capacity and expertise, giving due attention to effective measures for return and retention of scholarship-holders;
- To increase the number of attractive career openings and posts for doctorate holders throughout the public sector and public service;
- To design measures to improve the profile, career prospects and working conditions of public service/sector doctorate holders;

33 Commission Notice – Guidance on Innovation Procurement – C(2018) 3051 final

34 https://www.research.manchester.ac.uk/portal/en/publications/public-procurement-for-innovation-in-small-european-countries(92d21508-b3a2-4c01-8a69-e7ce8a546c58).html [accessed on 16.08.21]

35 https://mcst.gov.mt/mcst-news/tracking-career-pathways-phd-holders-2020-survey-project-report/ [Accessed 24.3.2022]

- To explore the potential for appointment of PhDs and post docs co-funded by business and government to serve as Chairs in research performing organisations/higher education institutions, responsible for third mission and related challenges and focused on business/ government priorities;
- To advise on the potential of setting up a Government Policy Lab. Government funded Policy Labs have become more common in advanced countries worldwide as a means for supporting and implementing public sector innovation and R&I based policy design[36]. They provide an ideal test bed for introducing innovative policy approaches and for engaging PhDs and post-doctoral holders specialized and active in relevant policy areas.

It is recommended that this endeavour is led by the Ministry responsible for R&I, supported by the Ministry responsible for finance and the Ministry responsible for public sector employment.

2.5.3 Building Science (R&I) Literacy, Capability and Capacity

The effective take-up of increased public and private sector spending on R&I depends on complementary measures to increase R&I capability to ensure the appropriate absorptive capacity. R&I capacity has always proven a bottleneck and it is often attributed to different factors, which persist and are resistant to change, including the lack of effective R&I narratives and a popular R&I culture, and insufficient mainstreaming of R&I in education, gender and diversity issues. In recent years, a number of important initiatives have been launched, including science café events and increased female role models in R&I.

In particular, the setting up of Esplora with its evolving comprehensive programme of science education and engagement activities, is having an impact with a marked improvement in the take-up of engineering technology and ICT among nine-year olds. The public surveys commissioned by Esplora indicate the level of public interest in science has increased between 2015 and 2019[37].

However, a number of shortfalls persist in this area, including the substantial shortfall of human resources qualified in STEM (Science, technology, engineering and mathematics) as well as professionals skilled in research and innovation in different sectors of the economy and government. This is a challenge which is set to become more acute in the coming years, as STEM disciplines will feature prominently in key professions in the future, including health, environment, energy, mobility, and agriculture. As technological change and innovation increasingly impact the labour market, the rate of change in job profiles is changing dramatically. By 2030 a combination of factors including globalisation and technological progress, including AI and automation[38], will impact the work environment, increase future job automation (up to 50%), leading to the loss of now-obselete jobs and the creation of new career paths. Research and innovation will undoubtedly play a key role in this change. The pandemic's impact on job profiles has been varied with some proving vulnerable and others, more robust, in particular those related to the digital economy. This highlights the need to invest in a STEM skillset. Indeed, in the current context, STEM skills are increasingly sought after as they are an important resource in creativity, innovation and problem-solving.

In recent years with the economy faring well, there is a concern that this may have resulted in students having a reduced interest and incentive

36 https://www.gov.uk/guidance/open-policy-making-toolkit/getting-started-with-open-policy-making#policy-lab-does [accessed on 16.08.21]

37 https://mcst.gov.mt/mcst-news/press-release-malta-council-science-technology-ensures-stem-engagement-research-innovation-remain-forefront-national-agenda/ [Accessed on 16.8.2021]

38 https://knowledge4policy.ec.europa.eu/foresight/topic/changing-nature-work/developments-forecasts-changing-nature-work_en [accessed on 16.08.21]

to continue to further their studies. The impact of the pandemic has opened up enhanced opportunities for learning as universities have increasingly made their educational offerings accessible online. Many higher education institutions with plans to develop online programmes found that the pandemic provided the added impetus. This prompts a rethinking of current ways of organizing education and learning at home. It also highlights the need to explore in-depth the possibility of encouraging and possibly incentivising students to pursue advanced degrees and studies in R&I partly/fully online rather than going abroad for the whole period of study. There are certain constraints with science degrees due to laboratory work, however more extensive use of online study grants can be explored. This opens important opportunities for further education, re-skilling and lifelong learning. Given the challenges faced by micro and small enterprises and the self-employed in investing in R&I, improved access to innovation skills via remote learning can provide some of the building blocks for increased investments in this area. This Plan has therefore identified the need to extend the current STEM education and engagement activities to innovation and entrepreneurship, as a means for promoting an innovation culture among children and young people.

Recommendation 4.3: Setting up of a more formal structure to address STEM Education & Engagement, Entrepreneurship and Innovation

The EU PSF Report underlined the importance of developing a proactive policy for increasing human resources in R&I and attracting relevant global talent. This Plan concurs with the PSF Report and highlights the need for the development of a more strategic approach to building both national R&I capacity (quantity) and capability (quality). Such an approach would help to identify areas of human resource strengths and shortfalls in required competencies and skills in priority sectors.

Given the need to ensure effective coordination between education, entrepreneurship and R&I, it is recommended that this will be a priority area for the Ministry responsible for R&I to tackle, with the appropriate engagement of relevant ministries as necessary.

This would also entail extending the ongoing cooperation between the Ministry of Education (MEYR), MFHEA and Esplora. In terms of implementation, this would fall within the remit of UM and MCAST (and any other formal higher education institutions) and should have a positive impact in terms of employability of graduates in an evolving economy. Moreover, the expansion of STEAM initiatives which combine STEM subjects with the Arts as a tool to horizontally engage youth and adolescents into STEM subjects whilst also equipping them with vital soft skills such as creativity, entrepreneurship and a drive to innovate will be vital in cultivating such a self-sustaining culture of R&I.

The Strategic Plan will make recommendations on:

- the upgrading of the current system for STEAM education and learning, to ensure that young people all have an appropriate STEM, R&I and entrepreneurial skillset when they enter the labour market.

Key avenues which could be explored include:

- developing an online foundation year course for first year university students on STEM, innovation and entrepreneurship;
- creating incentives for the take-up of online masters and doctoral studies in STEM, innovation and entrepreneurship, allowing a larger number of young people to benefit from the grant scheme;
- developing R&I competencies by providing support for innovation, transformation, reskilling and e-skills initiatives in the private and public sectors with priority to key sectors and players (energy, water, health and transport) and in particular to small businesses and the self-employed.

2.5.4 Gender mainstreaming in R&I

In the context of a growing awareness at national and European level of the pivotal importance of gender equality and mainstreaming for unlocking the full potential of national R&I, the development of a targeted effort focused on gender mainstreaming in R&I has become a priority. This has garnered particular importance in the context of EU efforts to promote and ensure fair, green, digital transitions. In recent years, advanced economies including the UK, Australia, Canada, US, Japan as well as emerging economic powers such as India, have invested in nation-wide gender equality initiatives in R&I. In this context, the UK Athena SWAN Charter is an accreditation scheme which has proven popular worldwide, providing a quality charter mark framework for higher education and research institutions in their efforts to advance gender equality.

These initiatives have been shown to render important impacts at many levels, in particular by improving the attractiveness of careers in science, research and innovation and thereby ensuring achievement of the full potential of women in R&I. It has also led to increased R&I productivity and international partnerships as well as helping to reduce brain drain. Indeed, RPOs and HEIs investing in such initiatives benefit from increased attractiveness to worldwide talent.

With the launch of the new Horizon Europe Programme, the EU has upscaled its efforts in this area to drive its gender equality agenda more forcibly by imposing the conditionality of Gender Equality Plans. Gender equality has always been one of the European Research Area priorities but now it has emerged as a policy frontrunner priority as a result of the joint action of the European Commission and Council as well as the advanced efforts of a majority of Member States.

A number of initiatives underway to promote women in STEM and gender mainstreaming throughout government provide an important backdrop, however more targeted efforts are required in the current context. The Plan outlines a set of actions to bring Malta up to par with other advanced economies. The overall aim is to unlock the full potential of women in STEM and R&I through a number of coordinated actions. These include actions to encourage and facilitate careers in R&I by ensuring that the enabling conditions are in place.

It is envisaged that actions will be required on a number of fronts in line with current practice in advanced economies and other EU member states, including:

- Promoting female role models in a range of STEM and R&I careers as well as related jobs, including new occupations opening up in the digital economy;
- Identifying and addressing barriers and obstacles which hinder girls/young women from taking up STEM studies and research careers;
- Ensuring that women are appropriately represented in key roles and decision-making structures in R&I (min. 40%);
- Gender proofing of recruitment and promotion procedures in RFOs and RPOs;
- Ensuring equivalence of pay and working conditions for women and men at all levels in R&I;
- Working with other public entities which fund R&I or undertake R&I to work together to develop comprehensive joined-up approaches and coordinated measures;
- Ensuring that public bodies, research organisations (public and private), and higher education establishments (both public and private) develop their own Gender Equality Plans (GEPs);
- Introducing a national certification scheme for the Gender Equality Plans to be developed and awarded by the Ministry responsible for equality.

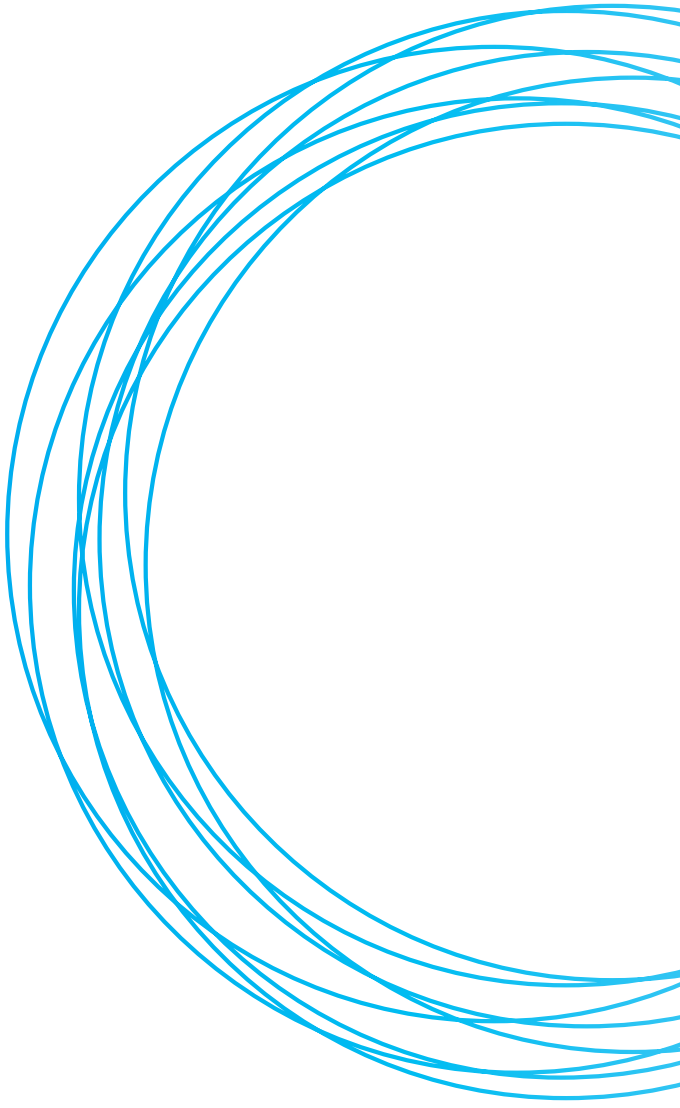
The types of gender mainstreaming measures which require consideration in line with EU practice include:

- Undertaking regular data gathering and analysis of key national trends relating to gender and R&I, including the extent to which women have been studying/working in STEM in order to identify gaps and shortfalls;
- Utilising and integrating policy tools such as the GEAR (Gender Equality in Academia and Research) which support RPOs in augmenting the representation and retention of women at all levels
- Ensuring that gender is given due attention and is meaningfully addressed in R&I supported (fully/partly) through public funding. In order to achieve this, a number of complementary measures need to be given consideration, including ensuring a minimum 40% female evaluators/peer reviewers of publicly funded national R&I programmes (HE target);
- Aligning with EU conditionalities for public bodies, including public and private research organisations and higher education institution to have a GEP in place when submitting project proposals for Horizon Europe calls from 2022.

While a number of these measures require timely action, the Plan recommends that work is undertaken in parallel on defining the appropriate review and reporting structures to be put in place.

Recommendation 4.4: Improved oversight of Gender in R&I

This plan recommends that the Ministry/ Ministries responsible for research and innovation and equality take a leading role in spearheading mainstreaming of gender in R&I, certification of GEPs and, in due course, national level reviews. In order to achieve the targeted long-term goals and impacts, this initiative will require the effective engagement of relevant stakeholders in the public sector as well as the support of the private sector. The Ministry/ Ministries should ensure that the right level of expertise and engagement is brought together to support the achievement of these objectives.



Goal 5: Strengthening R&I implementation structures

2.6 Goal 5: Strengthening R&I implementation structures

The Plan fully supports the PSF Peer Review recommendations relating to enhanced cooperation among all actors involved in funding R&I and the setting up of an effective monitoring system.

Recommendation 5.1: Community/Network of Practice for RFOs

In line with the EU PSF Review recommendations to improve synergies between research funding organisations, this Plan recommends the setting up of a community/network of practice to ensure enhanced transparency and coordination in the disbursement of public funds. This is particularly important in view of plans to upscale public R&I funding substantially in the coming years.

The RFO Community of Practice will be set up by the Ministry responsible for R&I, and all public RFOs will be required to participate.

The Community of Practice will explore opportunities for developing common standards drawing on EU and international best practice while taking account of local context. This would help to improve coordination and reduce fragmentation in programme design.

The Community may further explore:

- setting standards related to dissemination, advance notice, adjudication time, administrative burden, conditionality, etc;
- providing training and sharing of good practices;
- ensuring compliance.

Recommendation 5.2: Towards an upgraded MCST+

Given that implementation of the above recommendations will require a significant increase in MCST's operations, the Plan recommends implementation of the PSF's proposal that the Malta Council for Science and Technology (MCST) should be upgraded towards an 'MCST+' that expands its function of a research funding agency, responsible for the technical steering of the National R&I Strategy, including the Smart Specialisation Strategy (RIS3).

MCST+ would enable the entity to take on a significantly expanded remit and set of functions for effective implementation of this Strategic Plan.

In particular, MCST+ would take on a more proactive, embedded role in government by:

- Providing a strategic and advisory function within the governance structure referenced in Recommendation 1.1
- Providing technical support to the Ministry responsible for R&I and its internal structures including the thematic committees of the RIS3 Strategy;
- Advising Government/Ministers on Science and R&I policy on request/proactive on emerging issues;
- Fulfilling an extended science policy advice function (reports on R&I activity across government on key topics; EU briefings to government and relevant public entities; reviews/evaluation of funding programmes);
- Intelligence and horizon scanning briefings including Rapid Response Mechanisms (quick scans and sense-making of signals that change in society, economy, and technology is occurring on issues deemed relevant for R&I policy;
- Monitoring, review, evaluation and reporting work on the state of implementation of the relevant strategies, policies and funding programmes.

It is recommended that MCST+ is allocated increased human resources and funding as required in order to enable it to fulfil this extended remit effectively. Decisions on upscaling MCST need to ensure that there is no overlap in personnel, or other resources in the MCST and the R&I Ministry.

PSF Funding: To facilitate more synergies in the policy mix, the monitoring system is of central importance. It requires cooperation from all actors involved in funding R&I and should be led by MCST+, expanding its role of a 'policy intelligence unit'. Policy evaluation should also become regular practice.

3

Monitoring

In 2016, MCST set up its first research and innovation monitoring system to follow the implementation of the National Research and Innovation Strategy 2014-2020, including the Smart Specialisation Strategy. It is the first comprehensive monitoring system meant to oversee the development of the whole R&I ecosystem. Based on data availability, policy goals and objectives of the strategy, a variety of indicators were selected. In 2019, the Malta Council for Science and Technology issued the first monitoring report following the setting up of the monitoring mechanism - the National Research and Innovation Monitoring Report 2018[39] . The report covers the period between 2014 and 2018 and compares the latest available figures with the 2020 targets for the indicators identified in the National R&I Strategy 2014-2020.

Based on the experience and data obtained through the monitoring system, indicators have been reviewed and identified for monitoring developments of Malta's research and innovation system through the goals identified in this Strategic Plan.

The Strategic Plan seeks to focus on structural reforms based on the recommendations of the PSF Peer Review, as these systemic changes will be necessary to strengthen the present R&I system. Moreover, the Strategic Plan has identified concrete actions and recommendations to achieve the five goals of the Plan. Hence, the proposed monitoring structure needs to be tailored to this approach.

A selection of key indicators has been identified to monitor implementation and progress towards the five goals. These are headline indicators that address one or more of the goals and have been selected based on the robustness of available data. The list of identified indicators is presented in Table 3.1 below, together with an overview of which indicator is linked to which Strategy goal. Furthermore, the monitoring system will rely on an in-depth qualitative analysis to maintain oversight and ensure achievement of the proposed actions, beyond the statistical and data analysis of trends and progress through the selected indicators. The monitoring report will be published by MCST on a biannual basis.

39 http://mcst.gov.mt/wp-content/uploads/2020/02/Monitoring-Report-2018-compressed-compressed_compressed_reduce-1.pdf [accessed on 10.10.21]

Table 3.1 Identified monitoring indicators

Goal 1: Strengthening R&I governance and Priority-setting
Goal 2: Local ecosystem development
Goal 3: Enhanced directionality through missions and RIS3
Goal 4: Mainstreaming R&I in public policy
Goal 5: Strengthening R&I implementation structures

	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
Gross R&D expenditure as a percentage of GDP	●	●	●		●
Business Innovation expenditure as a percentage of GDP	●	●	●		●
Public R&D Effort expenditure as a percentage of GDP	●	●	●	●	●
Eco-Innovation Index[40]		●			
Innovative SMEs as a percentage of total SMEs	●	●	●	●	
No. of SMEs involved in R&D projects as a percentage of total innovative SMEs	●		●	●	
Number of innovative firms cooperating with PROs	●		●	●	
Employment in knowledge-intensive activities as a percentage of total employment		●	●	●	
Number of researchers split by sector of performance (expressed in full-time equivalents, FTE) as a percentage of total employment		●	●	●	
Number of employed PhD holders split by sector of performance		●	●	●	
Graduates in STEM related fields as a percentage of total graduates		●	●	●	
No. of publications in the areas of Green, Digital, Health and Energy Innovation as a percentage of total Maltese publications		●			

40 This is a composite score and all information on indicators used, can be found at https://ec.europa.eu/environment/ecoap/indicators/index_en

Summary Table

Goal 1: Strengthening R&I governance and Priority-setting

Recommendation	Action	Entity / Body responsible
Strengthening Governance and Championing of R&I	Upscale, streamline and strengthen Malta's R&I Governance	Ministry responsible for research
Improved oversight, coherence and synergy of funding instruments	Set up a governance structure that can provide effective oversight and coherence of existing and new funding instruments	Ministry responsible for research / MCST
Increasing knowledge sharing across the Government's scientific class	Setting up an informal group of Chief Scientific Officers	Ministry responsible for research

Goal 2: Local ecosystem development

Recommendation	Action	Entity / Body responsible
Improve framework conditions	Design a Roadmap of publicly funded R&I measures (comprehensive mapping and overview of ongoing demand and supply side measures, coupled with a plan for new/improved R&I measures supporting both public and private R&I).	Ministry responsible for R&I
Increase performance and maintain higher R&D funding levels	Call for another External Evaluation of the national R&I system and RIS3 process towards the end of this Strategic Plan	MCST
Develop a stronger, more targeted internationalisation drive	Adopt a more strategic drive to internationalisation	MCST
Leveraging private sector R&I	Enhance Intersectoral mobility and knowledge transfer through the launch of a pilot Knowledge Transfer Partnership (KTP) scheme	Malta Enterprise /UM
	Implement a differentiated approach to supporting private R&I: dedicated support to microbusiness with innovation potential through a TTI hub; dedicated R&I support facility for SMEs.	Malta Enterprise
	Consider undertaking a dedicated study to better understand the factors underpinning the attraction of FDI for R&I.	MCST co-owned and co-designed with Malta Enterprise, with the support of the Malta Chamber of Commerce, Enterprise and Industry

Goal 3: Enhanced directionality through missions and RIS3

Recommendation	Action	Body responsible/Entity
Towards Mission-oriented R&I	Identify a pilot mission & propose its operation, with the aim of launching future missions (at least one per 18-month period)	Ministry responsible for R&I
R&I in support of green, digital, health and energy transitions	Advance these priorities - identify the key actions needed to bring Malta in line with the EU agenda	Ministry responsible for R&I/ RIS3 Thematic Committees
Complementarities and synergies with RIS3	Identify synergies and complementarities	MCST/RIS3 Thematic Committees
	Refine the broader national policy mix to support smart specialization	

Goal 4: Mainstreaming R&I in public policy

Recommendation	Action	Entity / Body responsible
Deploy R&I and public procurement for innovation in key policy areas	Launch a Pilot action on Public Procurement for innovation	Ministry responsible for research/ Ministry responsible for public procurement
Incentivise PhD public service and public sector employment	Increase the transparency and attractiveness of PhD public sector employment	Ministry responsible for research / Ministry responsible for finance/ Ministry responsible for public employment
	Consider the setting up of an Open Policy Lab	
Building R&I Literacy, Capability and Capacity	Set up of a more formal structure to address STEM Education & Engagement, Entrepreneurship and Innovation	Ministry responsible for education / Ministry responsible for research
Gender mainstreaming in R&I	Set up a dedicated structure for Gender Mainstreaming in R&I for compliance with EU ERA requirements	Ministry responsible for research / Ministry responsible for gender equality
Gender mainstreaming in R&I	Design, establish and implement a national certification scheme for Gender Equality Plans (GEPs) in RPOs	Ministry responsible for research / Ministry responsible for equality

GOAL 5: Strengthening the R&I implementation structures

Recommendation	Action	Entity / Body responsible
Community/Network of Practice for RFOs	Set up an RFO Community of Practice as an inter-ministerial mechanism and all RFOs will be required to participate	MCST / Ministry responsible for research
Towards an upgraded MCST+	Expand MCST's remit and resources	MCST / Ministry responsible for research / Ministry responsible for finance