

November 2021

Malta's Smart Specialisation Strategy

2021 - 2027

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FOREWORD

Hon. Dr Owen Bonnici

Minister responsible for Equality, Research and Innovation

In these unprecedented times, our country has a golden opportunity to reassess its understanding of economic success. How do we want our economy to grow? Which sectors should we be supporting more?

Nobody questions the need for innovation. Theory and practice have shown, time and again, that turning challenges and opportunities into new products and services is the way to go if we want to keep pace with the rest of the developed world. Smart specialization is a particularly useful tool in this context. It puts innovation-led growth at its core but encourages contextualization, such that actions and measures are adapted to a particular country or region's realities and needs on the ground.

This smart specialization strategy (RIS3) 2021-2027 provides Government's clear priorities for investment in innovation over the coming years. It identifies areas of potential growth where Malta has already shown that it has the possibility to develop further with the right level and type of support. Some might argue that too many priority areas have been identified. I believe that as a small, open economy, Malta cannot afford to put all its eggs in one basket. I am convinced that we have the right balance in terms of number and breadth of identified sectors. Some sectors are more traditional. Others are relatively new. But in all sectors identified, Malta already has in place several of the building blocks necessary for more and better economic performance. They now need the right kind of help to take them to the next level.

What this help will look like will depend on each area's identified needs and potential, as this document explains in a lot of detail. There will not be a one-size-fits all approach. My ministry will be spearheading a dedicated implementation structure for this RIS3, to ensure that all relevant stakeholders remain involved at the implementation stage and to ensure that the operationalization of the strategy remains on point to target each sector's needs. It is also for this reason that I will seek to ensure that as wide an array of instruments as possible is available to make this strategy a reality. National funds, European funds, procurement, training, upskilling and access to international opportunities will all be deployed strategically for the benefit of each specific area.

It is for this reason that my Ministry will take a central coordinating role in this strategy's implementation, to allow us to pool expertise, resources and instruments from different entities and ministries across government and channel them in a concerted manner. I will of course rely on the continued technical input and support of the Malta Council for Science and Technology, who has spearheaded the development of this document and whom I warmly thank for their endeavours in this regard.

I look forward to the next years of hard work in making this Strategy a reality and in reaping the fruits of our efforts for a more prosperous economy built on innovation.

FOREWORD

Dr Jeffrey Pullicino Orlando

Executive Chairman Malta Council for Science and Technology

Having been at the helm of the Malta Council for Science and Technology since 2010, this is the second smart specialization strategy that the Council has spearheaded under my direction. MCST's small but highly dedicated team has worked tirelessly to ensure that this strategy truly represents the views and informed opinions of all stakeholders – from government to academia, the private sector and civil society.

Indeed, we have learned a lot from the first RIS3 - which covered 2014-2020. We have taken these lessons and applied them to the development of a new strategy. We have strengthened and broadened our consultative process, and we are helping to put in place mechanisms to ensure that the Entrepreneurial Discovery Process remains strong and vibrant throughout the duration of this strategy.

The Council and the Ministry will of course continue to work hand in hand to ensure the successful implementation of this strategy. However, this strategy's broad scope necessitates ownership and commitment across ministries and sectors.

We must all pull the same rope. Our efforts need to complement one another's. The Core Group and the Steering Group will retain a vital role in this respect. They will remain platforms for cross-ministerial coordination, and they will be complemented by a new set up within the Ministry, which MCST will be supporting both technically and administratively.

A strong RIS3 governance is a sine qua non for its success. Equally important, however, is the financial support that matches expectations. And, having mobilized so many players to put this document together, expectations for this RIS3 are indeed high. It is therefore imperative that we look at a broader funding mix than solely ERDF for this strategy's implementation. Other funding streams – European and national – will need to be channeled into this Strategy if it is to be successfully implemented. This is where the importance of the link between funding and governance becomes self-evident.

In conclusion, I am confident that we have identified an array of sectors and niches with great potential for our country. Their diversity is both interesting and challenging. We look forward to working with all stakeholders to put this plan into action.

EXECUTIVE SUMMARY

This Strategic document presents Malta's Smart Specialisation Strategy for the period 2021-2027.

Smart specialisation is a key principle underpinning the European Commission Cohesion Policy for the period 2021-2027 in the Research, Technology, Development and Innovation (RTDI) priority. It is a place-based policy approach that foresees channelling of public and private investments in carefully selected priority areas, through an 'entrepreneurial discovery process' (EDP). The bottom-up policy design approach brings together actors of the quadruple helix to identify a country's national competitive strengths and research and innovation potential.

This document is a result of the work undertaken between November 2018 and February 2021 to review and update Malta's RIS3. It takes into consideration the experience gained from the implementation of the 2014-2020 RIS3, the changing economic and social landscape, new R&I policy developments in RIS3 and beyond, emerging local and international trends. It does this through an extensive analysis of all relevant macro and micro-level statistics, coupled with a broad-ranging entrepreneurial discovery process.

The preparation of this document leveraged the experience of existing R&I coordinating bodies - namely the Core Group and the Steering Group – which have been in place since 2014. It expanded upon these with workshops, bilateral meetings, online surveys and focus groups. The result of this work is the identification of (6) smart specialisation areas for the period 2021-2027. These are:

- Health and Well-being, with a focus on cancer, cellular therapy, drug development, digital tools to support healthcare, focusing on e-health and bioinformatics and biomedical engineering.
- Sustainable Use of Resources for Climate Change Mitigation and Adaptation, with a focus on net-zero carbon buildings, renewable energy generation and energy storage solutions, resource efficiency in industry and turning waste into a resource.
- Smart Manufacturing, with a focus on sustainable manufacturing and flexible automation.
- Marine & Maritime Technology, with a focus on the valorisation of marine resources and maritime technology.
- Aviation and Aerospace, with a focus on avionics, composite materials and development of new technologies for maintenance of new products.
- Future Digital Technologies (this is both a vertical priority and a horizontal enabler for the former five areas), with a focus on big data and data analytics, open data, smart space applications, human-centric applications, digitizing industries and sustainable use of resources or climate change mitigation and adaptation.

Chapter 4 gives the full details of the rationale for each as well as the innovation potential identified. With regards to implementation, this RIS3 Strategy takes a holistic approach to the implementation of the opportunities identified in the six thematic areas. Indeed, while RIS3 is an enabling condition for access to Structural Funds, implementation of the strategy will require a wide array of different interventions that go beyond Structural Funds. This Strategy document, in Chapter 5, highlights the breadth of instruments that are available and that will need to be contextualised to each thematic area's needs and deployed accordingly. It also recommends an implementation structure that ensures

that the Entrepreneurial Discovery Process remains ongoing, and capacity building to support the tailored implementation of the identified RIS3 areas.

CHAPTER 1

1.1 Introduction

Smart specialisation is a place-based policy approach that foresees channelling of public and private investments in carefully selected priority areas, through an ‘entrepreneurial discovery process’ (EDP).¹

The EDP enables smart specialisation to address the difficult problem of prioritisation and resource allocation decisions by allowing entrepreneurial actors to demonstrate the most promising areas for future regional development (European Commission: Smart Specialisation Platform, 2012). The EDP process can reveal what a country or region does best in terms of R&D and innovation because entrepreneurial actors are best placed to know or discover what they are good at producing.

The EDP promotes a bottom-up approach that allows policymakers to learn from the stakeholders of the quadruple helix (government, academia, industry and civil society). It concerns the prioritisation of investment based on an inclusive stakeholder engagement and attention to national and international market dynamics and value chains. A national research and innovation strategy for smart specialisation (RIS3) is therefore an economic transformation agenda based on four general principles that are the criteria of the RIS3 process (choices and critical mass, competitive advantage, connectivity and clusters and collaborative leadership).

Smart specialisation is a key principle underpinning the European Commission Cohesion Policy for the period 2021-2027 in the Research, Technology, Development and Innovation (RTDI) priority. Similarly to the 2014-2020 programming period, the existence of a Smart Specialisation Strategy is an enabling condition for EU Member States (MS) to access structural funding under the European Regional Development Fund (ERDF) in this field.

This strategy builds on achievements and lessons learnt in the previous RIS3 2014-2020 (The Malta Council for Science and Technology, 2014).² The purpose of the renewed strategy is not to start the process from scratch, but to further reinforce those components that are not yet sufficiently developed, and to use this opportunity to recalibrate Malta’s priorities in line with economic developments as well as national challenges. Hence, the current RIS3 process does not take into account only economic benefits, but also on achieving a sustainable society by addressing environmental and societal needs and strengthening the well-being and quality of life of the country through research and innovation actions.

1.2 Background

1.2.1 Why Does Smart Specialisation Matter?

¹ <https://s3platform.jrc.ec.europa.eu/what-is-smart-specialisation-> [last accessed 26.03.2021]

² <https://mcst.gov.mt/psi/national-research-innovation-strategy/> [last accessed 26.03.2021]

Smart Specialisation Strategies play a role in stimulating research and innovation at the regional level in less-developed EU regions and Member States. It can also play an important role in the industrial transition of other regions.³ More traditional R&D-driven innovation policies rely on the generation of new technology and breakthrough research, and in fact the European Framework Programme follows this approach. On the other hand, industrial policy is innovation-oriented and focused on the economic impact of innovation activities in a specific industrial context. Hence, its focus is on a variety of factors that jointly generate productivity growth, employment or competitiveness of specific industries. More advanced regions tend to favour the R&D-driven innovation policies, whilst lagging regions focus on industrial policies to boost their economy.³ The smart specialisation approach attempts to reconcile the two policy approaches, whilst also looking to address societal needs and develop a place-based policy that is not too inward-oriented.

Smart specialisation was also proposed to prevent already limited R&D investments from being spread too thinly across sectors and research fields, and consequently, fail to make any substantial impact. Smart specialisation encourages investments that can complement a country's other productive assets and creates more diversity between regions, rather than imitate each other and result in duplication and fragmentation of R&D progress. Therefore, this strategic approach promotes differentiation and specialisation, avoiding the age-old adage "jack of all trades, master of none".

1.2.2 European Framework

Cohesion Policy

Cohesion policy is the European Union's strategy to promote and support the 'overall harmonious development' of its Member States and regions. Enshrined in the Treaty on the Functioning of the European Union (Art. 174), the EU's cohesion policy aims to strengthen economic and social cohesion by reducing disparities in the level of development between regions. The policy focuses on key areas which will help the EU face up to the challenges of the 21st century and remain globally competitive.⁴ One of the instruments that receives substantial funding from Europe's Multiannual Framework Programme (MFF) that contributes to achieving the goals within Cohesion policy is the European Regional Development Fund (ERDF), which aims to strengthen economic and social cohesion in the European Union by correcting imbalances between its regions. The ERDF focuses its investments on several key priority areas, one of which is innovation and research.

For the financial period 2014-2020, smart specialisation strategies were required as a pre-condition (ex-ante conditionality) to access the thematic priority objective for innovation and research under ERDF. Therefore, this was a main driver for European regions to embrace the smart specialisation policy approach. The requirement for regional RIS3 will continue in the next programming period, 2021-2027, as an enabling condition. The difference is that rather than having such a strategy in place only as a pre-requisite, the smart specialisation approach is recognised as a process and hence, will continue developing throughout the programming period as part of the entrepreneurial discovery process.

³ https://ec.europa.eu/regional_policy/sources/docgener/brochure/smart/role_smartspecialisation_ri.pdf
[last accessed 26.03.2021]

⁴ [https://ec.europa.eu/regional_policy/en/policy/what/glossary/c/cohesion-policy#:~:text=Cohesion%20policy%20is%20the%20European,its%20Member%20States%20and%20regions.&text=174\)%2C%20the%20EU's%20cohesion%20policy,level%20of%20development%20between%20regions.](https://ec.europa.eu/regional_policy/en/policy/what/glossary/c/cohesion-policy#:~:text=Cohesion%20policy%20is%20the%20European,its%20Member%20States%20and%20regions.&text=174)%2C%20the%20EU's%20cohesion%20policy,level%20of%20development%20between%20regions.)
[last accessed 26.03.2021]

For countries to ensure that the RIS3 approach is contributing to a smarter Europe by promoting innovative and smart economic transformation, seven fulfilment criteria have been identified:

1. Up-to-date analysis of challenges for innovation diffusion and digitalisation
2. Existence of competent regional/national institution or body, responsible for the management of the smart specialisation strategy
3. Monitoring and evaluation tools to measure performance towards the objectives of the strategy
4. Functioning of stakeholder co-operation ("entrepreneurial discovery process")
5. Actions necessary to improve national or regional research and innovation systems, where relevant
6. Where relevant, actions to support industrial transition
7. Measures for enhancing cooperation with partners outside a given Member State in priority areas supported by the smart specialisation strategy

The current strategy aims to address each criterion to ensure that the RIS3 2021-2027 fulfils the enabling condition for ERDF, and outlines how through governance, stakeholder cooperation and monitoring, Malta will continue ensuring that the smart specialisation process remains a living competitiveness-driven policy.

The budgets for ERDF are determined as part of the legislative package for a post-2020 multiannual financial framework (MFF), first published on 2 May 2018 by the European Commission. The MFF sets the annual limits on EU commitments in different policy areas ('headings') and on overall annual payments. Since then, the outbreak of the coronavirus pandemic and its massive socio-economic impact have complicated negotiations. On 23 April 2020, the European Council asked the Commission to come up with a proposal for a recovery fund of 'a sufficient magnitude' and linked to the MFF. The European Parliament outlined its expectations on the recovery plan and the revised proposal for the next MFF in the resolution of 15 May 2020. As part of a wide-ranging response, the aim of the Recovery and Resilience Facility is to mitigate the economic and social impact of the coronavirus pandemic and make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions. The Recovery and Resilience Facility entered into force on 19 February 2021.

European Green Deal

Although the implementation of smart specialisation is driven by its link to structural funding, strategies cannot be drafted in silos and the full European framework should be taken into consideration. A significant driver for research and innovation in the coming years will probably be the new European Green Deal. This is Europe's roadmap for making the EU's economy sustainable by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all. The Communication introducing the Green Deal admits that this unprecedented transformation will 'require a strong policy response at all levels' and significant investment efforts.⁵

A systemic challenge such as the Green Deal needs the mobilisation of all resources and actors across Europe. Smart specialisation has exactly this mission: identify new future activities based on the unique characteristics of all places. The transformation of the growth model is a transformation of the specialisation structure of our economies. To avoid fragmentation and capitalise on the diversity of

⁵ https://ec.europa.eu/info/publications/communication-european-green-deal_en [last accessed 26.03.2021]

European innovation ecosystems, smart specialisation could be a key delivery mechanism for the new growth strategy. It can combine the directionality of the European Green Deal roadmap with the entrepreneurial discovery process towards sustainable growth in all regions.⁶

European Framework Programme for Research and Innovation (Horizon Europe)

The EU has launched Horizon Europe, the research and innovation flagship programme for the upcoming programming period (2021-2027), succeeding Horizon 2020. Horizon Europe incorporates research and innovation missions to increase the effectiveness of funding by pursuing clearly defined targets, a unique difference to Horizon 2020. However, the goals of the framework programme remain unchanged; it is a means to drive economic growth and create jobs since R&I is an investment in our future and so has to remain at the heart of the EU's blueprint for smart, sustainable and inclusive growth and jobs. The framework programme is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling global challenges. The goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

One ongoing discussion is the need to create more synergies between the framework programme and structural funds. In the 2014-2020 period, some countries managed to achieve synergies by embracing the "Seal of Excellence". This is a quality label awarded to project proposals submitted to Horizon 2020 (and eventually Horizon Europe), to help these proposals find alternative funding, if they are judged to deserve funding but did not get it due to budget limits. In theory, countries could use their structural funding to support these projects. In practice, many countries encountered difficulties due to several legislative barriers and over-bureaucratic processes, resulting in calls for more synergies between the two programmes.

Achieving synergies will be even more important in this programming period due to the high focus on European Partnerships in Horizon Europe. Partnerships have been supported through past framework programmes, however, in the next framework programme the number of institutionalised partnerships will increase and a large proportion of Horizon Europe funding is tied to these Partnerships. For countries to continue increasing their participation in the framework programme, access to European Partnerships will be key, and this will require an increase in national funding. Structural funding could be one solution in those instances where the smart specialisation process of a country aligns with the rationale for participating in European Partnerships.

1.3 Transition Between Current Strategy & New Strategy

The current RIS3 is incorporated as one of the three pillars of the National Research and Innovation Strategy 2014-2020 (The Malta Council for Science and Technology, 2014). The rationale behind this decision was to embed smart specialisation within the national context and also to support the investment in smart specialisation through the other goals of the National Strategy, namely achieving

⁶ <http://www.efiscentre.eu/wp-content/uploads/2020/03/The-Green-Deal-and-Smart-Specialisation-draft-2-v4-final.pdf> [last accessed 26.03.2021]

a comprehensive R&I support ecosystem and achieving a stronger knowledge base. Whilst the importance of embedding RIS3 within the national context is still recognised, a decision by the governance structure (Core Group and Steering Group⁷) was taken in 2019 to have two separate strategy documents that, while remaining synergistic, address different aspects of the research and innovation system in a more holistic manner. By way of a practical example, the approach to internationalisation of identified RIS3 areas may well need to be managed very differently to internationalisation of Malta's R&D in general, hence the importance of separate (but complementary) approaches. That being said, complementarities and synergies will be ensured through a common oversight system for both strategies at the level of the Core Group, Steering Group and the responsible Ministry for Research and Innovation.

The RIS3 2014-2020 process involved a rigorous bottom-up approach and a variety of inputs, which eventually led to the identification of 7 smart specialisation areas, and a cross-cutting enabler.⁸ Malta also committed to follow up the 2014-2020 Strategy with the development of a dedicated Action Plan and the setting up of a tailored monitoring mechanism and to use the next seven years to refine the process, strengthen the EDP and continue homing in on Malta's competitive strengths. Hence, the RIS3 2021-2027 builds on the previous strategy using the experience gained and continues streamlining the selection of priority areas based on past success and lessons learned.

During the review of the RIS3 2014-2020, a SWOT analysis was undertaken as part of the evaluation process in preparation for the new RIS3. The overall economic development context of the country was given due consideration during the SWOT analysis, as well as along the whole design process of the strategy. This was done through consultations with stakeholders responsible for the development of economic policy as well as their inclusion as active members to the Steering Group. Malta Enterprise and the Ministry responsible for the economy and investments were also actively consulted and involved in the Steering Group and Core Group respectively.

The results of the SWOT analysis are shown in Figure 1.1.

⁷ <https://mcst.gov.mt/psi/national-research-innovation-strategy/#1568293707847-40fd0565-c843> [last accessed 26.03.2021]

⁸ RIS3 2014 – 2020 Smart Specialisation Areas are Tourism Product Development, Maritime Services, Aviation & Aerospace, Health with a focus on healthy living and active ageing and e-health, Resource-efficient Buildings, High value-added manufacturing, Aquaculture, and ICT both as an enabler and an innovation area in itself.



FIGURE 1.1 – SWOT ANALYSIS OF THE RIS3 2014-2020 PROCESS

In recent months, the COVID-19 pandemic has thrown policymakers into uncharted territory. Evidence-based policymaking becomes particularly challenging when the data and information available no longer represented the current economic situation. Hence, keeping a separate but complementary national R&I strategy is necessary to ensure that a short-term strategic plan can address any immediate concerns, whilst the RIS3 addresses the medium-term. Whilst the implementation of the RIS3 might be impacted by the pandemic, the rationale behind the identification of smart specialisation areas remains sound, and these economic sectors should be strongly supported for them to continue thriving in the current crisis.

CHAPTER 2

2.1 Methodology

The European Commission's Guide to Research and Innovation Strategies for Smart Specialisation (RIS3) of May 2012⁹ remains the blueprint for countries and regions seeking to develop and/or update their smart specialisation strategy. The Guide provides a stepwise approach for policymakers and implementing bodies on how to prepare for and design, draft and implement national/regional research and innovation strategies for smart specialisation (RIS3). Malta has based the development of its RIS3 2021-2027 on this document. Hereunder is a detailed description of the process undertaken by Malta in line with the RIS3 guidance.

2.1.1 The Analysis of the National/Regional Context and Potential for Innovation

Between 2019 and the first half of 2020, MCST carried out an in-depth desk-based analysis of available relevant statistics and trends, to further expand on the knowledge already generated in the national context and potential for innovation. Data was collected using eCORDA¹⁰, Eurostat¹¹, NSO news releases and data collected directly from stakeholders. Data collected was used to observe trends of various macroeconomic indicators to grab a snapshot of the country's economic landscape; using indicators such as gross domestic product (GDP), gross value-added (GVA), employment, etc. Specific indicators were used to better understand developments in the country's research and innovation ecosystem, including R&D as a percentage of the GDP, the European Innovation Scoreboard, number of researchers and statistics to related R&I programmes. This analysis was important to understand the general economic context and trends, and consequently to start focussing on Malta's most competitive economic sectors that also show strong R&I potential.

2.1.2 The Set-up of a Sound and Inclusive Governance Structure

The governance for the design and monitoring of the entrepreneurial discovery process and implementation of the Smart Specialisation Strategy was set up in 2014 with the launch of the National R&I Strategy 2020. Two groups were set up: the Steering Group (SG) and Core Group (CG). The groups are answerable to the Minister responsible for research and innovation. The rationale for the CG and SG stems from the need to optimise communication and coordination in the implementation of the Strategy to ensure that measures are complementary, and that best use is made of available funds. The Core Group meets at Permanent Secretary level together with the Minister responsible for R&I (or his/her delegate) and is responsible for deciding on priorities for action as well as timeframes,

⁹ <https://s3platform.jrc.ec.europa.eu/documents/20182/84453/RIS3+Guide.pdf/fceb8c58-73a9-4863-8107-752aef77e7b4> [last accessed 26.03.2021]

¹⁰ The external Common Research Datawarehouse, collecting proposal, evaluation and grant management data of all the operational systems automating key business processes around the Framework Programmes, H2020 – FP5

¹¹ Eurostat is the statistical office of the European Union situated in Luxembourg. Its mission is to provide high quality statistics for Europe.

resources and budgets on the basis of recommendations made by the Steering Group. The Steering Group meets at the level of Heads of Public Entities and Organisations or their high-level delegates. MCST, as the entity responsible for the drafting and coordination of research and innovation policy in Malta, ensures that the EDP remains ongoing, collects and analyses required information and acts as the secretariat for both groups. Despite the coordination and co-ownership brought about by the setting up of the Core Group and the Steering Group, a Peer Review in 2019¹² called for further coordination of the governance of Malta's R&I system. The new Ministry responsible for Research and Innovation, set up in December 2020, is a crucial step in addressing the fragmentation of R&I governance.

Within the context of the RIS3, a dedicated implementation set-up, led by the responsible Ministry, will be developed. The Ministry will appoint experts in thematic committees - one committee per thematic area of the RIS3 - to bring together all the relevant actors of the quadruple helix during the implementation stage of the Strategy. These committees will be mandated to continue analysing the needs of each sector to identify key actions for implementation which would unlock the innovation potential of each area as identified in the RIS3. The committees will advise on the operationalisation of the identified thematic priorities by, inter alia, looking at the adequacy of available instruments and potential new measures to make recommendations to the Minister as necessary. The committees will be answerable to the Minister responsible for R&I. The committees will be supported by MCST, who will be investing in building HR capacity in each thematic area. The MCST RIS3 implementation team will provide the secretariat to the committees, and support the committees with technical information as needed. The new team within MCST will also act as an intermediary between the thematic groups, the SG and CG and the various programme managers within MCST. This governance system is further illustrated in the Figure below:

¹² <https://rio.jrc.ec.europa.eu/library/peer-review-maltese-ri-system-final-report> [last accessed 26.03.2021]

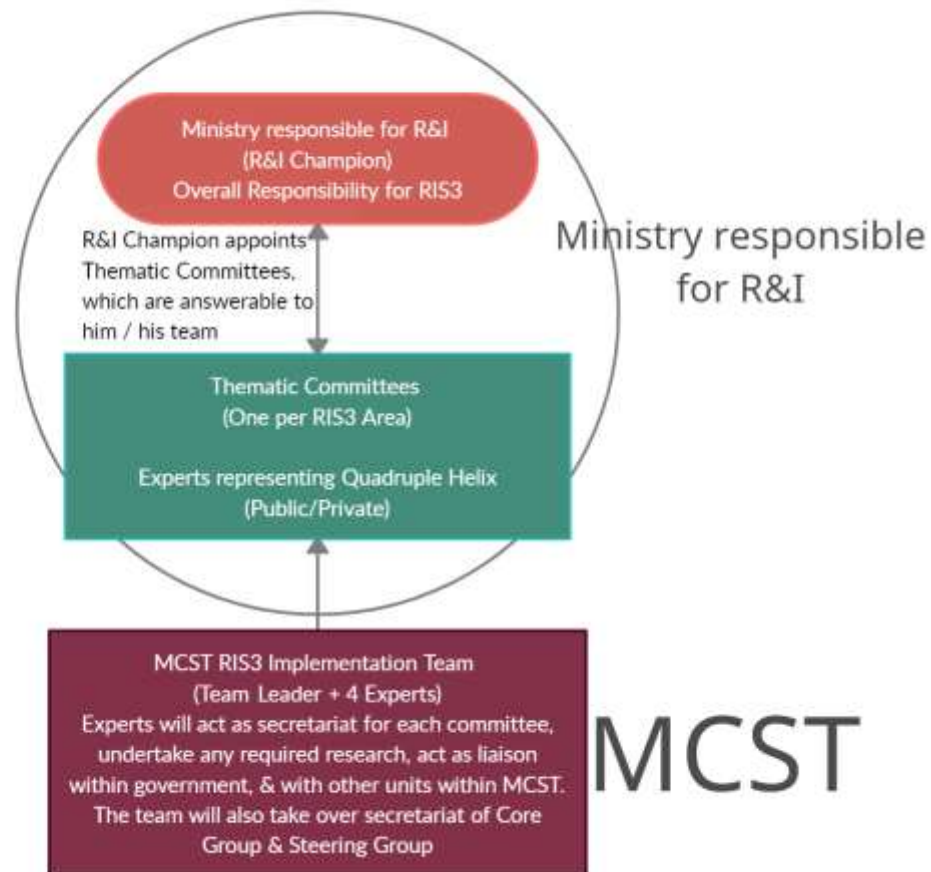


Figure 2.1 – New Governance System for Implementation of RIS3

2.1.3 The Production of a Shared Vision About the Future of the Country/Region

The Core Group and the Steering Group are at the heart of the coordination process. Over time, the Steering Group's composition has been revisited and widened to include more stakeholders to ensure that the groups' work is firmly grounded in the wider economic context of the country. In addition, the ongoing EDP and the extensive consultation with stakeholders further serve as a platform for concretising a common vision on priorities, capabilities and plans, with MCST acting as a bridge between the various stakeholders. This will be further concretised, at the implementation stage, through the new thematic committees under the responsibility of the Minister responsible for R&I, as explained in the previous section.

During discussions, stakeholders also emphasised the importance of marrying economic competitiveness with an economy of well-being during the implementation stage of RIS3; that is, an economy that is person-oriented and addresses the needs of society. This principle was kept at the forefront throughout the EDP. Other guiding principles that shaped the vision were openness and transparency, gender equality and inclusiveness.

2.1.4 The Selection of a Limited Number of Priorities for National/Regional Development

The major part of the EDP undertaken over the past two years was dedicated to the identification of priorities for national development through innovation. This requires striking a delicate balance. As an island microstate with a very open economy, located at the periphery of the European Union, Malta simply cannot afford to put all its eggs into one basket and a balance between under- and over-specialisation remains the holy grail of Malta's RIS3.

A variety of approaches were used to engage with stakeholders to ensure a comprehensive bottom-up, inclusive process involving all actors of the quadruple helix (business, academia, government, and civil society). Previous experience with focus groups and one-to-one meetings revealed that engaging the private sector and civil society was a particularly tough challenge. In order to address this challenge, other methods for engagement were deployed. At the beginning of 2019, an extensive online consultation was carried out aimed primarily towards civil society and the general public. The online questionnaire sought to understand the general public's perspective on how research and innovation can improve their quality of life, which sectors the government should be giving more priority to, and which sectors are most crucial to the country's economy. The questionnaire also directed questions to the private sector to understand which sectors of the current RIS3 2014-2020 were still valid, where their R&I interests lie, and any economic projections for the future years. Almost 400 responses were collected through the survey and this input complemented the information collected from the focus groups. Hence, the EDP was strengthened through this approach.

In addition, a dedicated consultative event was organised for the private sector, held after business hours. This was very well attended (75 companies and business representatives) and the private sector stakeholders indicated that consultation sessions after business hours are preferable to avoid business disruption during the working day. During the private sector event, a speed-dating style set-up was used, where small groups of randomised companies were brought together for 15 minutes to discuss their views on the R&I potential of the country, their interests, the competitiveness of their respective sectors and whether there are any barriers and obstacles to innovation and innovation diffusion that can be addressed.

Thematic focus groups and one-to-one meetings with key stakeholders were then held to engage primarily with academia, government entities, and also, as far as possible, the private sector. Between May and September 2019 one-to-one meetings were held with academics and government entities. In November 2019, thematic focus groups for all stakeholders were held on the proposed new smart specialisation areas to determine whether the evidence-based analysis was on the right track, as well as to kick off a discussion identify specific niche areas of focus. In total, over 200 meetings were held between April 2019 and March 2020 as part of this process, in order to ensure that all actors of the quadruple helix were adequately involved in the bottom-up strategy process.

Once the broad priority areas were identified, further in-depth analysis was carried out to identify niches of investment for specialisation. This was carried out by a thorough study of each sector, as well as bilateral meetings with key stakeholders within the sector. Niche areas for investment were identified based on R&I capacity, market potential, internationalisation potential and overall competitiveness. Further one-to-one meetings with key players were carried out between December 2019 and February 2020 to complete this exercise.

The first draft of the Vision¹³ for a new RIS3 was published by MCST in March 2020 for public consultation. The response was overall positive, and many comments, suggestions and critiques were received that helped shape the final RIS3.

The timeline is explained in detail in Figure 2.2.

¹³ https://mcst.gov.mt/wp-content/uploads/2020/03/Towards-a-RIS3-2021-2027-for-Malta_March-2020_Public-Consultation-Document.pdf [last accessed 26.03.2021]

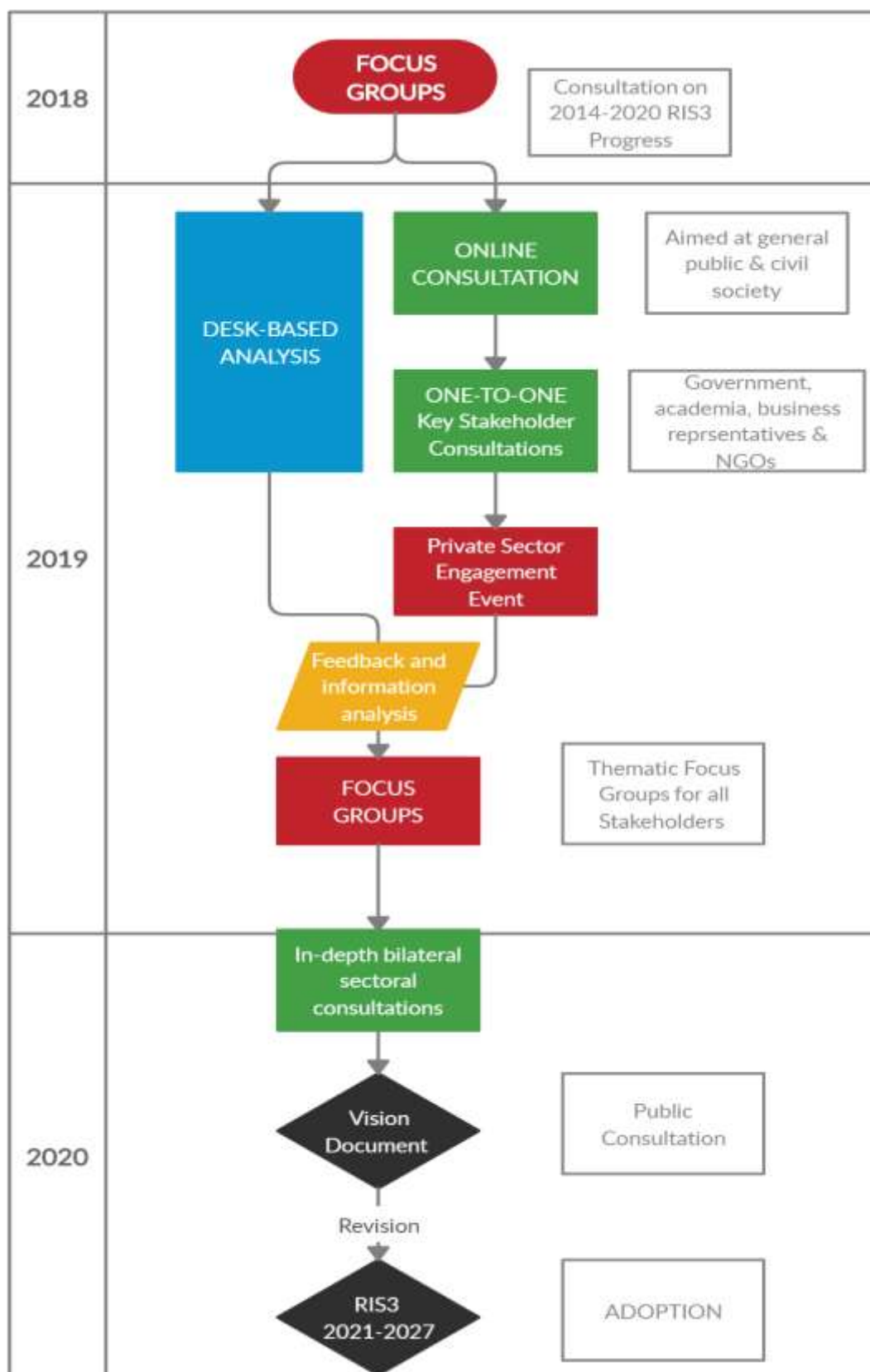


FIGURE 2.2 - METHODOLOGY AND TIMELINE OF THE RIS3 2021-2027 PROCESS

2.1.5 The Establishment of Suitable Policy Mixes

Once priority areas are selected, a suitable policy mix is needed to ensure effective and concerted implementation of the RIS3. Structural funds are of course a central tool to achieve the goals identified in each area, however in isolation, they are not enough. For a country, or region, to ensure impact, a coordinated effort is needed to consolidate national efforts and achieve the desired outcomes of smart specialisation. The policy mix may also need to go beyond financial instruments to measures that focus on human resource capacity and skills, policies that support sectoral transformation and the promotion of entrepreneurship. Whilst this strategy puts forward recommendations on how the policy mix can be achieved, complementary strategies and actions will be needed for Malta's RIS3 to achieve its full potential. The new governance system in place will be crucial to this end.

2.1.6 The Integration of Monitoring and Evaluation Mechanisms

As part of the National R&I Strategy 2020, a comprehensive monitoring system was set up, which encompassed a monitoring system for the RIS3. This being the first monitoring system established for gathering research and innovation data in Malta, a lot of work went into the gathering of the baseline information and the identification of suitable indicators. A set of seven headline indicators was established by the 2020 Strategy to monitor the overall inputs and outputs of the national R&I system. This was complemented by a comprehensive set of indicators covering the three Pillars and Action Lines of the Strategy which was identified with the support of the European Commission's Horizon 2020 Policy Support Facility (PSF). Data is collected from NSO, Eurostat as well as directly from stakeholders.

The first national R&I monitoring report for Malta¹⁴ was issued in 2019, covering data collected between 2014 and 2018. This compares the latest available figures with the 2020 targets for these indicators. Several recommendations are made regarding the indicators at Action Line level since data confidentiality and the restructuring of data sources (such as the Community Innovation Survey) were major obstacles in the data collection process. This was especially noted for the Smart Specialisation Areas. These obstacles made it difficult to reach robust conclusions and improvements to the system will be required in future reports.

The monitoring system is being adapted to the needs of the new RIS3 and remains an important input to the feedback loop of the governance system and EDP, as described in Chapter 6.

An image summarising the EDP process is shown in Figure 2.3.

¹⁴ <https://www.plumtri.org/node/797#> [last accessed 26.03.2021]

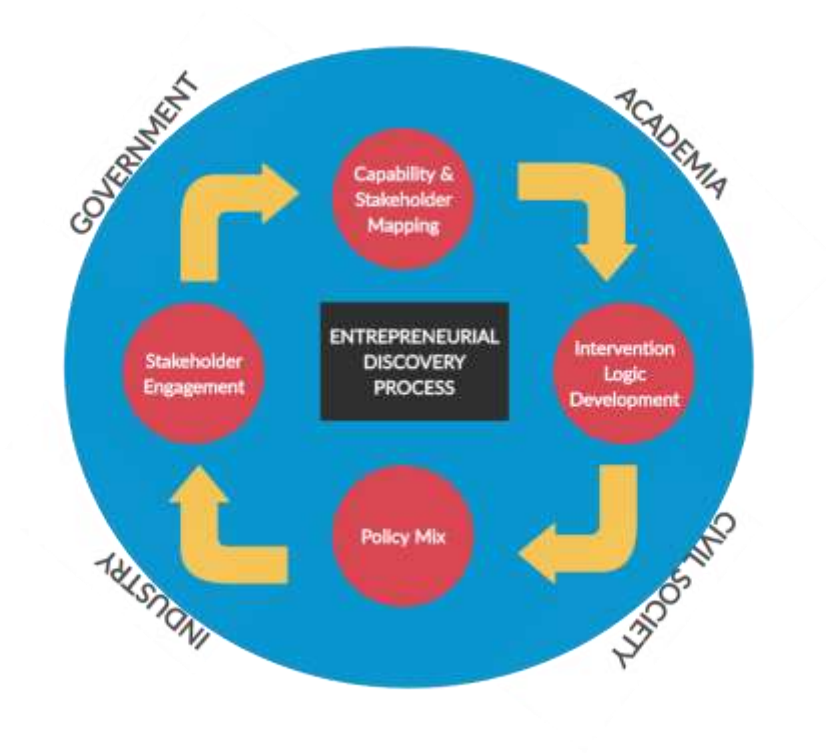


FIGURE 2.3 – THE ENTREPRENEURIAL DISCOVERY PROCESS

CHAPTER 3

3.1 Analysis

This Chapter provides an overview of the various sources of intelligence and insights which together provide the rationale for the identification of Malta's smart specialisation areas. The first part of the analysis is based on the desk study through the collection of data and statistics. This section is split into an analysis of macroeconomic indicators that gives an overarching view of the Maltese economic situation, and analysis of microeconomic indicators that give an understanding of the R&I context and ecosystem. The second part of the analysis relies more on the entrepreneurial discovery process, putting together a more comprehensive understanding through the collection of qualitative information and data that a desk-based analysis cannot provide. Quantitative data alone has its limitations, especially since data availability is not instant and can give a snapshot only up to a certain point in time (2018). The EDP is ongoing and information was collected for this analysis up to 2020. All quantitative data in this document was last updated from data sources in June 2020.

3.1.1 Desk-based Analysis – Macroeconomic Indicators

The rationale for the desk-based analysis was two-fold: to understand Malta's economic situation at a macro and micro level as well as to understand the changes that have taken place over time, particularly during the implementation of the RIS3 in 2014-2020. This was done by collecting data on various macroeconomic indicators that together provide a picture of Malta's evolving economy and workforce.

Overall, Malta's Gross Value-Added (GVA), a measure of value of goods and services, has steadily increased over time. Between 2010 and 2019, the GVA has doubled, showing that the country's economic productivity has increased. In 2020 Malta experienced a decrease in its GVA, which was to be expected due to the pandemic. This contraction in GVA was mainly due to a drop of 6.7% in Services (NACE sections G to U) in volume terms. Industry (NACE sections B to E) and Agriculture and fishing (NACE section A) declined by 1.0% and 10.7%, respectively. The drop in Services was mainly driven by the following sectors: Accommodation and food service activities (-64.7%); Transportation and storage activities (-43.1%); Wholesale and retail trade activities (-9.9%); and Administrative and support services activities (-10.7%)¹⁵. A comparison is done between 2010 and 2019, to show the trends in Malta's gross value-added before the pandemic (Figure 3.2) as well as a comparison between 2019 and 2020, to observe an additional impacts possibly due to the pandemic (Figure 3.3).

¹⁵ https://nso.gov.mt/en/News_Releases/Documents/2021/03/News2021_040.pdf [accessed on 28.09.2021]

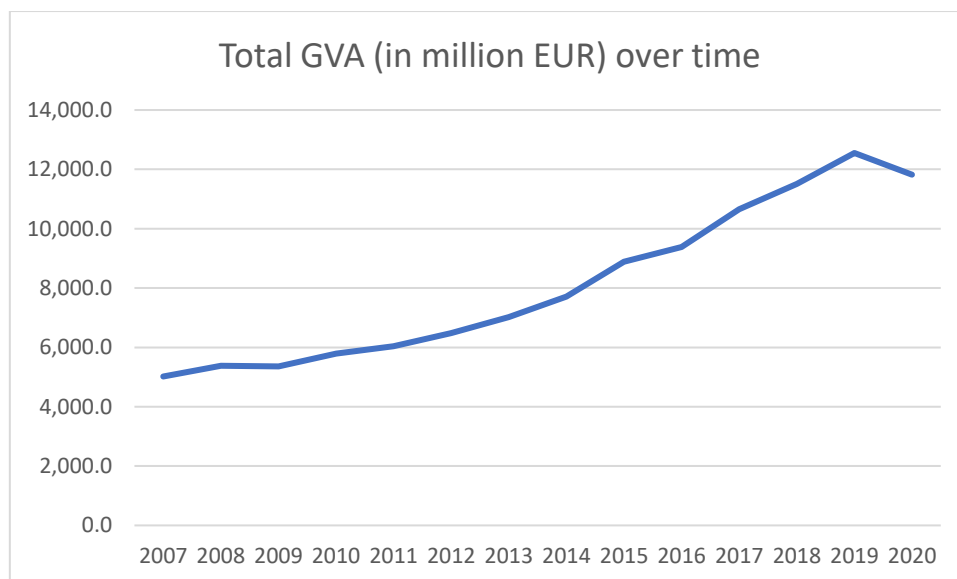


FIGURE 3.1 – TOTAL GVA IN MILLION EURO BETWEEN 2007 AND 2020

Over the past decade, the Maltese economy continued undergoing a gradual change from manufacturing to services. In 2000, the share of Gross Value Added in industry (manufacturing and water supply, sewerage, waste management and remediation activities – NACE codes C + E) was 24%. By 2011, it had gone down to 14% and in 2019, it decreased further to 9%. The Gross Value-Added of the Services sector (professional, scientific and technical activities; and support service activities – NACE codes M + N) exhibited the opposite trend (2000 – 5%, 2011 – 9%, 2019 – 15%) over the same time period. Most other economic sectors remained relatively stable over time. When analysing the employment distribution as a percentage by sector, similar trends to those observed in the GVA data can be noted. However, traditional sectors like manufacturing for example, still contribute significantly to Malta's economy, as in 2020 the GVA of the sector was 981.4 million Euro, and it is the sector contributing to the majority of our island's exports.¹⁶

The changes observed in the share of Gross Value Added are also reflected in the statistics for employment when compared over time. However, contrary to the GVA, employment trends between 2019 and 2020 did not show any drastic change and hence, a comparison of change in employment over time is shown in Figure 3.4.

¹⁶ <https://www.maltachamber.org.mt/en/why-manufacturing-in-malta-still-matters> [last accessed 26.03.2021]

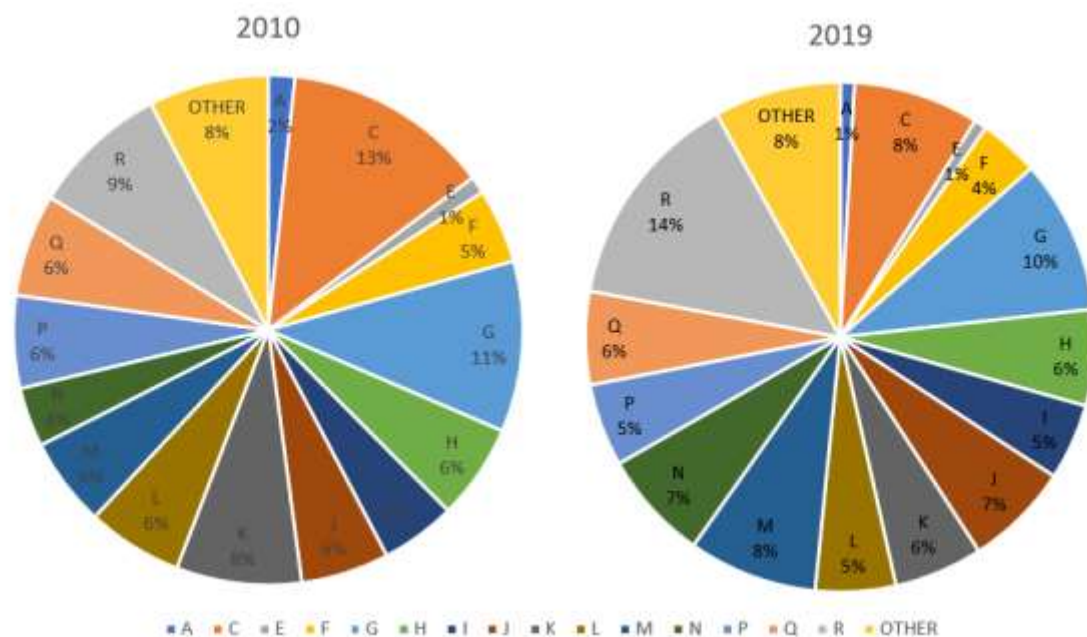


FIGURE 3.2 - CHANGE IN SHARE OF GROSS VALUE ADDED OVER TIME IN THE MALTESE ECONOMY (2010 – 2019)¹⁷

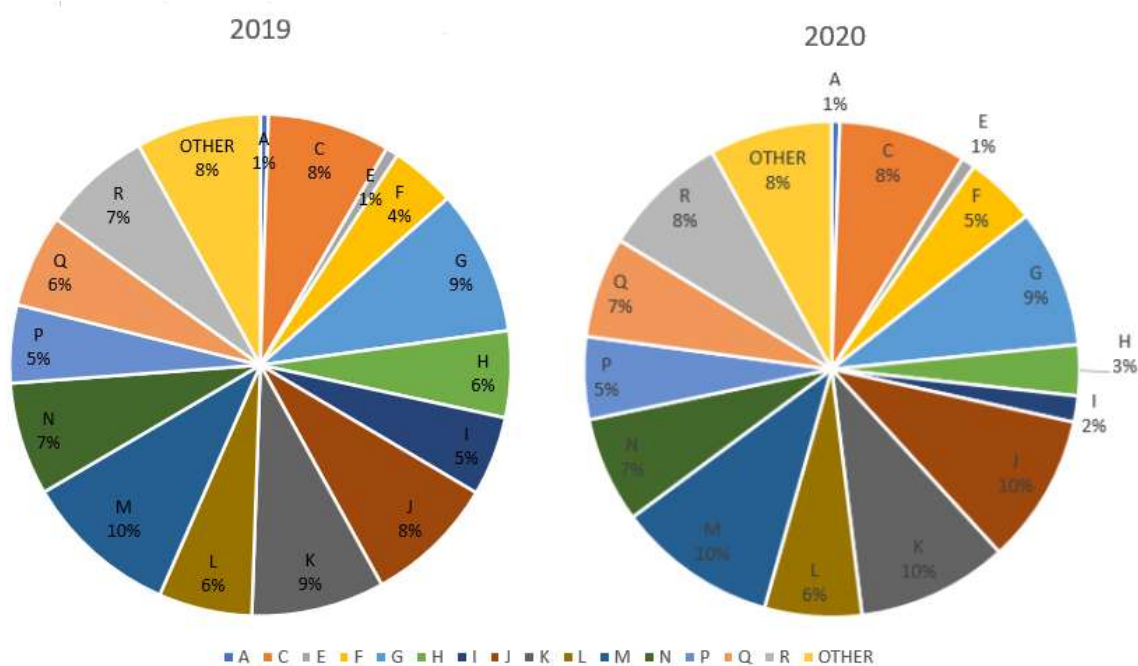


FIGURE 3.3 - COMPARISON IN SHARE OF GROSS VALUE-ADDED MALTA (2019 – 2020)¹⁷

¹⁷ LEGEND: A – Agriculture, forestry & fishing; C – Manufacturing; E – Water supply, sewerage, waste management and remediation activities; F – Construction; G – Wholesale and retail trade; repair of motor vehicles and motorcycles; H – Transportation and storage; I – Accommodation and Food service activities; J – Information and Communication; K – Financial and Insurance Activities; L – Real Estate Activities; M – Professional, scientific and technical activities; N – Administrative and support service activities; P – Education; Q – Human health and social work activities; R – Arts, entertainments & recreation

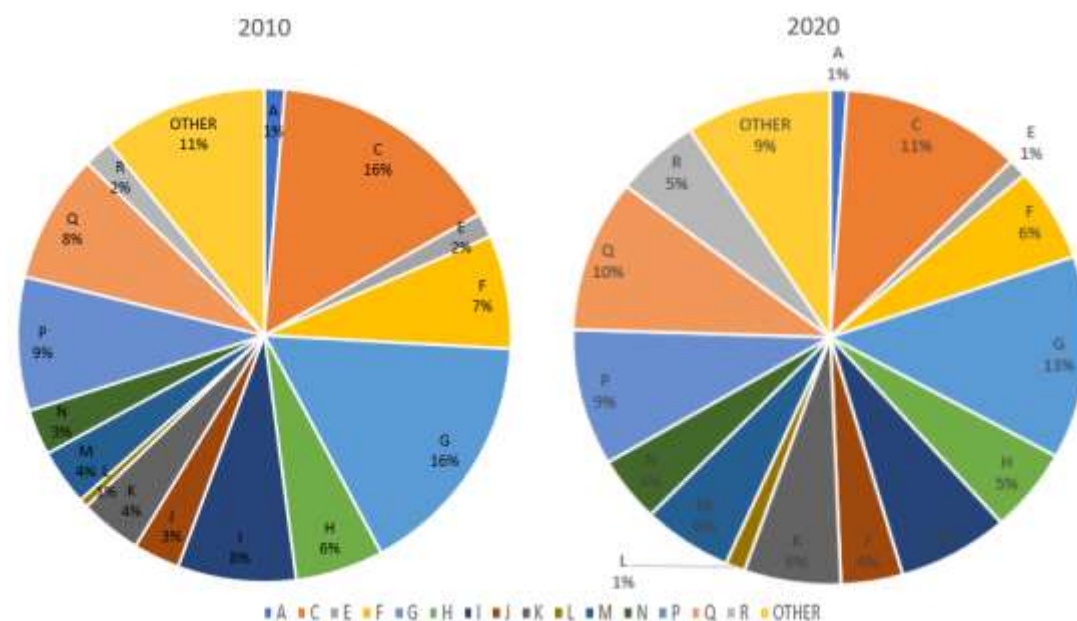


FIGURE 3.4 - COMPARISON IN SHARE OF EMPLOYMENT IN MALTA (2010 – 2020)¹⁷

One of the common indicators used to measure the strength of a country in terms of R&D is the R&D expenditure as a percentage of GDP (Gross Domestic Product). Whilst Malta's GDP has increased at a very quick rate over the last five years, this cannot be attributed to increased investments in R&D. From 2010 to 2015 expenditure as a percentage of GDP is seen to have been increasing, and then investments seem to have plateaued. The last available data shows an expenditure of 79.77 million Euro (provisional data for 2019).

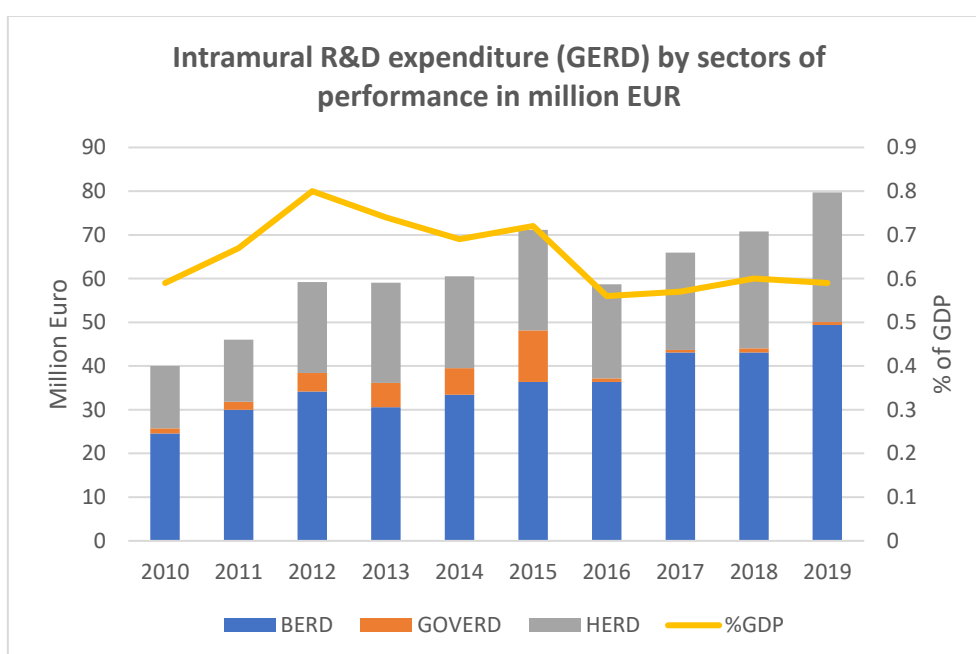


FIGURE 3.5 - INTRAMURAL R&D EXPENDITURE BY SECTORS OF PERFORMANCE IN MILLION EURO, AND A LINE GRAPH SHOWING R&D EXPENDITURE AS A PERCENTAGE OF GDP

As noted in Figure 3.5, the largest share of R&D expenditure is invested by the business sector (BERD) which has slowly but surely increased over the years. R&D expenditure by the Higher Education Sector (HERD) has remained rather constant since 2012, and Government R&D expenditure (except for 2015 due to one-off capital expenditure) remains very small.

3.1.2 Desk-based Analysis – Microeconomic Indicators

This section presents a select number of microeconomic indicators that give an overview of Malta's current research and innovation system, and that were particularly relevant to the development of the Smart Specialisation areas. For a more in-depth review, the first national R&I monitoring report was published in 2019.¹⁸

On a more granular level, business R&D expenditure on R&D increased in several sectors between 2010 and 2018. Notable exceptions are manufacturing (NACE Code C), construction (NACE Code F), and transportation and storage (NACE Code H).. No investments in R&D were made by the accommodation and food service activities (NACE Code I), real estate activities (NACE Code L), administration and support service activities (NACE Code N), Education (NACE CODE P), Human health and social work activities (NACE Code Q) and Arts, entertainment and recreation (NACE Code R)

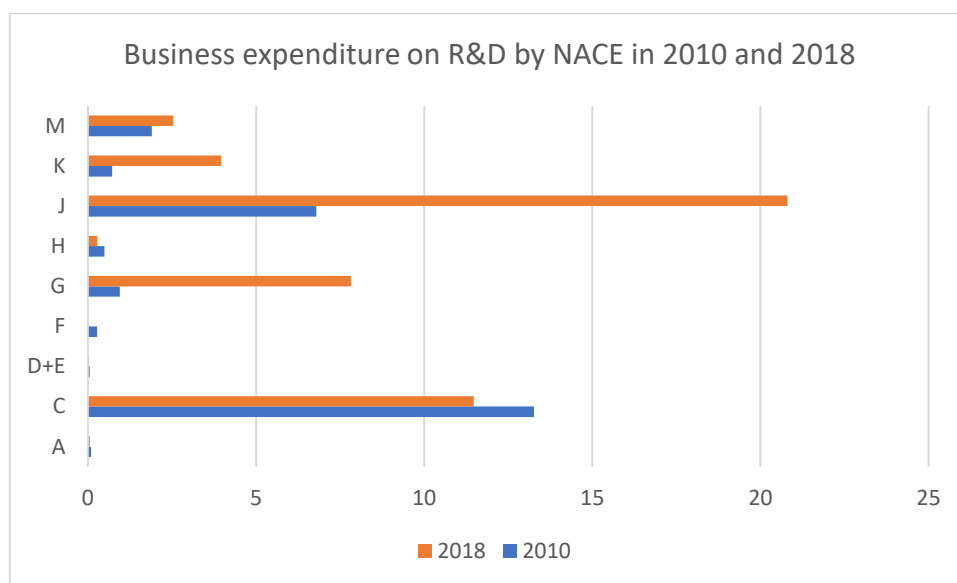


FIGURE 3.6 - BUSINESS EXPENDITURE ON R&D BY SECTORS OF PERFORMANCE IN MILLION EURO (2010 – 2018)¹⁹

To better understand R&D activity in the private sector, the total number of R&D personnel and researchers in business enterprise sector by NACE Rev. 2 activity can be analysed in full-time equivalents (FTE). When noting the change over time, the number of personnel and researchers has

¹⁸ <https://drive.google.com/file/d/1R1sH8A1ZCduLPOHbgAYEmC92aBmBvXK5/view> [last accessed 26.03.2021]

¹⁹ LEGEND: A – Agriculture, forestry & fishing; C – Manufacturing; D - Electricity, gas, steam and air conditioning supply; E - Water supply, sewerage, waste management and remediation activities; F – Construction; G - Wholesale and retail trade; repair of motor vehicles and motorcycles; H - Transportation and storage; J - Information and Communication; K - Financial and Insurance Activities; L - Real Estate Activities; M - Professional, scientific and technical activities; R – Arts, entertainments & recreation

remained more or less stable, as can be seen in Figure 3.7 (Data for 2019 was provisional when last accessed on 5 October 2021).

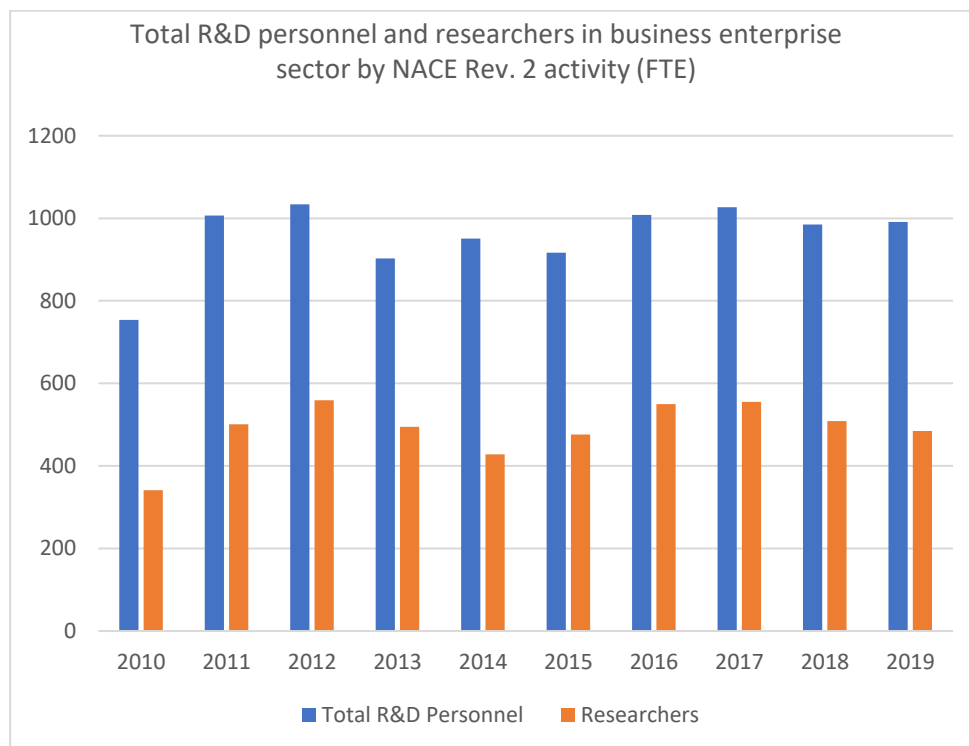


FIGURE 3.7 - TOTAL R&D PERSONNEL AND RESEARCHERS IN BUSINESS ENTERPRISE SECTOR (FTE 2010 – 2019)

The economic sectors employing most R&D personnel and researchers are manufacturing (C), Information and Communication (J) and Professional, scientific and technical activities (M). The data is presented in Figure 3.8.

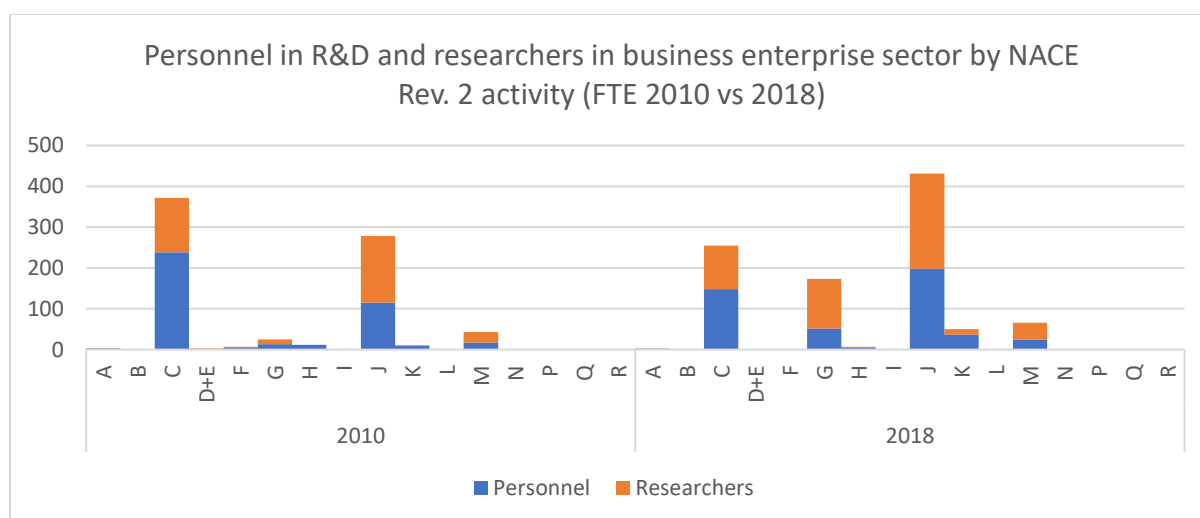


FIGURE 3.8 - PERSONNEL IN R&D AND RESEARCHERS IN BUSINESS ENTERPRISE SECTOR BY NACE REC. 2 ACTIVITY (FTE 2010 vs 2018)²⁰

²⁰ LEGEND: A – Agriculture, forestry & fishing; C – Manufacturing; D - Electricity, gas, steam and air conditioning supply; E - Water supply, sewerage, waste management and remediation activities; F – Construction; G - Wholesale and retail trade;

A strong research base is a pathway to a stronger innovation community. A thriving research community will also develop certain essential skills that lead to an entrepreneurial and innovative workforce, and hence, the number of PhD holders is a telling indicator. The number of PhD holders in Malta has been steadily increasing over the past years, in both real terms and when expressed as a percentage of the active population (refer to Figure 3.9 hereunder). The human capital with research skills within the Maltese workforce is growing.

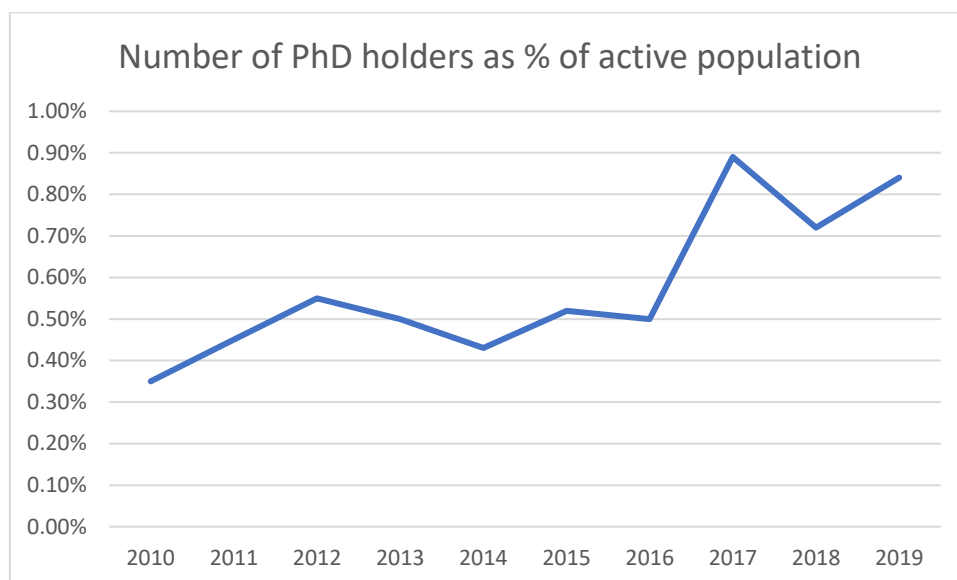


FIGURE 3.9 - DISTRIBUTION OF THE NUMBER OF PhD HOLDERS AS A PERCENTAGE OF THE ACTIVE POPULATION

Malta does well and is rather successful in collaborating with countries on research and innovative projects, as indicated in the Horizon 2020 data in Figure 3.10. This data shows that Maltese stakeholders are interested in participating in internationalisation initiatives. This is expected and understandable given the very small size of the local research community and the ensuing importance of collaborating and connecting with counterparts abroad.

No of signed Grant Agreements with MT participants	186
MT participants	250
Total EU Net funding for MT (Net SMEs contribution)	€ 36.716 million (€ 7.5 million)
MT success rate	13.94%
EU28 success rate	15.29%

repair of motor vehicles and motorcycles; H - Transportation and storage; J - Information and Communication; K - Financial and Insurance Activities; L - Real Estate Activities; M - Professional, scientific and technical activities; R – Arts, entertainments & recreation

FIGURE 3.10 - DATA SHOWING MALTA'S PARTICIPATION IN THE EUROPEAN R&I FRAMEWORK PROGRAMME HORIZON 2020, UP TO SEPTEMBER 2021

When analysing further the participation of Malta in the R&I Framework Programme, Horizon 2020, Maltese researchers have a higher interest and success rate in obtaining funded projects under certain thematic work packages than others. Malta is most successful in securing funding under “secure, clean and efficient energy”, “food security, sustainable agriculture, and forestry, marine and maritime and inland water research”, “climate action, environment, resource efficiency and raw materials” and “information and communication technologies”.

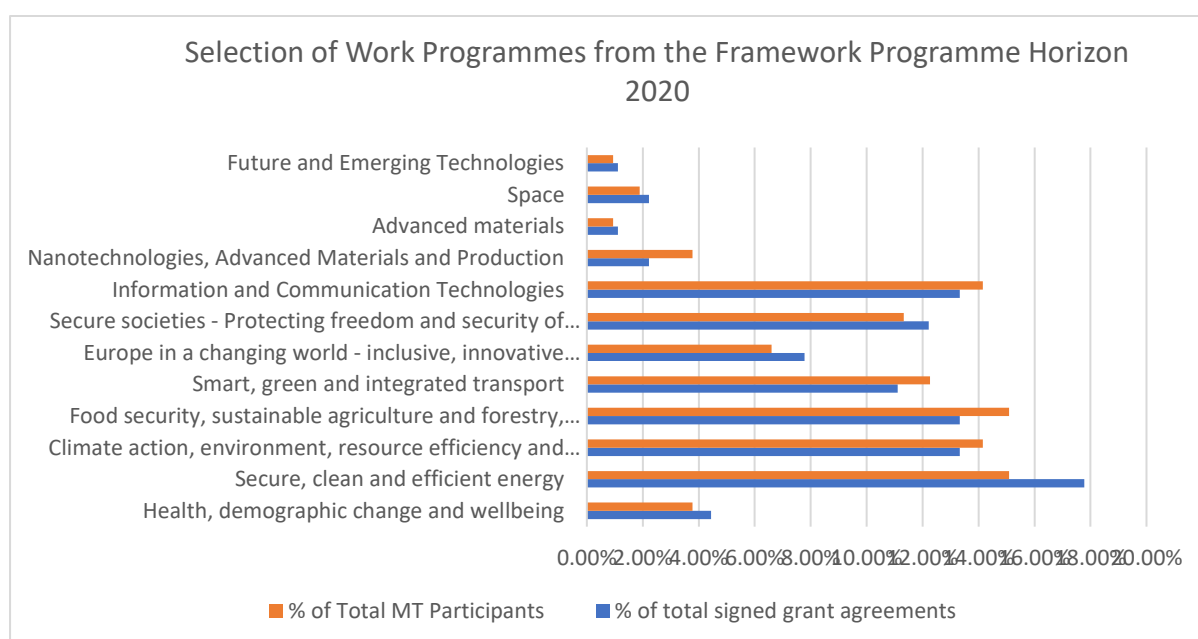


FIGURE 3.11 - DATA SHOWING MALTA'S PARTICIPATION AND NUMBER OF GRANT AGREEMENTS SIGNED UNDER SELECTED THEMATIC AREAS IN THE EUROPEAN R&I FRAMEWORK PROGRAMME HORIZON 2020, UP TO SEPTEMBER 2021

Another measurement tool for Malta's innovation performance is the European Innovation Scoreboard,²¹ a composite indicator that has placed Malta as a “moderate innovator” over the past decade. The measurement framework of the EIS comprises four main categories, namely Framework Conditions, Investments, Innovation activities and Impacts. These in turn are described by a total of 10 innovation dimensions which capture a total of 27 indicators. Between 2014 and 2021, Malta has improved its performance by 14.9%²¹ For each year, a composite Summary Innovation Index is calculated as the unweighted average of the rescaled scores for all indicators where all indicators receive the same weight (1/27 if data are available for all 27 indicators). Malta registered a high performance in comparison to other Member States for environmental sustainability, use of information technology and intellectual assets. Improvements in performance since 2017 have been observed in Broadband penetration, foreign doctorate students, and Innovative SMEs collaborating

²¹https://ec.europa.eu/docsroom/documents/46013_ [last accessed 05.10.2021]

with other. On the other hand, Malta ranked low in its performance in in-house product innovators without market novelties and Innovators that do not develop innovations themselves.

3.1.3 Analysis of Feedback Gathered through the EDP

As explained in the Methodology, the feedback gathering exercise was very extensive. The qualitative data collected was used to contextualise further the quantitative data and trends which emerged from the economic mapping exercise. This section provides an overview of the main outcomes of each step of the EDP, and how the qualitative results which were gathered contributed to the selection of the priority areas for smart specialisation.

Online Consultation

The purpose of the online consultation was twofold – to ensure that civil society and organisations could participate in the consultative process for the new RIS3, and for MCST to get a better understanding of society's perception of the impact of research and innovation.

Regarding the first objective, the online consultation process was successful in engaging the private sector, organisations and citizens that would otherwise not have attended dedicated meetings, workshops or focus groups during typical business hours (248 respondents). Whilst turnout for the organised consultations was always positive, the online consultation served to extend the reach to a much larger pool of stakeholders and respondents. While being aware that the number of respondents (248) cannot be deemed as statistically representative of civil society as a whole; nonetheless some interesting insights emerged.

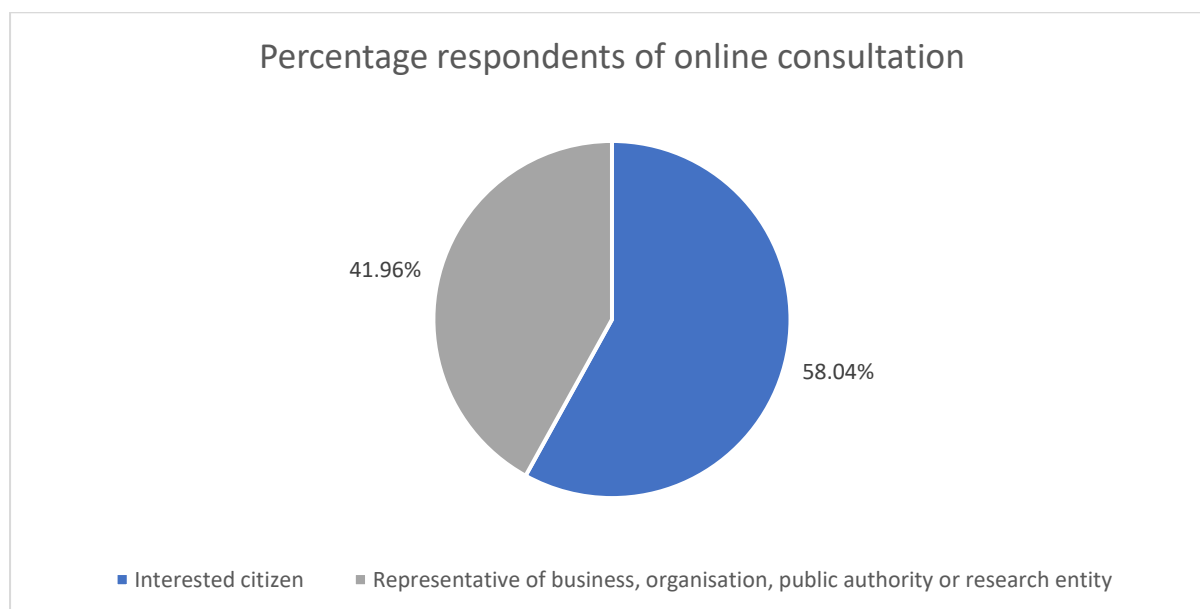


FIGURE 3.12 - DISTRIBUTION OF RESPONDENTS TO THE ONLINE CONSULTATION IN 2019

The online consultation, together with other methods of collection of qualitative information, helps to put together the public's perspective on the issues that citizens and private organisations feel are affecting their quality of life, and sectors where R&I can help address certain challenges. With the push (even from a European and global level) to focus investments in R&I not only for economic growth,

but also to address the Sustainable Development Goals and to support European Grand Challenges and missions, it is important that on a national level, Malta also seeks to bridge the gap between investing in sustaining the economy and addressing our country's needs.

From this consultation, when analysing the areas where respondents think investments should be made to improve their quality of life, 76.24% selected renewable energy. Other related areas that can be clustered under "sustainable environment" were also a preferred choice: environment (63.37%), pollution (59.41%), sea quality (45.5%), scarce drinking water (32.67%) and marine solutions (30.69%). Land traffic management (51.59%), over-population (45.54%), over-built cities (41.58%) and smart cities (41.58%) are another cluster of related fields that were highly selected as important areas of investment. When looking at the cluster of areas related to technology, most of which in the current Smart Specialisation Strategy 2014-2020, the preferred area of investment was in healthcare (48.51%), followed by food and water production (40.59%). Other technology areas were ranked rather low on the respondents' priority list, such as aviation and better tourism products. Under the section "other", respondents listed additional areas such as education, planning of development, quantum technologies, customer service and the judicial system.

In addition, survey respondents were asked what Malta's future smart specialisation areas could be, based on Malta's R&I potential. This was an open question and hence responses were varied, however, they can be split into 8 main areas. The majority of respondents suggested areas that fall under "advanced digital technologies", and areas ranged from cryptocurrency, blockchain, fintech, artificial intelligence, applied space technologies and gaming. Other groups of sectors that received several responses include "health", "energy", "marine/blue biotechnology", "sustainability" and "transport/infrastructure". Within the "health" area various related activities were suggested, mainly medical devices, drug research development, personalised medicine, medical cannabis, clinical trials, biobanking, genetics and health tourism. "Energy" topics focused mainly on offshore storage deployment, renewable energy, efficiency and grid stability. Regarding the marine sector, respondents said that the current sector, maritime services, is too narrow and should be broader to include marine science, maritime in general, and blue biotechnology. Sustainability is very wide and therefore included a variety of responses, such as pollution, environment protection, sustainable development, waste management and the circular economy. Areas of interest within the transport/infrastructure sector include electric transportation, more sustainable urban development, connectivity and road construction.

Other sectors mentioned, but to a lesser extent, could be grouped under "agriculture" and "high value-added manufacturing". In the former, respondents also mentioned developments in food and water technology, and in the latter respondents also commented on the necessity to move towards Industry 4.0. Some respondents also mentioned some cross-cutting themes that require investment; education and human resource and capital.

A positive spill-over of this online consultation was that individuals and organisations that are not normally in touch with MCST became aware of the Council's work. The consultation also served to raise awareness of the relevance of research and innovation in everyday life. This is an important outcome as it strengthens the EDP over time and encourages further participation in workshops and focus groups by civil society.

Focus Groups

As indicated in the methodological timeline, the focus groups specifically targeting the development of the new RIS3 started in 2018, with a kick-off event in November 2018 focused on a review of the smart specialisation strategy of 2014-2020. Discussions with stakeholders representing the quadruple helix centred on the progress of each of the selected priority areas, the status of implementation, and whether the rationale for choosing the areas in 2013 was still valid or otherwise. The focus groups revealed that whilst some areas remain of priority for Malta and have indeed a strong R&I potential, other areas had not developed as envisaged and therefore, a revision was necessary.

Areas that still had merit included health, ICT and manufacturing, but further understanding of these sectors was necessary to identify the right level of specialisation that holds most promise to achieving the desired impact through investment in research and innovation. Other areas such as tourism product development, maritime services and aquaculture, were less successful. Discussions concluded that certain areas like aquaculture were too specialised and Malta lacked the critical mass to achieve a significant impact, whilst a competitive economic sector like maritime services lacks R&I capacity and experience. Discussions also concluded that whilst the tourism sector in Malta is the largest sector contributing to the economy, the R&I capacity and participation in projects remained very low.

All focus groups organised through the consultation process were on open invitation to all interested stakeholders, with no restrictions of any kind. This was done to ensure that all those who registered interest in participation could indeed do so.

One-to-one Meetings

Between April and June 2019, and then again between December 2019 and February 2020, close to 200 one-to-one meetings were held with key actors of the quadruple helix, mainly government entities and ministries, as well as organisations representing enterprise, and individual enterprises to further specialise within the proposed smart specialisation areas. Apart from discussing R&I within the country's economic context and gaining an understanding of the direction in terms of investment in various sectors, the exercise was also fruitful for the identification of overarching issues and obstacles to undertaking R&I in Malta.

From a more general perspective, stakeholders brought up issues related to access to finance for the private sector to carry out R&D, the lack of funding towards higher education to carry out basic research, the fragmentation and extra bureaucracy when applying for funding, the complicated R&I funding landscape, outdated or lack of clear regulation in certain sectors, and lack of skilled personnel. The private sector commented on the importance for incentives to be designed to attract home-grown SMEs and provide grants rather than purely fiscal incentives.

Government entities observed a general reluctance from industry to invest in research and innovation, as observed through the insufficient take-up of most incentives. Malta should focus on industries that are agile, more knowledge-based and do not require large infrastructure. Organisations representing businesses explained that Malta's industry capacity seems to be geared more towards development rather than research and the country lacks critical mass in most economic areas, with the exception of the health and manufacturing sectors.

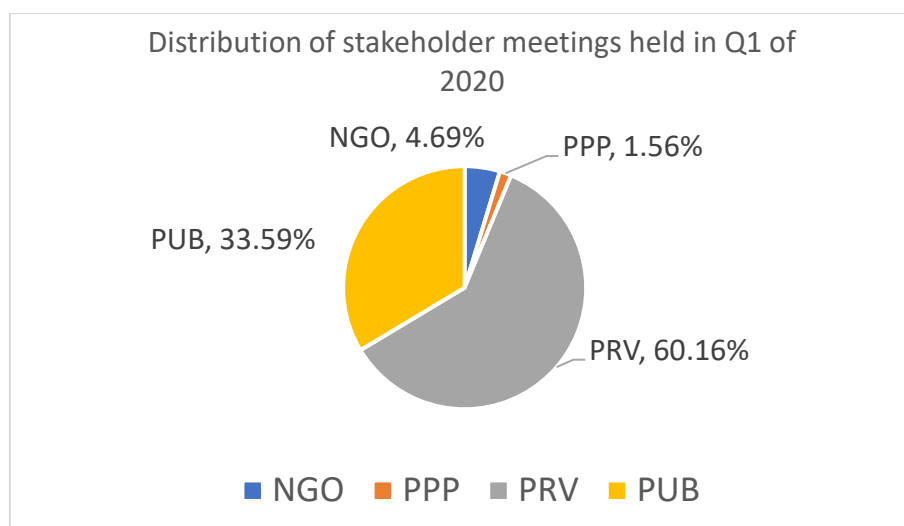


FIGURE 3.13 - DISTRIBUTION OF STAKEHOLDER MEETINGS HELD IN Q1 OF 2020

Private Sector Engagement Event

Although the online surveys and consultation events were successful, a more in-depth outreach was considered necessary to ensure that the private sector participates actively in the EDP. Therefore, a dedicated event was organised for the private sector that was outside typical business operating hours and hence, provides a platform for discussion and networking that the focus groups and one-to-one meetings could not provide. Apart from time dedicated to networking, round table sessions were organised in a speed-dating format, whereby participants discussed relevant topics on R&I for 20 minutes, rotating each time to discuss and meet with new companies representing different sectors. A total of 75 companies, representing a variety of economic sectors, registered for the event. From the priority area perspective, strong political and industry support was provided for manufacturing, pharmaceuticals, health, ICT, artificial intelligence, blockchain and sustainability. Many of the outcomes from this session reflect the outcomes of the one-to-one meetings, further strengthening the results obtained through the consultative process, namely the need for more dedicated support for businesses to innovate, less bureaucracy, more funds with short timeframes to grant and more support for training the workforce.

Thematic Area Focus Groups

After gathering all feedback, information and data between 2018 and September 2019, a preliminary analysis identified certain sectors that could be the priority areas for the RIS3 2021-2027. These were: High value-added Manufacturing, Health, Digital Technology and Space, Marine and Blue Biotechnology and Resource Efficiency. Therefore, in November 2019, thematic focus groups were held in each of these general sectors open to all stakeholders of the quadruple helix, to identify whether these areas were indeed reflective of the feedback received and, how to further identify specialisations within these broad areas. An additional focus group was held for any “other” areas that might have been overlooked. Whilst turnout for these thematic sessions was positive and stakeholders actively discussed and provided invaluable insight and guidance, it was felt that the private sector was not well represented enough. Therefore, it was decided that additional consultations would be held in the first quarter of 2020, to ensure sufficient participation. The additional consultations were also fruitful to identify the “niche areas” within each smart specialisation sector where Malta could really

have a significant impact in terms of R&I competitiveness. Between January and March 2020, over 150 meetings were held for this purpose.

Common Outcomes

Throughout the focus groups and many one-to-one meetings, stakeholders were asked to comment on their experience when dealing with challenges for innovation diffusion and digitalisation, and the internationalisation potential of their particular field or sector. On **innovation diffusion**, the overwhelming majority of participants said that a new RIS3 and complementary R&I strategic plan should first focus on overcoming the hurdles related to delivering innovation and bringing a new product or service to market. Whilst there is a good number of incentives and support to carry out research and innovation up to Technology Readiness Levels (TRLs)²² 6 or 7, companies, particularly SMEs and start-ups, argue that more support is necessary to actually move beyond the prototype stage and successfully bring their innovation to the market, that is, to level 9. Whilst every sector or priority areas have different requirements, this hurdle seems to be common across the board and therefore merits attention throughout the implementation of this strategy.

On **digitalisation**, stakeholders agreed that in order for Malta's economy to continue thriving and also overcome the impact of the COVID-19 pandemic, it will be vital for all actors of the quadruple helix, but especially the private sector, to embrace the industrial transition, increase the use of digital technology and adapt their business models accordingly. The extent to which this statement can be applied to the various priority sectors selected varies according to the unique characteristics of that sector and is dealt with in more detail in Chapter 4.

First Public Consultation

Based on the desk-based analysis as well as the various forms of stakeholder consultations undertaken, an initial vision document was published by MCST in March 2020, putting forward the proposed priority and niche areas for public consultation. The document "Towards a Smart Specialisation Strategy 2021-2027 for Malta"²³ was made available for public feedback between March 24th and April 9th and was widely disseminated on all MCST's platforms. The areas presented for the public consultation were the following:

²² https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf [last accessed 26.03.2021]

²³ https://mcst.gov.mt/wp-content/uploads/2020/03/Towards-a-RIS3-2021-2027-for-Malta_March-2020_Public-Consultation-Documents.pdf [last accessed 26.03.2021]

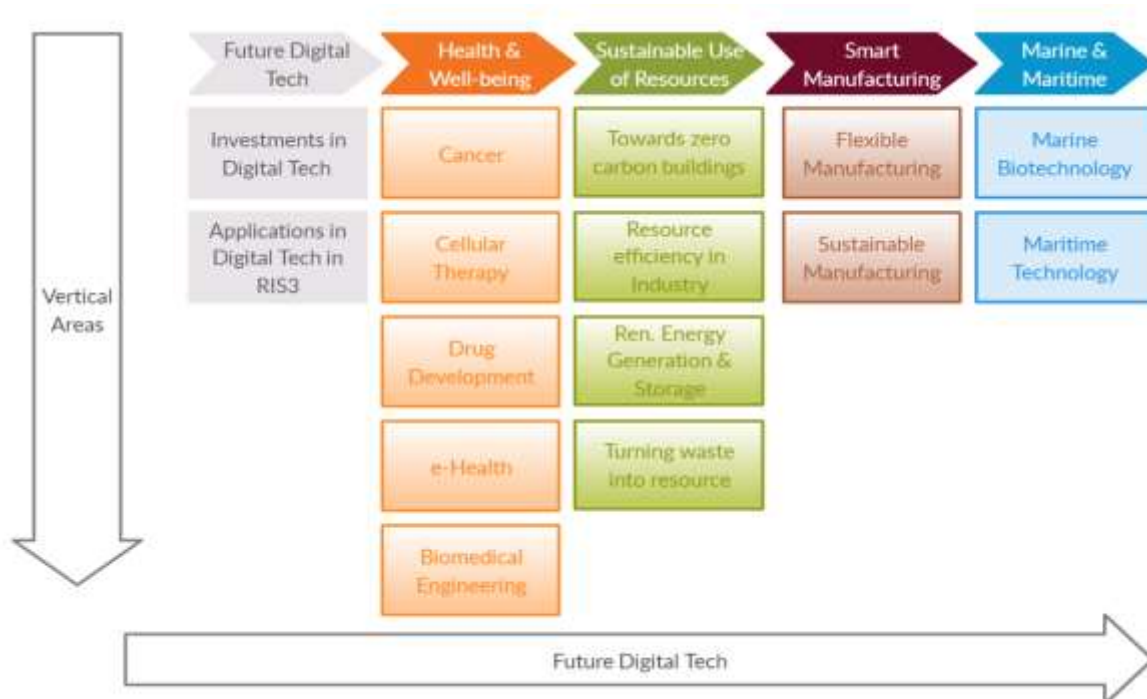


FIGURE 3.14 – FIRST DRAFT PROPOSED PRIORITY AND SPECIALISATION AREAS FOR RIS3 2021-2027

A total of 68 responses were received. The responses provided important feedback that resulted in a revision of the specialisation areas, as well as some overarching comments that helped shape the current document and final RIS3. Revisions were in fact necessary in particular in the identified niche areas within the sectors health and well-being, marine and maritime technologies and sustainable use of resources to mitigate climate change. This is testament to the effectiveness of the Maltese entrepreneurial discovery process and that the strategic policy cycle is indeed bottom-up. The revised priority areas are presented in-depth in the next section.

Second Public Consultation

Following the feedback received, the full first draft of the Smart Specialisation Strategy 2021-2027 was drafted and was subsequently issued once again for public consultation from 28th October till 18th November 2020. The revised areas and structures were included in this draft:

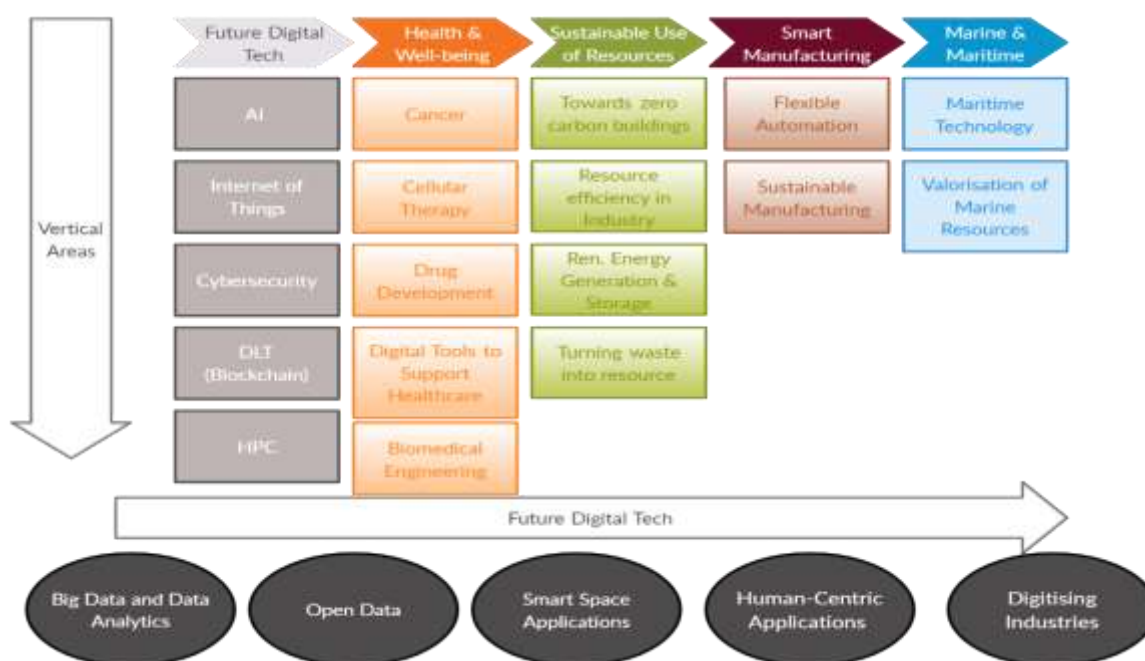


FIGURE 3.15 – SECOND DRAFT PROPOSED PRIORITY AND SPECIALISATION AREAS FOR RIS3 2021-2027

During the public consultation, the full draft of the RIS3 was presented and discussed with the Steering Group and Core Group respectively. 20 responses were received during the open consultation period from various academics, government entities and also civil society representatives. This feedback as well as the valuable input received from the Steering Group and Core Group, were assessed and revisions made accordingly in this present Advanced Draft.

One of the notable changes being made is the inclusion of a fifth smart specialisation area, 'aviation and aerospace', based on feedback received from Malta Enterprise and the University of Malta. From the information received as well as the subsequent discussions held, it was decided that the area merits to be included in the RIS3. An overview of the thematic areas is given in-depth in the next chapter.

CHAPTER 4

4.1 Thematic Areas

This chapter presents the results of the work undertaken since November 2018 to update Malta's RIS3 for the 2021-2027 period. It takes into consideration all the sources of information and feedback, from statistical figures to insights provided by stakeholders through various platforms. As explained in the previous chapters, the focus groups specifically targeting the development of the new RIS3 started in 2018, with an analysis of the smart specialisation strategy of 2014-2020. Discussions with stakeholders representing the quadruple helix centred on the progress of each of the selected priority areas, the status of implementation, and whether the rationale for choosing the areas in 2013 was still valid or otherwise.

The focus groups revealed that whilst some areas remain of priority for Malta and have indeed a strong R&I potential, other areas had not developed as envisaged and therefore, a revision was necessary. Areas that still had merit included health, ICT and manufacturing, but further understanding of these sectors was necessary to identify the right level of specialisation that hold most promise to achieving the desired impact through investment in research and innovation. Other areas such as tourism product development, maritime services and aquaculture, were less successful. Discussions concluded that certain areas like aquaculture were too specialised and Malta lacked the critical mass to achieve a significant impact, whilst a competitive economic sector like maritime services lacks R&I capacity and experience. 'Aviation and aerospace' was also considered as a less successful area during the focus groups; however, this was reconsidered in light of feedback received from Malta Enterprise and University of Malta.

Therefore, Malta has identified six (6) smart specialisation areas for the period 2021-2027. These are:

- Health and Well-being,
- Sustainable Use of Resources for Climate Change Mitigation and Adaptation,
- Smart Manufacturing,
- Marine & Maritime Technology,
- Aviation and Aerospace,
- Future Digital Technologies (this is both a vertical priority and a horizontal enabler for the former five areas).

The above is better illustrated in Figure 4.1. The current chapter will present each area in depth, explaining the rationale behind the selected area as well as the niche areas of focus within each economic sector.

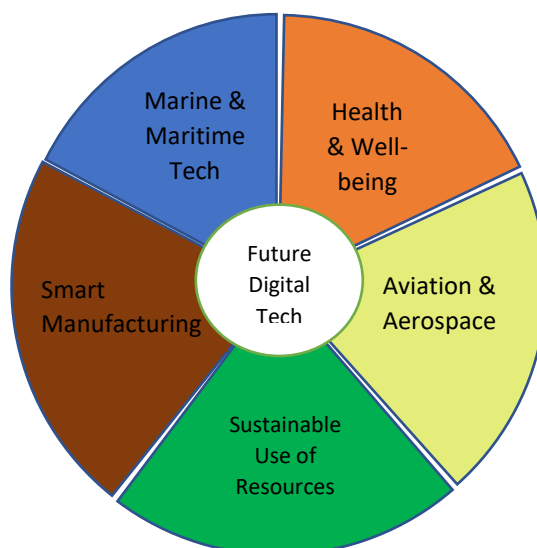


FIGURE 4.1 – SMART SPECIALISATION AREAS FOR RIS3 2021-2027

4.1.1 Health and Well-being

Background and State of Play

Through the EDP process and analysis carried out, a substantial amount of evidence was collected to support the health sector remaining as a smart specialisation area. Through the open online consultation, participating citizens said that Health, at 74.73%, was the most popular sector selected from the RIS3 2014-2020 to see further investments in research and innovation. Though only 37.36% of the respondents thought that ‘healthcare’ is an economic strength for Malta, more than 50% of respondents felt that health is an area where Malta could be competitive on a European level.

This economic sector is unique in comparison to the other areas selected, as the main stakeholder and key player is government. Whilst there is a thriving private sector, the larger part of the healthcare system is funded through public funds. Hence, national strategies²⁴ related to health were key to identify the applications in health, such as ICT²⁵, understand the Government’s current and future plans for the sector, which areas of health are crucial and require immediate action and investment, and identify the sector’s R&I needs.

Health contributes significantly to Malta’s economy (in 2019, 5.98% of the total GVA of Malta) through the expenditure by the government on the public health system most especially through employment.

²⁴ A Mental Health Strategy for Malta 2020-2030; National Strategy for the Elimination of Hepatitis C Virus (2018-2025); Transgender Healthcare; National Cancer Plan (2017-2021); A National Health Systems Strategy for Malta 2014-2020; National Breastfeeding Policy & Action Plan 2015-2020; Diabetes: A National Public Health Priority, A National Strategy for Diabetes 2016-2020; Communicable Disease Control Strategy; Food & Nutrition Policy & Action Plan for Malta 2015-2020; A Healthy Weight for Life: A National Strategy for Malta 2012-2020. All available from: <https://deputyprimeminister.gov.mt/en/Pages/National-Strategies/NHS.aspx> [last accessed 26.03.2021]

²⁵ Malta The Ultimate AI Launchpad; A Strategy and Vision for Artificial Intelligence in Malta 2030. Available from: file:///T:/Policy/Strategy%20Policy/R&I%20Strategy/R&I%20Strategy%20Post%202020/Drafting%20of%20Areas/HEALTH/Strategies/Malta_The_Ultimate_AI_Launchpad_vFinal.pdf [last accessed 26.03.2021]

There are a few private hospitals, however the government strives to retain the best personnel as well as to provide the latest equipment and high standards of health services on the island.

Nevertheless, the health system is supported by private enterprises that, beyond providing services in their respective field, bid for projects through a tendering system for contracts. For instance, to date, tenders have been issued for the performance of specific operations (e.g. cataract removal surgeries) or diagnostic tests (MRIs) to shorten waiting lists at MDH, provision of Security services, hospital catering (providing in-patient meals), pharmaceutical products, among others. Given the extent and magnitude of public procurement in this area, there is scope to explore the potential of public procurement for stimulating innovation in health.

Research and innovation in the health sector had to speedily rise to new challenges, realities and opportunities presented by the COVID-19 pandemic that shook the world at the start of 2020. The health system has had to adapt rapidly to dealing with a virus of which little was known, and hence public health measures had to be ensured based on the scientific data made available daily by the international scientific community. Maltese entities and researchers also contributed in these unprecedented circumstances. Being small and largely centralised, Malta's health system has shown remarkable agility at responding to the emerging situation. The COVID-19 pandemic has shown a very active response from academia, public and private enterprises. Some companies helped by the reorientation of their operations to manufacture personal protective equipment, such as 3-D printed face shields, while researchers at UM developed a prototype to disinfect respirators at a time when there was a worldwide shortage of such equipment.

Data Supporting the Sector and its R&I Potential

Health as an economic sector can be classified under NACE²⁶ code Q "Human health and social work activities". When looking at macroeconomic data such as Gross Value-Added (GVA), in 2019 human health and social work activities contributed to 5.98% of the total GVA of Malta. In actual numbers, the value of the sector has increased by 329.7 million EUR since 2010 (700.9 million EUR in 2019).²⁷ Both the past and current focus of research and innovation is directed towards human health activities rather than social work. In the case of Gross Value Added, data is available specifically for growth in human health activities (NACE Q 86). Data in 2019 shows that the value of the sector has increased since 2010 by 199.1 million EUR (467.4million EUR in 2019), contributing to 3.99% of the total GVA.

Employment in the sector ("human health and social work activities" as a total since a breakdown is not available) has also increased since 2010 and in 2019, NACE Q contributed to 9.7% of total employment.

In terms of research and innovation capacity in the health sector, data from the FUSION programme²⁸ is very positive. From the 2014-2020 eight smart specialisation areas, health is one of the strongest in terms of funded projects as well as the area of most interest from researchers and participants of the FUSION programme. For CVP, 9.23% of all project proposals submitted were under the health pillar, and for TDP, 14.3% of all proposals submitted were under the health pillar.

²⁶ NACE Rev. 2 Statistical classification of economic activities in the European Community by EUROSTAT <https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF> [last accessed 27.03.2021]

²⁷ Data source EUROSTAT nama_10_a64 as seen in May 2020

²⁸ The National R&I Programme FUSION <https://mcst.gov.mt/ri-programmes/fusion/> [last accessed 27.03.2021]

The participation of Malta in the European Framework Programme for research and innovation (Horizon 2020) shows that the R&I community in Malta is very interested in undertaking R&I projects within the health sector on a European and International level. From the 900 eligible proposals submitted by Maltese participants under Horizon 2020 to date (2019), 44 (4.89%) were related to health, demographic change and well-being, whilst 4.4% of those submitted were successful. When compared to other thematic areas, the success rate is rather low (Chapter 3, Figure 3.10) 4 projects were successful and leveraged a net EU financial contribution of EUR 458,817. Malta also supports the growth of the sector by investing in its human resources. Between 2014 and 2018, 15% of the total number of graduates of the total smart specialisation areas graduated in the health sector (total number of graduates 9293). Also, in the same time frame, 1335 publications are listed in the open access repository of the University of Malta on topics related to the health sector (7.91% of the total number of publications related to the smart specialisation areas).

Researchers in Malta have increasingly been contributing to knowledge within the medical community through several publications on a variety of topics over the years. The data obtained on an online journal database, PubMed²⁹, illustrates just how active the health-related research community is within the Maltese islands.

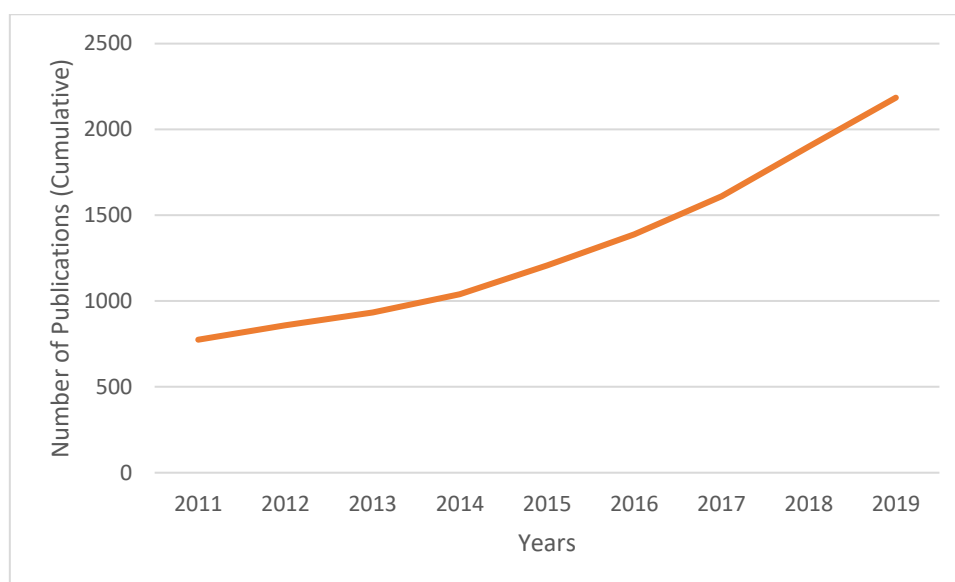


FIGURE 4.2 – NUMBER OF HEALTH-RELATED PUBLICATIONS BY AUTHORS AFFILIATED TO MALTESE ENTITIES. (DATA FROM PUBMED HELD BY NATIONAL CENTRE FOR BIOTECHNOLOGY INFORMATION)

The Current Infrastructural Landscape and Previous Investments

Throughout the EDP, local stakeholders underlined the necessity to continue to build on Malta's capacity to conduct R&I in niche areas linked to health. Out of all the areas discussed and revisited, Health was one of the most popular sectors among members because it is one of the sectors where Malta has consolidated a substantial capacity in terms of human resource, experience and skills. There is a lot of knowledge and capacity that has been built over quite a number of years. Medical records

²⁹ <https://pubmed.ncbi.nlm.nih.gov/> [last accessed 27.03.2021]

of the country are centralised and therefore there's potential to make use of the available data, and there is a thriving multi-disciplinary industry that contributes towards the growth of the health sector.

In broad terms, Malta has several advantages to enable it to position itself as a strong hub for innovation in health. It has a sizeable population and a centralised public health sector. The native population is largely captured by the public health system, enabling Malta to perform longitudinal long-term trials. Malta has a flat structure, in having single agencies in charge of specific aspects of the healthcare system (e.g. Medicines Authority, Health Ethics Committee, amongst others). Research in some areas related to health, such as cancer, is further assisted by having digitized Cancer Registry data of approximately thirty years, and Malta's e-Health infrastructure is currently being built through the CONvErGE project. The CONvErGE project aims to strengthen the Government's ICT systems, and health was one of the earmarked sectors with more than €9 million allocated to build a national comprehensive infrastructure for health, i.e. e-Health. Its goal will be to support improvement of Malta's health and increased efficiency and sustainability of Malta's healthcare system.³⁰

In June 2007, Malta opened the doors of a new acute general and teaching hospital, Mater Dei Hospital, affiliated to the University of Malta, offering hospital and specialist services. Following this major investment, Sir Anthony Mamo Oncology Centre was constructed taking over cancer care. In order to provide more healthcare services closer to home and strengthen primary care in Malta, the Healthcare Centre in Paola is being transformed into a Southern Regional Hub (allocated €33 million ERDF funds). Moreover, in October 2019, Barts Medical School building opened in Gozo, next to Gozo General Hospital, offering students a new facility for the study of Queen Mary University of London's MBBS medical degree.³¹

The Malta BioBank³² provides population-based biomolecular tools to promote biomedical research both in Malta and in collaboration with other Euro-Mediterranean countries to improve healthcare. Many academic and corporate centres require well-organised collections of human biological materials and data to support discovery in pharmaceuticals and diagnostics. The Biobank is a national archive of blood and DNA together with associated health data, which curates over 100,000 samples. It has developed over the years with various European and private/public and institutional funding and includes specific disease collections and datasets that are fundamental for biobank-led research.³² This has enabled the Maltese Genome Project to search for genes responsible for causing diseases in the Maltese population. The Malta BioBank forms part of the largest Health Research Infrastructure in the EU, BBMRI-ERIC (Biobanking and BioMolecular Resources Research Infrastructure, European Research Infrastructure Consortium).

In June 2016, the Centre for Molecular Medicine and Biobanking was inaugurated, seeing a 6.5-million-euro investment by the University of Malta and the Ministry for Education and Employment.³³ This Centre houses 25 new state-of-the-art laboratories which are further assisting research in Human Genomics and Genetics Medicine, which has been increasingly gaining importance over the past 30

³⁰ eGovernment services that the project foresees are: 1) Government Formulary, Medicines Protocol and Specification System; 2) Electronic Patient Records for Primary Health Care; 3) Patient Consent Management; 4) National Electronic Health Records; 5) Patient Registries; 6) Health Data Exchange; 7) Health Information System Object Storage. More information available from:

<https://eufunds.gov.mt/en/Operational%20Programmes/Monitoring%20Committees/Documents/OPI%202014-2020%20May%202019/3.%20OPM-CONvErGE-MAMonitoringCommittee-V1.0.pdf> [last accessed 27.03.2021]

³¹ <https://www.qmul.ac.uk/malta/about-us/> [last accessed 27.03.2021]

³² <https://www.um.edu.mt/biobank> [last accessed 27.03.2021]

³³ University of Malta's landmark Centre for Molecular Medicine and Biobanking, 28 June 2016 [Online] <https://www.um.edu.mt/newspoint/news/features/2016/06/universityofmaltaslandmarkcentreformolecularmedicineandbiobanking> [last accessed 27.03.2021]

years. The Maltese researchers who work on the Maltese Genome Project³⁴ form a core part of this centre; thus aiming to have critical mass to enhance new advances in Personalised (or Precision) medicine, i.e. ‘your own treatment for your own disease’. To date, major inroads have been made with respect to genetic studies on diabetes, osteoporosis, certain types of cancers, heart disorders, amongst others.

The new Centre for Blood, Tissue and Cells (BTC Centre) to be funded through Malta’s Recovery and Resilience Plan will add another very important dimension by providing the necessary setup to provide specialised services to the main general hospital in terms of harvesting of particular cells, such as stem cells and corneal transplants. In addition, there are plans for undertaking related research focusing on efficacy of harvesting and storage of bone, stem cell banking and cornea, providing innovative treatment locally. A stem cell donor registry will also be established that will link up to international registries, opening to a more international market. There will also be innovation on plasma collected from blood donors which will be referred for fractionation into non-labile products with the aim of self-sufficiency in blood products.

Another important infrastructure that was built in recent years is the Malta Life Sciences Park, envisaged to create a cluster from which advanced health-associated services (non-patient) could be provided, built in close proximity to Mater Dei Hospital. It has successfully built three buildings and a fourth building focusing on medical services is in the pipeline. One building is focused on hosting businesses related to biology while the second to chemistry; the third is referred to as the Digital hub with plans to have it operating as a centre where specialists from different sciences meet with innovation in mind.

Last but not least, in reaction to the global public health emergency that emerged in the first quarter of 2020, Malta Enterprise Corporation and the Malta Council for Science and Technology pooled their resources and designed a national fund entitled the “COVID-19 R&D Fund” with a total budget of €5.3 million.³⁵ It is aimed at enabling research and development projects related to COVID-19 as a departure point, with outcomes not only addressing innovative and improved approaches related to the current pandemic, but also potential future waves and other relevant antiviral research. The extent of uptake of this fund by local entities cannot be established at the time of writing, a lot of interest was expressed by local stakeholders when the scheme was announced.

Based on this information, health and well-being was identified as a smart specialisation area, with an added focus on five specialised niche areas.

Niche Areas of Focus

As highlighted, the health sector continues to be an area of strong R&I potential for Malta. Malta has several advantages to be a strong hub for innovation in health. It has a sizeable population and a centralised public health sector and the native population is largely captured by the health system, enabling Malta to perform longitudinal long-term trials.

³⁴ <https://www.um.edu.mt/think/the-hidden-history-of-the-maltese-genome/> [last accessed 29.03.2021]

³⁵ COVID-19 R&D Fund. Available from: <https://mcst.gov.mt/ri-programmes/covid-19-rd-fund/> [last accessed 29.03.2021]

After stakeholder meetings, internal discussions, taking into account feedback received from the Public Consultation of the Vision Document for the post-2020 RIS3 Strategy, and verified by analysis of publications, the niche areas were refined to reflect better the scope of the RIS3 Strategy. The identified niche areas are the following:

1. Cancer

The National Cancer Plan (2017-2021)³⁶ states that every 5 hours, someone in Malta is informed that they have cancer. A total of 1800 individuals are diagnosed with cancer in Malta each year, with this number expected to increase by around 1.5-2% each year.³⁷

Cancer research in Malta has gained increased prominence over the past years, as evidenced by the sizeable research cohort within UM, interesting breakthroughs in innovative methods for cancer screening³⁸, the setting up of the Emanuele Cancer Research Foundation³⁹ and the inclusion of a dedicated pillar on research in the National Cancer Plan.⁴⁰ The National Cancer Plan identifies 'Researching Cancer and Cancer Surveillance' as a priority, outlining a number of initiatives aimed at increasing opportunities and boosting the infrastructure for research concerning various aspects of the cancer care pathway, including ongoing cancer surveillance, research in the molecular science and genetics, evaluation of patient outcomes and of cancer services including cost-effectiveness studies.

In line with this approach and building on the strengths identified above, Malta's RIS3 should pursue and support capacity building towards a patient-oriented approach to cancer research and innovation in Malta. Research should focus on areas related to cancer care and control where Malta can make a difference, especially on a local level. Investments should promote R&I initiatives aimed towards early diagnosis and screening programmes and the related infrastructure, especially in cancers that have increasing prevalence in Malta. There is scope for using the National Cancer Registry as a research tool to develop innovative solutions addressing planning and management of cancer services. There is a recognised need as identified in the National Cancer Plan, to strengthen the Registry's source base and to further develop its functions and capabilities to better allow for advancement of medical knowledge on cancer at the national and international level. Given the wide array of R&I initiatives planned and ongoing in this area, there is scope for valorising and coordinating this through the setting up of a dedicated cluster on cancer research and innovation, to bring together in a more formal manner all the various research nodes in this area for closer, multidisciplinary collaboration.

2. Cellular Therapy

Cell therapy is a technology that relies on replacing diseased or dysfunctional cells with healthy, functional ones. According to key stakeholders working in this field, therapeutic products are very

³⁶ Office of the Deputy Prime Minister and Ministry for Health, "The National Cancer Plan for the Maltese Islands 2017-2021", <https://deputyprimeminister.gov.mt/en/CMO/Documents/NationalCancerPlan2017.pdf> [last accessed 29.03.2021].

³⁷ Coleman, M.P., Alexe, D.-M., Albrecht, T. and McKee, M. (2008) Responding to the challenge of cancer in Europe. Ljubljana: Institute of Public Health of the Republic of Slovenia.

³⁸ <https://www.tvn.com.mt/en/news/new-blood-test-may-detect-cancer-two-years-symptoms-appear/> [last accessed 29.03.2021]

³⁹ The University of Malta Research, Innovation and Development Trust, "Malta gets its first cancer research foundation", at: <https://researchtrustmalta.eu/news/malta-gets-its-first-cancer-research-foundation/> [last accessed 29.03.2021]

targeted and specific and therefore, have important applications in a range of areas including, inter alia, active ageing and possibly diabetes.

Development of cell therapy leads to the development of niche products and treatment that can target not only the local population, but even a wider base with a significant potential for internationalisation, especially the North African countries since cell therapy treatment is not readily offered and patients tend to be referred to other European countries. Malta is currently investing in strengthening its current public research infrastructure and human capital in this area through the setting up of a Blood, Tissue and Cell Centre, to be funded under Malta's Recovery and Resilience Plan, that will service Mater Dei Hospital by providing novel products to patients that are currently unavailable in Malta. It is planned for this centre to be set up by 2025. In addition, this investment and opening the possibility of participating in international clinical trials, would create a welcome demand for more researchers in the area of therapeutic products, novel therapies, treatment and management of patients.

3. Drug Development

In view of the legal restrictions imposed over the years, cannabis for medicinal and research purposes has been essentially unexplored, both locally and beyond. In 2018, Malta introduced legislation on the production of cannabis for medicinal and research purposes. In February 2019, MEPs called for an EU-wide policy for medical cannabis and properly funded scientific research to take place. There is clear interest in investing in production of cannabis for medicinal purposes in Malta, and the companies should be setting up the premises through 2020. In March 2020, Malta Enterprise (ME) confirmed that it had received a total of 25 Letter of Intents (LoI) of which 5 had already started setting up the production line. At the same time, Malta Medicines Authority (MMA) had confirmed that none of these applicants had successfully achieved a licence to start production.

Analysis of the peer-reviewed publications, published by researchers established in Malta, reveals that there is increasing research on drug design and development, with only one publication issued in 2012, and a total of 25 publications up to May 2020. Moreover, there was a total of 112 publications related to neurology, published between 2012 and 2019 with research focusing on dementia (notably Alzheimer's disease) and Parkinson's disease as well as epilepsy.

Stakeholder consultations corroborated the above. Maltese research teams are working in translational neurological research from bench to bedside, with several researchers focussing on the development of personalised medicine targeting such conditions. Researchers are aiming to identify lead compounds for the development and design of novel therapeutic agents against neurological conditions or diseases, or the study - at a molecular level - of specific pathways which may be targeted for their treatment. In particular, the research expertise focuses on understanding the pathophysiology of central monoaminergic systems (dopamine and serotonin) in different neuropsychiatric disorders, in particular Parkinson's disease, Alzheimer's disease, drugs of addiction, depression and epilepsy. Neurological research is supported by the unique collection of related samples in the Malta Bio Bank.

In order to capitalise on the legal developments and Malta's research strengths in this field, there is scope for focussing on research in medical cannabis use in the context of addiction, Parkinson's disease, Alzheimer's disease, depression and epilepsy. The means to achieve this could be through the setting up of an independent, purpose-built facility offering an advanced research environment and analytical services relating to medical cannabis. The centre would work towards accreditation to operate in a sustainable manner, and therefore not only act as a service provider but also support in-

house research. An independent laboratory would serve as a local incentive, while also presenting an opportunity for a consolidated infrastructure that supports sharing of resources, expertise, and data management, alongside patient-centred research endeavours, dissemination of knowledge and innovative initiatives. The establishment of this type of facility would be in line with national policy, WHO recommendations, as well as the European Parliament resolution on medical cannabis adopted in February 2019⁴¹, calling for an EU-wide strategic action to boost properly funded scientific research and innovation, in guaranteeing controlled access to cannabis which meets safety and quality requisites. In the long term, the national centre may take a leading role as a reference laboratory, attracting industry and driving excellence in this field.

4. Digital Tools to Support Healthcare, focusing on e-Health and Bioinformatics

Mater Dei Hospital, as well as other stakeholders, expressed interest in the potential of innovative digital tools to support healthcare. Innovation potential is seen primarily in e-health and bioinformatics applications. Bioinformatics is the application of computational and statistical techniques to understand biological data (both for research and clinical applications). Bioinformatics is a cross-cutting concern that underpins nearly all the niche focus areas mentioned under the Health and Well-being sub-chapter; especially cancer, drug discovery and eHealth. In cancer, bioinformatics is used to identify disease-causing structural variants present in the genome. In drug discovery, bioinformatics is used to model protein structure, which in turn is used to guide the drug discovery exercise. Clinical bioinformatics may be used to find the disease-causing genetic mutations in patients. Moreover, bioinformatics is key in managing the collection, storage, retrieval, analysis and interpretation of healthcare data and information.

This would predominantly involve the use of Artificial Intelligence tools, (mainly that of Machine Learning), with the most promising areas of innovation being in pathology and radiology. Indeed, Mater Dei Hospital is already engaged in a Digital Pathology Project which aims to incorporate AI programmes for reporting on tests received for pathology screening, with the aim to increase the efficiency and accuracy of reporting, thus reducing human error. This will also enable bioinformatics-enabled research which will help analyse molecular biology data generated in Malta via computational means and hence obtain a better biological insight of the Maltese population.

Since COVID-19, it has been shown that IT infrastructure can be used successfully in the medical field. In fact, various medical professionals are operating through IT tools such as the Telemedical GP service where a video consultation takes place rather than a face to face check-up. Thus, an evaluation of the different tools used should be carried out following the COVID-19 situation and see whether such tools can be amended, further developed or continue to be used. Such measures may be very useful for persons who are housebound including the elderly and persons with a disability. In the medium- to long-term, telemedicine would help improve on waiting lists and reduce clinic traffic to only those who need an actual visit. This would have positive ripple effects on reducing transmission of communicable disease from the community to the hospital settings and vice versa, as well as increasing the efficiency of healthcare resources, given the limited resources available.

⁴¹ https://www.europarl.europa.eu/doceo/document/TA-8-2019-0113_EN.html [last accessed 05.04.2021]

5. Biomedical Engineering

Biomedical engineering is a niche area that has been producing innovative solutions for the local and international market, especially with respect to medical devices. Research by the Department of Metallurgy and Materials Engineering and Department of Anatomy at UM addresses tissue and neural engineering (e.g. BioSA⁴² and Wildeye⁴³ respectively). In fact, most projects in health in the FUSION programme address this niche area, leading to the development of medical devices such as biodegradable iron for orthopaedic applications⁴⁴ and a new hip joint.⁴⁵

These innovations have seen successful close collaborations between academia (medical and engineers) and private companies, and hence further exploration of this area is supported. Analysis of publications over the past eight years has shown a sustained collaboration⁴⁶ between these traditionally strong sectors in Malta (Health, Engineering, and the Manufacturing Industry). Moreover, investments in the Malta Life Science Park will further assist this sector in achieving its maximum potential. This would entail further investments on what this industry already does best, such as improving devices already used in the local market as well as for coming up with novel devices building on local expertise in various medical fields, as well as supporting novel concepts to automate parts of the health service industry.

Past and current funding programmes have shown that private entities are willing to collaborate in projects in this sector, which is positive and fosters excellent collaboration between stakeholders. However, performing R&I activities is very resource-intensive, requires long-term investments and success is never a guarantee. Hence, R&I activities can cause a financial strain until an innovative product reaches the market and providing suitable funding mechanisms to this niche area would benefit from incentives and support to companies willing to perform R&I.

4.1.2 Sustainable Use of Resources for Climate Change Mitigation and Adaptation

Background and State of Play

Malta is the most densely populated country in the EU and remains particularly vulnerable to climate risks (European Commission, 2020). The importance of innovation in this area stems from the need for tailor-made solutions to enable Malta to fulfil the legal obligations that it has in this field as well as its commitment to fulfilling international agreements such as the European Green Deal, Paris Agreement and UN's Sustainable Development Goals. To this end, the 2014-2020 RIS3 Strategy identified resource-efficient buildings as a smart specialisation area. This led to the development (funded through ERDF funds for the period 2014-2020) of a 'Sustainable Living Complex' within the

⁴² Tonna, C., Saliba, L. (2019). 'Iron and its alloys for Bone Regeneration Scaffolds – A Review', *Xjenza Online*, 7(1), 49-64 [online]. Available at: <https://www.xjenza.org/JOURNAL/OLD/7-1-2019/04.pdf> [last accessed 05.04.2021]

⁴³ Cristina, S., Camilleri, K.P. (2018). 'Unobtrusive and pervasive video-based eye-gaze tracking', *Image and Vision computing*, 74, 21-40 [online]. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S026288561830060X?via%3Dihub> [last accessed 05.04.2021]

⁴⁴ <https://www.um.edu.mt/eng/mme/ourresearch/biomaterials/biosa> [last accessed 05.04.2021]

⁴⁵ <https://www.um.edu.mt/newspoint/news/features/2020/03/Malta-Hip-Launch> [last accessed 05.04.2021]

⁴⁶ An average of three publications per year, since 2012, illustrating consistency of the research output within this niche area.

UM to serve as a living lab to test new building methodologies and materials in a real-life scenario. However, the updated EDP and analysis show that to achieve these ambitious goals, R&I investments should look beyond resource-efficient buildings and consider a more holistic approach to sustainability.

The present and future challenges associated with the sector will require Malta to build on the country's existing capacity and investments to further improve its design and management of resource and energy-efficient systems, thus also promoting climate change mitigation and adaptation measures. Climate change mitigation and adaptation has been identified by the international community, the European Union and Malta as an essential policy response to the current climate concern. Its horizontal integration into all relevant policies, and their implementation is a key measure for the effective achievement of climate and development goals. The policy context is thus favourable for Malta to aspire to strengthen its R&I expertise in innovative solutions for waste, water and energy.

The seven thematic priority areas within the fields of energy and water identified in the National Strategy for Research and Innovation in Energy and Water⁴⁷, namely water use efficiency, renewable solutions for islands, desalination and water treatment process, integration of renewable electricity, wastewater treatment and reclamation, energy-efficient solutions and water-friendly urban centres, concur with the niche areas proposed further below. The National Strategy for Research and Innovation in Energy and Water prioritises basic research and applied research to experimental design (TRL 2 – 6). Financial resources to support additional domestic R&I activities in line with the objectives of the Strategy will be provided through the establishment of a fund under Platform-RINNEW. Such funds may act as an essential springboard for research teams to apply for more significant levels of support as required at higher TRLs as projects evolve.

Data Supporting the Sector and its R&I Potential

The interest and activity of Maltese actors in R&I in projects related to resource and energy efficiency can be gauged through several sources. Under the EU's current research framework programme for 2014-2020 (Horizon 2020), 46 applications were submitted by Maltese individuals and organisations for projects under the 'Climate action, environment, resource efficiency and raw materials' category, with over 10 million euro of funding requested. The success rate of Maltese proposals was one of the highest when compared to other thematic work programmes (13.3% as quoted in Chapter 3, Figure 3.10), with 11 projects selected and over 1.7 million euro awarded. Between 2010 and 2018, over 70 publications were issued by the University of Malta on related subject areas.

From an economic perspective, the sector's contribution to the country's overall economic output is also notable. The sector "water supply, sewerage, waste management and remediation activities" contributed to 98.1 million euro GVA in 2019. Furthermore, as of 2016, 3,481 jobs were related to the green economy, making up nearly 2% of the total employment in the Maltese economy, with the strongest area being within the water supply, sewerage, waste management and remediation activities field (57 %).⁴⁸

The feedback received through the consultation process points to a need for more investment in tailor-made solutions for Malta. Several academics at the University of Malta (UM) and the Malta

⁴⁷ <https://www.energywateragency.gov.mt/research-and-innovation/draft-strategy/> [last accessed 05.04.2021]

⁴⁸ State of the Environment Report 2018, Environment and Resources Authority <https://era.org.mt/wp-content/uploads/2019/05/SoER-Summary-Report-2018.pdf> [last accessed 05.04.2021]

College of Arts, Science and Technology (MCAST) are carrying out research in the area of energy and water efficiency in buildings as well as construction and demolition waste recycling. A number of wastewater treatment technologies are being tested and prototyped. These solutions are particularly useful to hotels and industry such as manufacturing companies that utilise large quantities of water in production processes. A number of research and innovation projects in the fields of energy and water have been funded in past years.⁴⁷ Awarded projects include a micro-combined heat and power system; low-cost geothermal systems; domestic water reuse for the Mediterranean region and micro waste-water treatment systems using photocatalytic surfaces.

The Sustainable Living Complex project within the UM will provide a space for collaboration between the academic and private sector on developing innovative solutions to Malta's challenges in this area. Other ongoing projects include improving environmental performance of heritage buildings and green roofs suitable for the Mediterranean climate. Private entities are working on material life cycles and lightweight composites, building materials with improved insulation properties and sustainable technologies such as smart lighting and sustainable heating/cooling systems.

Niche Areas of Focus

Based on the factors described above, the area of sustainable use of resources for climate change mitigation and adaptation is selected as a smart specialisation area for 2021-2027. In particular, there is a strong need for R&I investment to develop tailor-made solutions for Malta. This may in turn create additional opportunities for tapping into international collaboration and markets. Any type of tailor-made solution proposed for Malta should be developed with current and future climate change scenarios in mind. Based on this, investments in the following niche areas have the most potential in providing such needed solutions in the coming years.

1. Towards Net Zero Carbon Buildings

This area addresses water, energy, building materials and recycling of construction and demolition waste. GVA in the construction sector (NACE F) overall increased by 128.5 million EUR since 2010 (contributing to almost 4% of GVA in 2018) while employment increased by 2.9 thousand since 2010 (6.35% of total employment in 2018). This growth is generating increasing social and environmental concerns relating to, inter alia, land use, waste management (construction and demolition waste rose to over 2.2 million tonnes in 2017, up from 1.3 million tonnes in 2016⁴⁹) as well as an increase in the energy consumption of buildings. Legal Notice 376/2012⁵⁰ requires that by 31st December 2020 all new buildings are nearly net-zero-energy buildings. New buildings occupied and owned by public authorities were required to be nearly zero-energy buildings by 31st December 2018. Therefore, building quality needs to improve to ensure that architecture and civil engineering contribute towards

⁴⁹ *Country Report Malta 2020 European Semester: Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011* <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52020SC0517> [last accessed 05.04.2021]

⁵⁰ *Legal Notice 376/2012 Energy Performance of Building Regulations* <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11947&l=1> [last accessed 05.04.2021]

buildings that are more energy-efficient. This should also be complemented by investments in energy-efficient technological solutions for new and existing buildings (retrofitting).⁵¹

As also identified in the National R&I Strategy 2014-2020 under the sector “resource-efficient buildings”, there is great potential in research on the integration of green infrastructure in an urban environment. Investing in green infrastructures, such as green roofs and walls, provides multiple benefits in the form of supporting a green economy, improving quality of life by improving human health and wellbeing, supporting biodiversity conservation, and enhancing the ability of ecosystems to deliver services such as disaster risk reduction, water purification, air quality, space for recreation and climate change mitigation and adaption.

Energy consumption can be minimised by passive design⁵² solutions, which utilise natural sources of light, heating and cooling by appropriately orientating the building and carefully designing the building envelope (roof, walls, windows and floors) to minimise unwanted heat gain and loss. These solutions include daylighting, natural ventilation and solar energy.⁵³ Therefore, there is scope for supporting the development of innovative solutions that are tailor-made to the local scenario.

2. Renewable Energy Generation and Energy Storage Solutions

Malta should seek to exploit indigenous sources of renewable energy in order to improve the grid’s reliability by diversifying our energy mix thus enhancing our ability to depend less on international energy sources, create green jobs and increase green energy generation. Malta’s dense population and limited land area render offshore and marine renewable energy technologies⁵⁴ a potentially important alternative for Malta to invest in renewables. Malta has several successful projects in this area, and there is a need to test/upscale existing solutions in order to further develop and commercialise alternative renewable energy technologies. Therefore, support for researchers, and especially private companies, to take these projects forward and break into the market should be considered.

As the influx of renewable electricity to the national power infrastructure increases over time, research and innovation on the integration of renewables, storage and e-mobility in the electricity grid and grid balancing becomes increasingly important. Research and investments for a better understanding of how to handle the integration of various energy sources, as well as better energy storage are needed to ensure seamless operations and become less dependent on international supply and non-renewables.

In the absence of enough natural fresh water supplies to meet the needs of the population, Malta is highly dependent on seawater desalination. Malta has been a pioneer in desalination in the past as the country started successfully producing water through desalination since 1982. 4% of Malta's total

⁵¹ *Malta’s Low Carbon Development Strategy Public Consultation Document June 2021*

https://meae.gov.mt/en/Public_Consultations/MECP/PublishingImages/Pages/Consultations/MaltasLowCarbonDevelopmentStrategy/Malta%20Low%20Carbon%20Development%20Strategy.pdf [last accessed 05.10.2021]

⁵² *Passive design, an approach to building design that uses the building architecture to minimize energy consumption.* <https://www.climatecolab.org/contests/2014/buildings/c/proposal/1309226> [last accessed 05.04.2021]

⁵³ <https://www.yourhome.gov.au/passive-design> [last accessed 05.04.2021]

⁵⁴ Marine renewable energy sources include offshore wind, tides, ocean currents, waves, thermal differences, salinity gradients, and biomass. Offshore renewable energy systems are situated at sea some distance from the shore and include floating PV technology in offshore environment.

electricity consumption goes towards generating freshwater, with the process emitting large quantities of greenhouse gases. The expense of and environmental effects caused by the use of existing desalination techniques makes research related to technologies such as renewable desalination and brackish and seawater desalination especially important. Through Cohesion funds obtained, the Water Services Corporation is investigating how to reduce the energy consumption to produce desalinated water by producing new and upgraded technology.⁵⁵ There is scope for further support to innovation in this area.

Malta has a relatively strong history of investigating the possibility of solar energy as a solution for Malta's energy needs. Existing investments include a solar research lab at the Institute for Sustainable Energy which was built using ERDF funds. A priority area of research revolves around existing as well as new materials for solar panels. Stakeholders have expressed interest in expanding the scope of renewable energy research undertaken locally and to increase collaboration between the private and public sector. This may necessitate infrastructural investment in laboratories and equipment, training of personnel and mechanisms to facilitate joint projects.

These investments would fill an existing void by providing local companies with access to state-of-the-art research facilities and encouraging local start-ups in the area. This is in line with local policies to foster and increase the share of renewable energy, to develop industry in these areas and to increase R&D spending, as well as build local capacity.

3. Resource Efficiency in Industry

Local industry incurs added operational costs associated due to Malta's insularity. Transportation costs to import and export and higher than other companies situated on mainland Europe and therefore, have higher overheads. Improving resource efficiency can be a means to, at least partially, offset these costs.

Reducing costs through implementation of resource-efficient solutions would help increase the industry's competitiveness and moreover, reduce the carbon footprint. The provision of financial support to industry to develop innovative solutions to resource efficiency challenges is therefore warranted. Examples include increasing efficiency of cooling systems in manufacturing companies and recycling packaging materials whilst retaining the desired properties. To become more resource-efficient, companies in Europe are looking into creating products that embrace the concept of the circular economy, that is, producing as little waste as possible and creating a production "loop" rather than a line. The circular economy concept also encourages the use of waste generated by a sector as a resource by a different sector. Collaboration in the area of resource efficiency already takes place through collaboration between companies and researchers in higher education locally. It is worth looking into formalising mechanisms for such collaboration to make them more widely known and available. Through meetings with potential stakeholders, emphasis was made on the fact that funds must be allocated to research that can be very beneficial to industry, since many SMEs and FDIs do not have research and development departments in Malta or lack human resource and specialised equipment.

Malta is currently investing in infrastructure that can bring together the private and academic stakeholders to develop solutions for increasing resource efficiency in industry, mainly the Sustainable Living Complex (SLC) and the Transdisciplinary Research and Knowledge Exchange Complex (TRAKE).

⁵⁵ <https://www.eea.europa.eu/signals/signals-2018-content-list/articles/interview-2014-malta-water-scarcity> [last accessed 05.04.2021]

Once set up, they will bring together the engineering and sustainability aspects of resource efficiency and can serve to formalise such collaborations and put in place mechanisms that will benefit the industry. This niche area overlaps with the proposed niche areas ‘Turning waste into Resource’, ‘Towards Net Zero Carbon Buildings’ and ‘Sustainable Manufacturing’.

4. Turning Waste into Resource

While the shift from a linear to a circular economy⁵⁶ is indeed a global one, the challenges that different countries face and the solutions required may well be very diverse. Malta’s insularity and lack of economies of scale are perhaps the greatest obstacles to reach the defined targets.

Solid Waste

Malta’s Long Term Waste Management Plan 2021 - 2030 recognizes a number of targets that Malta is expected to reach which include recycling 50% of paper, plastics, metal and glass waste from households by 2020; recovering 70% of construction and demolition waste by 2020; and a binding landfill target to reduce landfill to maximum of 10% of all waste by 2030.

In 2015, based on statistics released by NSO in 2017, 2,652 tonnes of dry recyclables were collected through bring-in sites whilst a further 14,926 tonnes were collected through the kerbside collection system. Taken together, this accounts for a separation rate of around 17% which is below the recycling targets. Circa 190,000 tonnes of biodegradable municipal waste generated were landfilled in 2015. The latter exceeds the amount of biodegradable municipal waste generated that is allowed to landfill, which stands at circa 50,000 tonnes. It is acknowledged that these threats are compounded by Malta’s limited landmass and small population (thus a limited market) where diseconomies of scale determine the feasibility of nearly all commercially driven operations.⁵⁷

Recent investments in waste management include the Multi-Material Recovery Facility in Hal-Far as a waste separation facility and the Beverage Container Refund Scheme (BCRS) to incentivise recycling of plastics, glass and metal. The development of a Waste to Energy (WtE) plant, which is expected to cater for 40% of waste currently being landfilled, is in the pipeline.⁵⁸ In addition to its contribution to managing waste in Malta, a Waste to Energy facility will provide the opportunity for generation of low carbon and renewable electricity in Malta. This facility will partially address the issue of organic waste and biomass, diverting such waste away from landfills and into energy production.

Since the WtE will be processing 40% of all produced waste, the next step would be to identify innovative solutions to treat the remaining 60% of generated waste. Ideally, this waste is also recycled and transformed into secondary resources. Therefore, tailor-made solutions for Malta should be developed, with added potential for exporting these technologies to other islands or remote communities facing similar issues and diseconomies of scale. Investment should target areas and technologies which are economically viable on a smaller scale, possibly making Malta a leader in these

⁵⁶ European Commission. A circular economy aims to maintain the value of products, materials and resources for as long as possible by returning them into the product cycle at the end of their use, while minimising the generation of waste. Retrieved from: <https://ec.europa.eu/eurostat/web/circular-economy> [last accessed 05.04.2021]

⁵⁷ Long Term Waste Management Plan 2021-2030 <https://environment.gov.mt/en/Pages/longTermWasteManagementPlan.aspx> [last accessed 05.10.2021]

⁵⁸ <https://environment.gov.mt/en/Waste%20Management/Pages/Home.aspx> [last accessed 05.04.2021]

technologies. In addition, an important consideration in this regard is the important role of updating legislation and strengthening enforcement to drive innovation in these areas.

Liquid Waste

During Malta's preparation for accession to the EU, investments needed to be made to treat the raw sewage being dumped into our seas. Based on the urban wastewater treatment directive of 1991⁵⁹, Malta invested in installing and upgrading waste-water treatment plants, namely the Ras il-Hobz sewage treatment plant in Gozo, ic-Cumnija treatment plant in Mellieħa, and Ta' Barkat near Xgħajra. Secondary treated wastewater which was previously discharged to the marine environment is now being treated with advanced treatment processes which include ultrafiltration, reverse osmosis and advanced oxidation processes, to produce water which is of a very high quality that is currently being distributed to the agricultural sector. Further research into the area of wastewater reclamation should target the optimisation of wastewater treatment processes for wastewater reclamation, the transition of wastewater reclamation plants to energy-positive facilities and the additional recovery of nitrogen and phosphorus from wastewater streams for practical use in local agriculture. Research can also target decentralised wastewater reclamation processes for use in local industries which are high consumers of water as well as the hospitality sector.

Researchers are undertaking research in the area of waste-water treatment and reuse on a household level with a number of local companies. There exists significant potential at the national level in grey and black waste-water treatment and for reuse, with some technologies already being tested and prototyped.⁶⁰ Further research is necessary to identify solutions for bringing these prototypes to market.

4.1.3 Smart Manufacturing

Background and State of Play

Despite Malta's shift towards a service-based economy, the manufacturing sector in Malta remains an important economic contributor, accounting for 13% of all private-sector employment.⁶¹ The manufacturing industry is responsible for the largest share of Malta's exports⁶¹, giving manufacturing companies the opportunity to reach wider markets. Business R&D expenditure of the manufacturing sectors is one of the highest in comparison to other sectors (Figure 3.5). Manufacturing is also seen as providing stability to the economy, since companies setting up manufacturing premises tend to remain for the long-term due to the large infrastructural investment needed, unlike other, more volatile sectors. The manufacturing sector in itself also supports several service-based industries, such as the banking and finance sectors. Attracting FDIs to set up parts of their operation on the island comes with a number of positive spill-over effects as several local manufacturers are subcontracted by FDIs to support production, contributing significantly to the economy. However, local stakeholders have commented that incentives in place (such as tax incentives) are largely aimed towards supporting

⁵⁹ https://ec.europa.eu/environment/water/water-urbanwaste/legislation/directive_en.htm [last accessed 05.04.2021]

⁶⁰ *National Strategy for Research and Innovation in Energy and Water 2021-2030*
<https://www.energywateragency.gov.mt/rni/draft-strategy/> [last accessed 05.04.2021]

⁶¹ <https://www.maltachamber.org.mt/en/why-manufacturing-in-malta-still-matters> [last accessed 05.04.2021]

FDIs and more specific support is required for the local manufacturing industry to develop innovative high value-added products.

Another strength identified in the local manufacturing sector which gives Malta a competitive edge over other regions is the creative and dynamic population; local manufacturing plants tend to be adaptable and flexible in their production processes. Local manufacturers have developed this skill and therefore, have become proficient in carrying out market-centric innovation for specialised products customised to the local or foreign market needs. Companies are therefore investing more in flexible and customisable production lines.

Data Supporting the Sector and its R&I Potential

Statistics for the manufacturing sector proves the continued importance of this economic sector in Malta. The gross value-added for Manufacturing (NACE Code C) has been steadily increasing over the last few years (from €722.3 million in 2015 to €910.1 million in 2018). Investments have remained stable and the number of enterprises in this NACE code is steadily increasing over time. It remains an important economic sector that generates a significant share of gross value-added (9% in 2019) and accounts for 13% of all private-sector employment.

High Value-Added Manufacturing (HVAM) was identified as a smart specialisation area in the RIS3 2014-2020. Various incentives were available to continue supporting this sector, mainly through Malta Enterprise to support FDI, investment in infrastructure and also absorption of R&D personnel in the workforce. Moreover, 27% of all projects awarded through the National R&I Programme (FUSION) between 2015 and 2019 (latest data available) were in this area.

In terms of R&I capacity in the private sector, the number of researchers in Full-Time Equivalents in manufacturing is a fluctuating figure. When discussing with the industry, key players lamented that it is a struggle to find skilled people not only for research, but also in general. Hence, measures should be taken to support HR investment through complementary funds.

The Current Infrastructural Landscape and Previous Investments

Currently in Malta there are 8 Industrial Estates (1 in Gozo) and an Aviation Park. In terms of funding support, the main entity that provides aid and funding to local businesses is Malta Enterprise. Malta Enterprise is Malta's economic development agency, tasked with attracting new foreign direct investment as well as facilitating the growth of existing operations. Malta Enterprise provides incentives and support measures to enterprises that fall within the smart specialisation areas and beyond. Currently (2020) there are 7 schemes for R&I and 17 Enterprise Support schemes available.

Niche Areas of Focus

Based on the above information, Malta should support the sector to move towards Industry 4.0 and invest in "smart manufacturing" through dedicated incentives that assist the private sector. Specifically, support should be available for the following niche areas:

1. Sustainable Manufacturing

Sustainability is a key concern across the manufacturing sector, especially in recent years with increased awareness about pollution generated through manufacturing processes as well as climate change. Moreover, customers are becoming increasingly aware of the impact of production costs on the environment and understand that large infrastructures like manufacturing plants can have quite an impact on a country's carbon footprint. Therefore, there is increasing customer demand to produce eco-friendly products. However, shifting to more sustainable practices comes at a cost and therefore, support should be provided to incentivise companies to embrace sustainability. This can be done by exploring new raw materials, looking into innovative packaging with lower environmental impacts, or through finding ways to valorise production waste and transition to a circular economy approach.

Another opportunity could be to treat wastewater in-house at factories. Malta needs to address water treatment as water scarcity is an issue (as addressed in Chapter 4.1.2) and therefore, there is potential for investing in water recovery.

Furthermore, industry needs to focus on the life-cycle assessment of products since there are manufacturing companies that specifically produce components and various products for other local or foreign factories in sub-contracted agreements. Since global manufacturers are actively looking to produce more eco-friendly products, not following the same ethos can affect business relationships and opportunities.

2. Flexible Automation

The global economic landscape is constantly changing and this is more so for Malta, a microeconomy which is extensively affected by external pressures.⁶² Stakeholders feel that mass industrialisation is considered risky in Malta's context. Instead, the focus should be more on flexibility and customisation via flexible automation. This means that products would be manufactured in smaller quantities but provide a greater variety, therefore stock and storage spaces would decrease thus increasing cost efficiency, and customer base is diversified.

Moreover, the production and manufacturing industry is being threatened by long-term challenges in terms of human resources on the shop floor. Through the EDP, stakeholders expressed concerns of finding enough employees to work on their production lines. This issue could be partially addressed through automation, since a smaller workforce is needed during the production process. On the other hand, the workforce that is needed will need to be trained to be versed with the new technologies being used.

Additive manufacturing such as 3D printing is an aid when it comes to flexible automation and could eventually replace traditional methods such as injection moulding, but the industry, by and large, has not yet transitioned to using the new technology available. 3D printing can be considered an enabling technology and to date has mainly been utilised for sampling or prototyping products or components. However, 3D printing technology has now reached a maturity level which allows for a growing number of practical and essential uses in the manufacturing industry and beyond. Incentivising the industry to shift their practices and include 3D printing in their production and operation lines could assist the manufacturing sector to shift to more flexible automation.

The COVID-19 pandemic has been a tangible manifestation of the need for flexibility in automation and the ability of several Maltese manufacturing enterprises to react quickly to high demand for niche-

⁶² <https://mcst.gov.mt/wp-content/uploads/2017/02/National-RI-Strategy-2020-June-2014.pdf> [last accessed 05.04.2021]

products (in this case, production of PPE) in a limited time frame. Beyond this external shock, there is scope for supporting the capacity of the local manufacturing industry to be flexible and adaptable as a means of mainstreaming resilience across the board within the sector.

Some companies have production lines that also include some digital technologies that support automation. However, further digitisation of production lines could be improved by incorporating computer-integrated manufacturing (CIM) whereby the entire production process is interconnected and can be run via a computer minimising the need for a large number of workers on the shop floor, as having enough HR in the manufacturing sector has been flagged as an issue. Moreover, this will mean that the current workforce will need to be upskilled to handle the management of a CIM. Via CIM, manufacturers are able to employ more efficient methods of keeping stock, ordering materials and distribution with the data being collected by the CIM. Therefore, CIM offers further flexibility, sustainability and efficiency for the manufacturer. Whilst solutions can be bought, especially for SMEs, large corporations might require a more customized product. Digital technology therefore plays an important role in the progress of the manufacturing sector and is hence considered an enabling sector, as explained in Chapter 4.1.5.

CIM and other technologies that support flexible automation can be utilised to continuously innovate products to meet customer demands and increase competitiveness. It can also facilitate the diversification of the manufacturers' product line which can give companies the opportunity to revise their business models and would have a significant impact on their competitiveness and economic growth. There is also substantial potential in terms of R&I, process and product innovation in terms of making the manufacturing process more sustainable and cost-effective as well as meeting consumer demand. This has become more essential in the current pandemic scenario, where businesses had to shift to different products in a very short timeframe.

4.1.4 Marine and Maritime Technologies

Background and State of Play

The potential of the European seas, coasts and oceans is manifold and complex.⁶³ Economic sectors active on or near the seas interact in complex value chains. Therefore, sectors that are related to marine and maritime issues have been consolidated in the Blue Growth concept. Blue Growth is a concept used to describe the untapped potential of oceans, seas and coasts for jobs and growth. Blue Growth is seen as an innovative way to develop a range of marine and maritime activities that are often dependent on each other by relying on common skills and shared infrastructure.⁶⁴ In the implementation of the EU's Blue Growth Agenda, the importance of innovation across all sectors of the blue economy has been highlighted.⁶⁵

Over the past few decades, Malta has taken considerable steps to upgrade the quality and levels of its services contributing to the blue economy, for example, participating in the Blue Flag initiative⁶⁶ to promote Malta's clean beaches and attract coastal tourism, and upgrading its ports and marinas to

⁶³ <https://webgate.ec.europa.eu/maritimeforum/en/node/2946> [last accessed 05.04.2021]

⁶⁴ EC (2012) Blue Growth – opportunities for marine and maritime sustainable growth. COM(2012) 494 final

⁶⁵ EC (2014) Innovation in the Blue Economy: realising the potential of our seas and ocean for jobs and growth. COM(2014) 242 final/2

⁶⁶ <https://www.blueflag.global/> [last accessed 05.04.2021]

continue building Malta's strong ship register, maintaining its position as a key pillar of the country's overall growth. The blue economy contributes 406 million euro to Malta's total GVA. While Malta's most prominent blue economy sectors have remained consistent over time, (example tourism and maritime services), the EDP showed that it should look to further capitalise on its capacity in other non-traditional and more innovative areas. Opportunities should be explored that move beyond maritime services, focusing on exploiting its potential for research and innovation in other areas of the blue economy. In Malta's current smart specialisation strategy, 2014-2020, maritime services and aquaculture were two of seven sectors selected through the entrepreneurial discovery process as Malta's key areas of R&I strength. However, the consultation process of 2018-2019 showed that the sectors had limited success - aquaculture was seen as too narrow and few stakeholders could tap into opportunities provided for the sector, whilst maritime services, albeit a large and successful economic sector, lacked R&I capacity.

Through the entrepreneurial discovery process of 2018-2020, it was therefore pertinent to understand which economic sectors in Malta are contributing to the Blue Growth agenda, and how the principles of Smart Specialisation can be used to stimulate the marine and maritime economy, creating more critical mass for innovation in distinct domains. The maritime economy encompasses anything connected to the seas and waterways, especially in relation to navigation, shipping and marine engineering, whilst the marine economy relates to the valorisation of resources found in seas.

Data Supporting the Sector and its R&I Potential

Malta has a strong maritime heritage and a long history as a hub for maritime activity which has long contributed to the country's economy and has amassed significant experience, human capital and reputation as the maritime hub of the Mediterranean. Historical records show that Malta has used the sea for its survival since the first settlements of civilisation, and culture, traditions and the economy have been built around the sea. Maritime transport ensures the security of supply of energy, food and commodities and is the main vehicle for European imports and exports. Over 90% of all goods entering or leaving Malta pass through our ports. Hence, the vital importance of the sector is undeniable and investments in this sector are essential to ensure that the sector continues evolving with the needs of today. It is estimated that Malta's maritime sector contributes to the employment of over 20,000 people.⁶⁷

Malta's marine sector has established itself as a fundamental economic contributor. 15.4% of Malta's total GDP is dependent on the marine environment, offering opportunities in an array of areas.⁶⁸ This is well above the analogous EU figure which stands at 3-5% of the EU's GDP.⁶⁹

The interest of Maltese actors to conduct R&I studies related to the marine and maritime sectors is evident. According to the results obtained as part of the data mapping exercise, over the period of 2014 to 2018, 14.78% of the University of Malta's publications on the priority areas identified in the current smart specialisation areas stemmed from the maritime, marine and aquaculture sectors.

⁶⁷ https://economy.gov.mt/en/public_consultation/documents/integrated%20maritime%20policy.pdf [last accessed 05.04.2021]

⁶⁸ Marine Strategy Framework Directive – Economic and Social Impact Assessment Report, AEE Consortium

⁶⁹ Estimated EU average for 2004

This interest is further confirmed by the data relating to the participation of Maltese researchers in the EU's Horizon 2020 framework programme. Research applications were submitted by Maltese R&I actors in the fields of seafloor mapping, marine archaeology, and offshore renewable energy storage. Furthermore, funding was successfully awarded to local researchers to conduct projects in ocean monitoring and forecasting, the offshore business economy, sustainable activities in the marine environment, marine data management and maritime products. Based on data published on European platforms, 16 Maltese participants received funding in the area of food security, sustainable agriculture and forestry, marine & maritime water research and the bioeconomy. Out of these 16 participants, 8 were specifically awarded funding for marine and maritime projects. This success rate is high in comparison to other work programmes of Horizon 2020, as illustrated in Chapter 3, Figure 3.10.

The Malta Ship Register is the largest in the EU, and 7th largest worldwide. As of 2018, 8286 vessels were registered under the Malta Flag, with a total of 77.2 gross tons.⁷⁰ Malta's Ship Register is therefore a valuable asset that, combined with improved and consolidated logistics and maritime services as well as ICT, can be an important data source for innovation in the maritime sector for Malta.

Niche Areas of Focus

Encouraging investment in this sector will enable Malta to build on its R&I expertise in the marine science and maritime sectors, while also becoming competitive in new areas outside its traditional spheres of operation. Malta's Integrated Maritime Policy (IMP) underscores the importance of investing in R&I in the marine and maritime sector as well as the potential of the sector to offer a variety of jobs in R&I. Investments in R&I in the marine and maritime sector will contribute to the IMP's drive to transform Malta into a maritime hub of excellence⁷¹ and support the EU's drive to foster blue growth.

The traditional sectors, namely the tourism, fishing and ship-register activities, will continue to contribute to Malta's economy; however, it is also expected that new areas, such as biotechnology, renewable energy and offshore activities that are currently in their infancy, to grow over the coming years. Based on this and the above analysis of the various sectors, the following smart specialisation niche areas are being proposed:

1. Valorisation of Marine Resources

The sea is a valuable resource for the Maltese Islands, that needs to be managed carefully and responsibly to, among others, develop new products and services in a profitable and sustainable manner. This requires further focus on research in marine sciences as a primary source of knowledge for effective management and valorisation of marine resources without over-exploitation. The valorisation of marine resources has the potential to create new market niches and opportunities for Malta. This of course requires achieving the right balance between using natural resources without

⁷⁰ Data provided by Transport Malta, January 2020

⁷¹ Integrated Maritime Policy -

https://economy.gov.mt/en/public_consultation/documents/integrated%20maritime%20policy.pdf [last accessed 05.04.2021]

impacting primarily biological communities as well as other economic sectors such as tourism, transport and fisheries.

Building on a strengthened research base in marine sciences, the areas which have most potential for Malta to benefit from the valorisation of marine resources are marine biotechnology, aquaculture and renewable energy and offshore technologies. Whilst the number of companies in these fields is small, they are highly innovative and active in various R&I programmes such as MARTERA, PRIMA and the SINO-MALTA Fund.

Marine Biotechnology, including Aquaculture

The aquaculture industry has considerable socioeconomic value and potential, notwithstanding challenges such as competing uses of space like tourism and shipping, and the environmental impact of some aquaculture activities. This sector contributes to primary food production, provides valuable export earnings and contributes positively towards the EU trade deficit for fisheries products. The rapidly expanding world of aquaculture also represents a growing market for research and innovation products like research services, technology testing, production of knowledge-intensive supply materials (technology design, feeds, vaccines, seed material). To develop these products, there also needs to be close cooperation and investments with the marine biotechnology sector.

Previous investments in the Malta Aquaculture Research Centre (MARC) has resulted in various positive outcomes. MARC has conducted a variety of national and EU-funded projects on species diversification, the hatching of amberjack and blue-fin tuna, in partnership with local fish-farming companies. The private aquaculture research sector in Malta is also very well established and widely acknowledged in the global world aquaculture industry. This sector collaborates with the public sector and has a yearly growth of above 20%, recently bringing in more than €5 million annually of high-level contracted research, collaborative research, and high-end engineering work to Malta.⁷² The experience of the last 20 years shows clearly that Malta has several competitive advantages to further develop this sector.

The aquaculture sector in Malta has a high potential for innovation, if the right investments are made. Despite the adoption of a National Aquaculture Strategy (2014-2025), the average 128 million euros it contributes to the economy⁷³ and Malta's nearly unrivalled expertise in offshore aquaculture, stakeholders opined that few if any national investments have been made in recent years. However, stakeholders identified strong innovation potential at the interface between aquaculture research and marine biotechnology. The progression to investment in higher value-added activities is where innovation can occur. This avenue is already being explored, specifically by looking at the potential of using fish waste as a resource for producing new commercial products. Apart from the innovation potential in this area, this approach, if successful, would lead to a reduction in the volume of fish waste dumped at sea, clearly putting into practice the principles of the circular economy. Other research avenues include the exploration of marine organisms to produce medical and cosmetic products.

Furthermore, Malta should look to build on both public and private R&I capacity and explore how best to exploit their research results on different finfish species, shellfish, and aquatic plants, as well as the non-fish farming and supply services side of aquaculture. However, it seems that the private sector is

⁷² Data supplied by a private company during the consultation process

⁷³ (Applied Economics Consulting Ltd., 2009)

reducing its diversification and instead, is mainly focusing on the capture and fattening of wild tuna, due to immediate and large profit margins that this business model yields. Whilst this might be lucrative for the time being, the EU⁷⁴ is increasing pressure to reduce tuna fishing quota and therefore, the sector needs to look at the long-term sustainability of their current business. The Malta Aquaculture Research Centre is still also looking to expand its facilities to be able to undertake more research projects in conjunction with the private sector, for which structural funds could be used.

Renewable Energy and Offshore Technologies

Our seas have the potential to become important sources of clean energy. Marine renewable energy, which includes offshore solar, wind, as well as wave-energy, provide Malta with a potential opportunity to generate economic growth and jobs and in so doing, enable Malta to fulfil its policy drive to diversify its energy supply and to boost technological innovation.

The need to meet the EU2020 energy efficiency targets on increasing the uptake of renewable energy sources and reducing carbon emissions has also led to the consideration of new and alternative sectors within the marine economy. Malta has conducted various research projects on ocean energy. Studies such as offshore energy storage systems⁷⁵ and wave energy generation⁷⁶ have successfully taken place, involving the participation of both the University of Malta and private industry. Moreover, in addition to having been highlighted as a priority, the government continues to closely examine future investments in ocean energy.

Malta should strongly consider the exploration of blue renewable energy opportunities as a means to achieving these goals. The four main blue energy areas being pursued for further study are offshore wind farms, floating photovoltaic islands, tidal wave energy conversion and blue renewable energy. Malta needs to promote and support the necessary research required in order to identify the most suitable and most feasible energy source for the Maltese Islands.

There is a clear market potential not only for Malta, but also in the Mediterranean region. Developments in these areas are still rather new in Europe, and hence, Malta can be part of the European drive for further investments towards the Blue Growth agenda and be at the forefront of such technologies. Academic institutions have several researchers and ongoing innovative projects in these fields, some of which have successfully completed the technology development programme of the national R&I grant scheme, FUSION, and are looking towards commercialisation of prototypes.

A consolidated effort will be needed to ensure that the academic research being carried out by institutions reaches fruition and is taken up by the private sector. Due to the small size of most of these companies, support will be needed for such SMEs to undertake larger and more impactful projects. Due to the fields mentioned being relatively new for Malta, structural funds could be used to undertake various investments needed in terms of equipment for development of technology. Support could be provided for an innovation space for Blue Growth developments in Malta.

⁷⁴ https://ec.europa.eu/fisheries/bluefin-tuna-season-2018-eu-determined-maintain-control-standards-and-guarantee-recovery-trend_en [last accessed 05.04.2021]

⁷⁵ FLASC – <https://www.offshoreenergystorage.com/> [last accessed 05.04.2021]

⁷⁶ http://oceania.research.um.edu.mt/cms/blueocean/index.php?option=com_content&view=article&id=11

2. Maritime Technology

Investment in this niche area will enable Malta to build on its existing and traditional sectors, as well as its large human resource and expertise. These areas include **shipping logistics and services, ship manufacturing and maritime engineering and ICT**.

Shipping Logistics and Services

Stakeholders have commented that systems supporting maritime services and logistics are outdated, fragmented and still paper-based, so further investments through digital technology would lead to better service as well as more cost-effective solutions. The country should look to capitalise on its extensive experience in maritime transport and make use of smart technologies, such as digitisation, artificial intelligence and blockchain to better coordinate logistics and services and improve operations in Maltese waters. This sector could also benefit from investments in non-technological innovations linked to efficiency improvements for door-to-door freight and passenger transport.

ICT

e-Maritime is an EU initiative that aims to foster the use of advanced information technologies for working and doing business in the maritime transport sector and supports the development of the necessary ICT systems to ensure the effective management of data and economic growth. Nowadays, most vessels, yachts and oil rigs are equipped with state-of-the-art technology that require various ICT support services including maintenance, new software applications and electronic systems to keep up with the market and operational demands. Support should be provided to ensure that the private sector can cater to meet such demands, especially due to the increase in the number of superyachts berthing in Malta.

Ship Manufacturing and Maritime Engineering

According to stakeholders consulted, ship repair is experiencing a resurgence in Malta and shipyards are increasingly focused on tapping niche opportunities and attracting new business. Shipyards have invested in new equipment and new working methods injecting more millions in turnover directly into the Maltese economy in order to diversify to also service the oil and gas sector, cruise ship refitting, repair services to yachts and oil rigs. There are opportunities to shift to higher added value work, including LNG conversions of vessels as a niche that has emerged within the EU. Malta can focus on exploring, supporting and promoting initiatives that can attract companies to address this niche market, or support existing companies to make the necessary investments and upskill the workforce to cater for such higher value-added work. Being in the centre of the Mediterranean, the internationalisation market for ship repair and maintenance, as well as the extension of such services to other sectors, is promising. New technological solutions should be targeted, aiming at developing research linked to infrastructures and retrofitting existing ships.

Since ship repair is gaining momentum and the sector is already investing in higher value-added activities, the sector should take the next step and continue investing in more research dedicated to greening maritime vessels. As advocated for in the Bluemed Initiative⁷⁷, researchers in the maritime engineering sector are seeking ways to increase energy efficiency and reduce energy consumption of ships, that could help mitigate the pollution caused by the maritime sector around ports and harbours,

⁷⁷ <http://www.bluemed-initiative.eu/> [last accessed 05.04.2021]

and incentives should be in place to foster collaboration between academia and the private sector and bring these technologies to market.

Structural funds could also be used to support the University of Malta in increasing its R&D capacity to continue developing its research infrastructure in the maritime engineering sector. Such infrastructure and R&D facilities are currently lacking, and researchers rely on facilities overseas. Yet there is a local manufacturing private sector that would make use of such a service. Furthermore, Malta must also look to strengthen its workforce. More work needs to be undertaken to understand the skills gap and support the sector by training human capital, possibly using the ESF.

4.1.5 Aviation and Aerospace

Background and State of Play

Malta's civil aviation sector has been established for decades. The precursors of our modern productive aviation sector however can be traced back to the creation of the national airline, AirMalta, in 1975 and establishment of Medavia in 1979. The sector rapidly grew in the 2000s mainly through the investment of Lufthansa Technik in 2002 working on Airbus base maintenance, and taking up various expansions over the years.

Lufthansa Technik Malta (LTM), a joint venture between Lufthansa Technik and AirMalta, offers a service spectrum that covers aircraft overhaul operations, support services for long-range aircraft, structural work, the repair of composite materials, painting and extensive cabin modifications.

In cooperation with the Malta College of Arts, Science and Technology (MCAST), LTM trains aeronautical technical personnel in a dedicated Technical Training Centre. With over 60,000 square meters of hangar space at its disposal and given its strategically favourable situation in the southern European Mediterranean region, with its proximity to Africa and the Arabian Peninsula, Lufthansa Technik Malta is well-positioned to offer a competitive, quality product.

The maintenance, repair and overhaul (MRO) ecosystem was further bolstered by the addition of SR Technics in 2010.

In 2016, Easyjet entered into an agreement with Lufthansa Technik Malta and SR Technics Malta, which will see its entire fleet undergoing maintenance in Malta. During this same year, Aviation Cosmetics, a company specialised in the painting of aircraft has opened a new facility at the Safi Aviation Park. This facility can service wide body and narrow-body aircraft.

Other players in the sector include training schools and flight simulator company Simliner Ltd, Gulfmed aviation services, MCM, Aeromaritime, Bravo Air Traffic Services, Celier aviation and Britten Norman, one of the latest additions who will be ramping up their presence in Malta in the next months.

Therefore, apart from maintenance, repair and overhaul (MRO) operations for both fixed-wing and rotary aircraft, the sector currently includes flight training, component manufacture, R&D and innovation on unmanned aerial vehicles, back-office support/call centre operations and ICT for the aviation industry. One must also take note of the fast-growing aircraft registry, helped in no small way by a flexible, competitive legal structure.

Consulted Stakeholders

The main stakeholders consulted for the scope of this thematic area were the country's economic development agency – Malta Enterprise and the Institute of Aerospace Technologies at the University of Malta.

Malta Enterprise, as the central touchpoint for productive investments in the aviation industry has first-hand knowledge of the current and future operations of the indigenous and FDI operators, and is also best positioned to provide an overview of other incoming investment. In fact, Malta Enterprise were able to analyse and present the pipeline of incoming investments that would particularly be relevant to the analysis of future requirements pertaining to research development and testing in the wide aerospace industry.

On their end, the Aerospace Institute at the University of Malta has provided a thorough description of all their current research project, sectoral projections and further areas that are being matured for further industry development and assimilation.

Analysis of the Sector

The identification of 'aviation and aerospace', as an area of specialisation for Malta, is based on the recognition that this sector has gained an energetic momentum over recent years, and moreover has grown to a level of competence that demonstrates real R&I potential.

This is the rationale for further investment and growth in this area through R&I, as this supports its crucial role in improving resilience amidst competitive and economic challenges.

Hereunder is a more in-depth explanation that quantifies the current contribution of this particular industry to the Maltese economy.

Contribution to the Economy:

In January 2020, Full Time (FT) employment in (NACE C.33) the Repair and installation of machinery and equipment (which is highly influenced by MRO activities) stood at 1,947. This represented 0.8% of the total gainfully occupied in Malta and 8.7% of those employed in manufacturing. Back in 2013, this sector contributed 1,289 FT jobs representing 0.8% of the gainfully occupied and 6.4% of the employment in manufacturing. It is evident, that the role that this sector plays in Malta's manufacturing sector has increased both in terms of absolute employment as well as its contribution to manufacturing.

The GVA generated in (NACE C.33) the Repair and installation of machinery and equipment amounted to EUR 80.2 million in 2019. This represents a significant increase from the EUR 33.1 million recorded in 2010 and EUR 62.4 million recorded in 2015. In 2019, this sector contributed towards 0.7% of the total GVA generated by the Malta economy and 8.3% of the total GVA generated by the manufacturing sector.

The latest data available from Eurostat for the EU28 and the EA19 for the corresponding statistics are for 2017. On average during that year, repair and installation of machinery and equipment in the EU28 contributed to 3.8% of the EU28 manufacturing GVA. The same figures apply for the EA19. It is worth noting that when taking into consideration the average GVA generated under NACE C.33 in the EU28, EA19 and Malta and express it as a percentage of the respective average GVA generated by the economy, a similar share is attained (0.7%).

Infrastructure:

This current aviation industry investment is centred around the Safi Aviation Park, a specialised industrial area designed to provide secure, airside facilities for the industry.

While a number of aviation companies were already operating within the perimeter of the Malta International Airport, the Safi Aviation Park is designed to bring the cluster closer together, providing better operative infrastructure to its tenants, as well as direct access to the general airport infrastructure and its main runway.

Four new hangars were constructed within the Park in 2016. With these hangars, the Safi Aviation Park covers an area of almost 240,000sqm. The project also included the construction of a common apron of approximately 4,600sqm as well as a newly constructed maintenance route, all in accordance with ICAO (International Civil Aviation Organisation) standards.

Park 4 is another zone within Malta International Airport which is home to the MRO cluster and indeed in a few months' time it will be home to two of the main operators side by side: Lufthansa Technik and SRT.

Lufthansa are already housed in this area and as part of the recent agreement between Malta Enterprise, INDIS Malta (formerly Malta Industrial Parks) and Lufthansa, the latter will be investing 25 million euro to expand its facility in Malta with a new hangar. Their new neighbours SRT are currently advancing the construction of their new six-bay hangar announced in 2017; another 30 million euro investment that will create around 300 new jobs.

Potential Areas of Focus

Over the last three decades, Malta has developed a range of competencies in aviation, including air traffic management and flight operations and maintenance, repair and overhaul. Malta has developed a strong activity in avionics R&D in the last 15 years, focusing on surveillance systems, cockpit HMI and crew support tools. Malta's strength is the focus on technology areas of long-term use (MRO, avionics, UAVs, air traffic management). Other areas of development and opportunity are Remotely Piloted Air System (RPAS) technologies, small aircraft design, operation of a flight test facility and space applications. Malta has some unique features and qualities that can allow it to achieve world-class excellence in specific area (UAVs, etc.).

Malta has the competencies and potential to expand its current role and contribute more significantly in these sectors, in particular by providing varied services to MROs, ground handlers, ANSP, airlines, manufacturers, airports and travel agents.

Malta Enterprise:

Malta Enterprise, the country's Economic Development Agency has related that they foresee that in the years to come RDI in aviation shall be more widely pronounced. Malta shall be further sophisticating its positioning as a regional aviation hub. Malta's advantages as a jurisdiction are validated by an ever-increasing number of FDIs who are already main players in the cluster. One that ranges from MROs, air chartering, aircraft and airline registration, aircraft leasing, academia and training, RDI, tech for aviation, specialised engineering services, manufacturing, the growing drone industry and other sub-niches.

Medavia is still going strong as per its MRO services and it was recently announced with De Havilland Aircraft of Canada whereby Medavia will be an Authorised Service Facility.

Malta Enterprise is also looking forward to advancements in the aviation training industry where given that Malta has the right level of tuition and training, and the right infrastructure, it believes that Malta can attract more students to learn and train for various aviation jobs including pilots, cabin crew, engineers and technicians.

Malta Enterprise is also set to advance in a strong way its plans on the drones front, be it piloted but also UAV'S of various sizes. Malta can truly become a testbed, attracting companies working on particular categories of innovative prototypes that are tested safely here before entering larger markets. Such technologies have the potential of bringing advantages to our population, while creating economic added value.

Institute of Aerospace Technology - Fusion R&I Programme (2015 – 2020)

From their point of view, the Institute of Aerospace Technology (IAT) at the University of Malta explained how over the last period of the Fusion R&I Programme (2015 – 2020), the Institute was awarded a total of 12 projects, in excess of euro 2.25 million in research funding. All projects have been delivered in collaboration with 7 industry partners, who have directly benefitted with over euro 0.5 million. The list of Partners is as follows: DiversCode, Idox Health, QuAero Ltd., Medavia Ltd., HandsOn Systems, Malta Air Traffic Services and Abertax Kemtronics.

The IAT research activity has led to the filing of 7 patent applications, of which 5 have been awarded. 6 projects have been successfully concluded while the rest are ongoing. Projects that are still ongoing also intend to file for patent applications, thus increasing the portfolio of the IAT. The University of Malta is currently in discussions with Airbus with the intent to license/sell some of these patents. The discussions however will also serve to further research cooperation in the area.

The projects also have deliverables in the form of Conference and Journal publications. The IAT has so far delivered over 25 publications of this manner. Such dissemination events are important as they not only demonstrate the technical achievements but send a message to the international academic fora that the University of Malta has the skills to research and deliver in the particular topic, often promoting research collaboration.

Institute of Aerospace Technology - ERDF Funding

Meanwhile it is also pertinent to highlight how throughout the last years, the University of Malta has secured ERDF funding in excess of euro 60 million. These will fund the Transdisciplinary Research And Knowledge Exchange (TRAKE) building and Sustainable Living Complex (SLC). The SLC will host the Institute of Aerospace Technologies with over 1000m² dedicated for a UAV lab, an Aerospace Systems lab, an Avionics lab, an Air Traffic Control Tower Simulator and a Full Flight Simulator. A fund of ca. euro 1 million are also reserved for the purchase of a research full flight simulator. These facilities will not only be beneficial for the IAT but also for the local aviation industry, which will be able to make use of such facilities (to conduct experiments, test equipment and so on) through collaborations with IAT.

While the IAT has so far been successful in research (despite severe limitations in office space and research labs), further ERDF funds to support growth and development in the area will be necessary. Moreover, it will enhance the investment being held with the University, in that it will now not only

have facilities but also an opportunity to apply for research funding and together with industrial partners, utilise the facilities.

Further investments in the aviation and aerospace sector not only benefit the University of Malta, but will also improve the country's aviation infrastructure through ERDF support. It would also tie in the efforts being made by various sectors of government and industry to attract further investment in aerospace in Malta (e.g. Malta Enterprise, TM-CAD). This funding (through the next National R&I programme) will harness the good work which has been done so far and offer an opportunity for further development.

Institute of Aerospace Technology – Other EC Funded Projects

The IAT has been, and is still, involved in several EC funded projects (under FP6, FP7, CLEANSKY, SESAR JU and ERASMUS+) with international organisations such as Airbus, Thales Avionics, Alenia Aermacchi, Selex Galileo, EADS-IW, NLR (Dutch Aerospace Centre), DLR (German Aerospace Centre) and Delft University of Technology, Latecoair, Onera, CIRA, Cranfield University and DeepBlue, amongst others. Malta's involvement in such projects has helped to establish its reputation in Avionics Research and contribute towards the Union's efforts to make Europe climate neutral by 2050 through such initiatives as the European Green Deal which, amongst other areas, focuses on clean energy and sustainable mobility (including aviation).

The national R&I Fusion programme currently provides a platform/framework to develop and mature innovative technologies and be able to pitch them at a higher TRL when applying for EU-funded projects.

Examples of this are the projects KERSair (held in collaboration with Medavia) which aims to develop a Kinetic Energy Recovery for a landing Aircraft. The preliminary study has been done through the (still ongoing Fusion TDP Programme). However, the IAT has now applied for a Sino-Malta fund (with a project value of euro 0.4M) which will see UM partner with The University of Nottingham, Ningbo China and Shandong University, China. The project is being supported by COMAC – the Chinese aircraft manufacturer which has an active aircraft development programme.

Likewise, project SATMET (held with HandsOn systems and Malta Air Traffic Services), which investigated engineless taxiing is being used as a platform for a euro 25 million Green Deal Project (Topic 5A).

The project aims to use Malta as a technology demonstrator for cutting aviation emissions on the ground. The project will involve all the local stakeholders (MIA, AirMalta, Malta Ground Handling Services, Civil Aviation Directorate, Ministry for Energy, Climate Change and Planning (MECP), Ministry for Transport, ERA, private companies, two international companies and two other international airports which will hold observer status. The observer airports will commit so that any lessons learnt in the project will be applied. These examples demonstrate how this thematic area enables locally funded research to make an impact not only at national level but beyond our shores and the local economy. The Institute has submitted that continuing to support aviation as a Smart Specialisation Area will bolster the ability to exploit similar projects and opportunities in the near future.

Other industry benefits from aviation and aerospace include:

- Investment in R&D knowhow (which is then trickled to support industry)
- Investment in new equipment (which is available to UM and industry) and a wider use of industry-owned equipment and services

- Creation of a strong knowledge base that can be used to attract investment
- Extension of product/service portfolio
- Research projects force an increased communication and collaboration between industry partners and UM. This often leads to discovery of new industry problems which can then be addressed through UM skills.
- Greater exposure of the industry through dissemination events, conferences, etc.
- An increase of IP generated in Malta
- International innovation awards that send a strong message of competence in the field when coupled to aviation as a smart specialisation area.

Aviation Working Group

An inter-governmental aviation Working Group is currently being set up. This Working Group will also be able to take stock of the skill-set and facilities that are available and use them accordingly when promoting the country and attracting foreign investment.

Airport Zoning Strategy

Malta Enterprise referred to the Airport Zoning Strategy, which a number of Government entities led by INDIS (former Malta Industrial Parks) have collaborated on and which is currently being assessed by Government. The process also aims at synergising laws, entities and responsibilities in order to attain a more effective output.

This will lead to a more unified level of quality of service and lead to the regulator's refinement of their core outputs.

Horizontal Analysis

A particular future infrastructural project that would potentially fit in the remit of putting ERDF funds to practical and tangible use in relation to a Project of excellence. The project that is being developed by Malta Enterprise would also be a good example of horizontal implementation within the industry and across some of the other Smart Specialisation sectors identified for Malta (such as Maritime, Smart Manufacturing).

Autonomous Mobility Centre of Excellence – (Air/Land /Sea)

While the establishment of a drone hub for Malta's upcoming UAV research and development sub-niche is already positive in itself, it could also act as the first phase of a much wider project.

The first building blocks of such a project would entail setting up a permanent drone testing hub for all drone categories therefore also including a runway assisted launch. Such a hub would include a number of smaller hangars which can be allocated to various operators that could be developing their prototypes in such facilities and testing them right away via the runway that would be annexed to the site. Malta's Civil Aviation Directorate has already made itself available to set up air corridor and bubbles over the country's territorial waters whereby testing could be performed with decreased level of risk to the population.

Autonomous vehicles and related technologies such as Internet of Things (IoT), sensors, 5G technologies can indeed enable such a vision.

The wider vision that is being presented is to have all different elements of unmanned mobility tested via the establishment of one consolidated centre. This would also enable the running of autonomous cars, either within the precincts of the centre or inside adjacent areas. At a later stage, vehicles can be tested on the road at specific times.

Malta has some unique selling points when it comes to autonomous vehicle testing which include different terrain and road network complexity. Malta Enterprise is actively pursuing links to major automotive original equipment manufacturers (OEM) to test interest. There are also ongoing discussions with telecommunication operators in Malta on the provision of enhanced 5G connectivity in selected areas. This will enable better testing for autonomous vehicles in the future. Such a concept may also be extended to encompass testing of water UAV. At least two different areas have been earmarked that could possibly house such an activity. ERDF funds can be potentially leveraged to part-finance this fully-fledged centre for air/land/sea autonomous mobility as a veritable European centre of excellence.

Companies whose prototypes would be successfully developed in Malta (potentially even assisted through a certification process coordinated between MT CAD – EASA) could also translate their operation to a manufacturing outpost, making use of the export expertise/facilities already available in Malta (Freeport/Malta International Airport).

Recommendations

Development Needed

- Malta has a competitive edge in flight test facility and UAVs, since it has a large Flight Information Region, mostly over the sea and hence not populated. Malta also offers generally temperate weather conditions, which are ideal for test flights as these require good visibility. It is envisaged that Malta can cater for various sizes of drones and to perform maintenance if the operator requires this. Such a pillar of activity will be able to give value to the foreign industry and help to start up a niche market locally. It will operate on foreign investment and will continue to attract this investment during its course of operation. Hence, despite adding value to the UAV sector of aviation and raising competitiveness of the respective operators, it will also generate revenue for the island.
- Build on and develop current R&I strengths to boost the competitiveness of local industry.

The following areas have been identified:

- Avionics, in particular cockpit display technology based on participation in TOUCHFLIGHT 1 and 2, flight data monitoring;
- Composite materials;
- Development of new technologies for maintenance of new products, e.g. glass cockpit, remote health inspection, inspection of fuselage by drones, improve inspection on shop floor using non-contact inspection techniques, (radio frequency identification) RFID tracking,

innovation in cleaning materials which are required for cleaning parts prior to inspection, waste treatment, seating-rails corrosion inspection techniques, amongst other ideas.

4.1.6 Digital Technologies

Background and State of Play

In contrast to other areas, the digital sector is unique in that it is an area with a high potential for innovation in itself as well as an enabler of innovation across several other sectors. Additionally, compared to other sectors, the evolution of digital technologies is generally over shorter timeframes, more volatile and nimbler, and more generally accessible. In general, new Information and Communication Technology (ICT) companies tend to have a higher survival rate than those in non-ICT sectors, and Malta is no different.⁷⁸ Companies in the digital sector, for example, are often not tied to a single physical location and are able to relocate should the conditions and environment they operate in no longer remain attractive.

In Malta, the sector is made up of a number of different actors, ranging from national entities (MDIA, Malta Enterprise, MCA, Tech.MT, MITA, MCST, the Planning Authority, eSkills Foundation etc.), to the public academic sector (UM, MCAST), and private industry. The majority of privately run companies tend to be SMEs, with a mix of both local and foreign ownership. While the sector is well established and consists of many players, one of the biggest drawbacks is the existing fragmentation, with minimum coordination and cooperation, as well as a duplication of resources.

It is also important to distinguish between the sector's current activities and future potential. When separating the interlinkages to the gaming and finance sectors, as well as the commercial and application elements of ICT, the activities dedicated to research are rather limited. During stakeholder consultations, many private companies admitted that their research capacity is often minimal and restricted. While there is an element of research involved in their commercial work, it tends to be limited and used to further shore-up existing processes. It is not often the case that research is pursued with the aim to specifically foster new innovations.

Data Supporting the Sector and its R&I Potential

Although a comparatively new player within Malta's economy, the ICT sector has grown to represent an important segment. Currently, the industry is composed of more than 300 companies, employing around 7,500 individuals. The success registered to date and the evolving initiatives over the past years suggests favourable prospects for future investments within this sector.⁷⁹

When analysing the data and information available on the sector's contribution to the country's overall economic output, the picture painted is one of relative stability. The available statistics indicate that during the period 2010-2018, the contribution of the business R&D expenditure in the ICT sector

⁷⁸ <https://publications.jrc.ec.europa.eu/repository/bitstream/JRC94807/jrc94807%20final.pdf> [last accessed 05.04.2021]

⁷⁹ National eSkills Strategy 2019-2021

https://eskills.org.mt/en/nationaleskillsstrategy/Documents/National_eSkills_strategy.pdf [last accessed 05.04.2021]

as a percentage of GDP remained largely unchanged over time (Figure 4.3). Nonetheless, following the COVID-19 outbreak, the numbers may have altered and an analysis should take place to examine the extent to which the pandemic impacted the sector's growth and role within the economy.

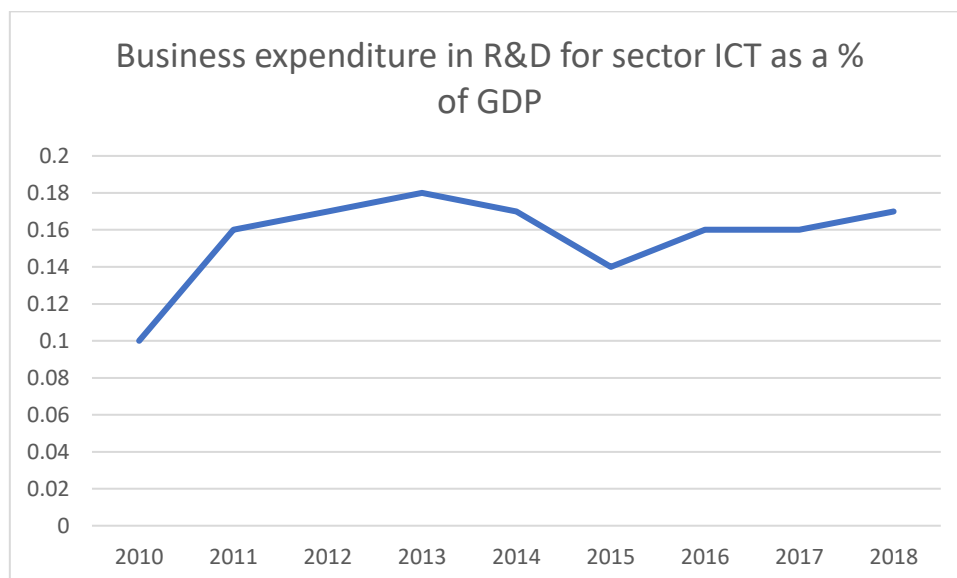


FIGURE 4.3 – BUSINESS R&D EXPENDITURE FOR THE ICT SECTOR AS A PERCENTAGE OF TOTAL GDP

Over this same period, the government embraced an agenda that placed the development of new emerging technology sectors as a national priority. Examples of initiatives linked to these investments include the creation in 2018 of the 'Malta Digital Innovation Authority' (MDIA) as the regulatory body responsible for governmental policies that aims to promote Malta as a centre for excellence and innovation across digital technologies. In 2019, the government also launched Tech.MT, a public-private foundation tasked with advancing Malta as a leading global hub for emerging technologies. Also, in 2019, the Gozo Innovation Hub⁸⁰ was inaugurated, a centre of activity designed to attract local and foreign companies to open a base in the sister island of Gozo. Furthermore, there have been several strategies drafted and launched to help boost and support this sector, namely the National eSkills Strategy⁸¹, Digital Malta Strategy 2014-2020⁸², National eCommerce Strategy 2014-2020⁸³ and the Malta AI Strategy.⁸⁴

In addition, the Malta Communications Authority (MCA), eSkills Foundation, Malta Information Technology Agency (MITA) and the Malta Gaming Authority (MGA) are public entities that, in some capacity, focus efforts on promoting local, ICT-related investments. By way of an example, Malta has a 'National Coalition for Digital Skills', whose members include MITA, MCA, MGA, the Malta Chamber of Commerce and the Ministry of Education and Employment. The coalition carries out several initiatives, such as awareness campaigns on digital skills and the ICT profession, the organisation of a

⁸⁰ <http://www.gozoinnovationhub.com/> [last accessed 05.04.2021]

⁸¹ https://eskills.org.mt/en/nationaleskillsstrategy/Documents/National_eSkills_strategy.pdf [last accessed 05.04.2021]

⁸² <https://digitalmalta.org.mt/en/Documents/Digital%20Malta%202014%20-%202020.pdf> [last accessed 05.04.2021]

⁸³ <https://www.mca.org.mt/sites/default/files/pageattachments/MCA%20eCommerce%20Strategy%20Document.pdf> [last accessed 05.04.2021]

⁸⁴ https://malta.ai/wp-content/uploads/2019/11/Malta_The_Ultimate_AI_Launchpad_vFinal.pdf [last accessed 05.04.2021]

pan-European fintech event, and e-competence framework courses.⁸⁵ Moreover, the ‘Malta-Digital Innovation Hub’, made up of MCA, University of Malta, MCAST, MITA and the Malta Chamber of Commerce, is another example of a coalition of ICT-related public actors. The Hub works towards consolidating the local R&I ecosystem and assist start-ups and SMEs in accessing sector-specific, technological and financial expertise. Other examples also include MITA’s accelerator ‘YouStartIT’ programme, as well as the University of Malta and the Ministry for the Economy, Investment and Small Businesses’ ‘TAKEOFF Seed Fund Award’ (TOFSA).

The information pertaining to employment in ICT and its contribution to the Maltese economy paints a relatively consistent picture. The total number of employees engaged directly in the field of information and communication technology in 2019 amounts to just over 4% of the total employed population, close to 10,000 people recorded in 2019. The figure has steadily increased over time.

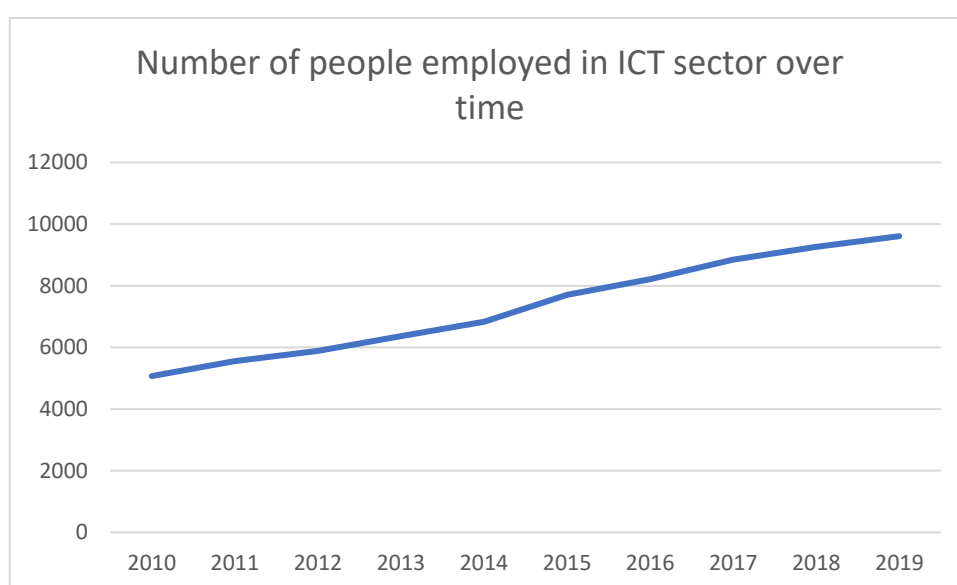


FIGURE 4.4 – TOTAL NUMBER OF PERSONNEL EMPLOYED IN THE ICT SECTOR

The employees engaged by the private sector in 2019 represent 92% of the total population employed in ICT. The remaining 8% of the ICT workforce work within the public administration.⁸⁶ Furthermore, the total number of employees working in ICT part-time was 518, representing around 2.2% of the total gainfully occupied part-time population. What is notable is that that 52% of those engaged in part-time work within the local ICT industry do not have a full-time job, whereas the remaining 48% have both a full-time and a part-time engagement.

The availability of personnel with skills and data literacy competencies was identified as a key challenge during meetings and consultations with members of the ICT stakeholder community. Companies in the private sector found the issue particularly challenging, highlighting the difficulty to find workers with the necessary qualifications and expertise. Moreover, the lack of skilled labour has

⁸⁵ Digital Economy and Society Index (DESI), 2020 Country Report <https://digital-strategy.ec.europa.eu/en/policies/desi> [last accessed 05.04.2021]

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https://nso.gov.mt/en/News_Releases/View_by_Unit/Unit_C2/Labour_Market_Statistics/Documents/2019/News2019_110.pdf [last accessed 05.04.2021]

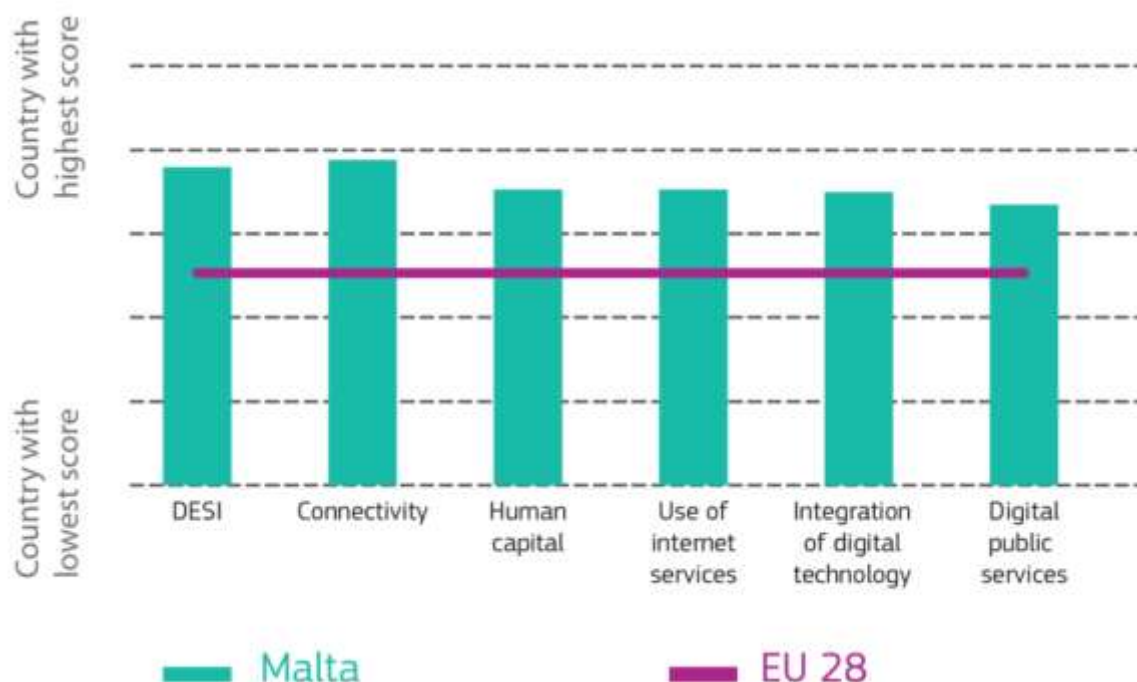
led many companies to often import labour from abroad. While this approach tends to temporarily fill the gap, the situation is unsustainable, while the process is time-consuming, laborious and requires advanced planning and preparation.

In terms of Internationalisation activities and efforts by local companies to connect with those abroad, most initiatives tend to be carried out on an ad-hoc basis, without a specific, structured collaborative framework or set of networks put in place. This is also the case for those in the academic sphere. Despite the various examples of international collaboration activities by Maltese educational institutions and academia, a large portion of the established ties and joint efforts are due to individual and personal connections.

Malta is a member of the following cross-border cooperation programmes: Coordinated Plan on Artificial Intelligence, Digital Skills and Jobs Coalition (DSJC), CEN Technical Committee (TC428), SCALE, European Centre for Women and Technology – ECWT, European Blockchain Partnership and MED7 Collaboration. The fields covered by the initiatives are diverse, ranging from Digital Skills for SMEs and workers, to blockchain, Distributed Ledger Technologies (DLTs) and Smart contracts.

The Current Infrastructural Landscape and Previous Investments

Malta continues to have a reputable infrastructure landscape, with significant improvements over time and a favourable standing when compared on an international level. The Digital Economy and Society Index⁸⁷ published in June 2020 ranks Malta 5th overall, and Malta performs above the EU average in all categories making up the index. Malta remains a European leader in the availability of fixed broadband (basic, fast and ultrafast), as the only Member State with full coverage of ultrafast networks. Malta also has a favourable Human Capital score, due to the large number of ICT graduates and Maltese businesses rank first in the category of big data usage, and has also improved in the provision of digital public services, when compared to previous years.



⁸⁷ <https://ec.europa.eu/digital-single-market/en/countries-performance-digitisation> [last accessed 05.04.2021]

FIGURE 4.5 – MALTA'S PERFORMANCE IN THE DIGITAL ECONOMY AND SOCIETY INDEX WHEN COMPARED TO THE EU-AVERAGE, PUBLISHED JUNE 2020

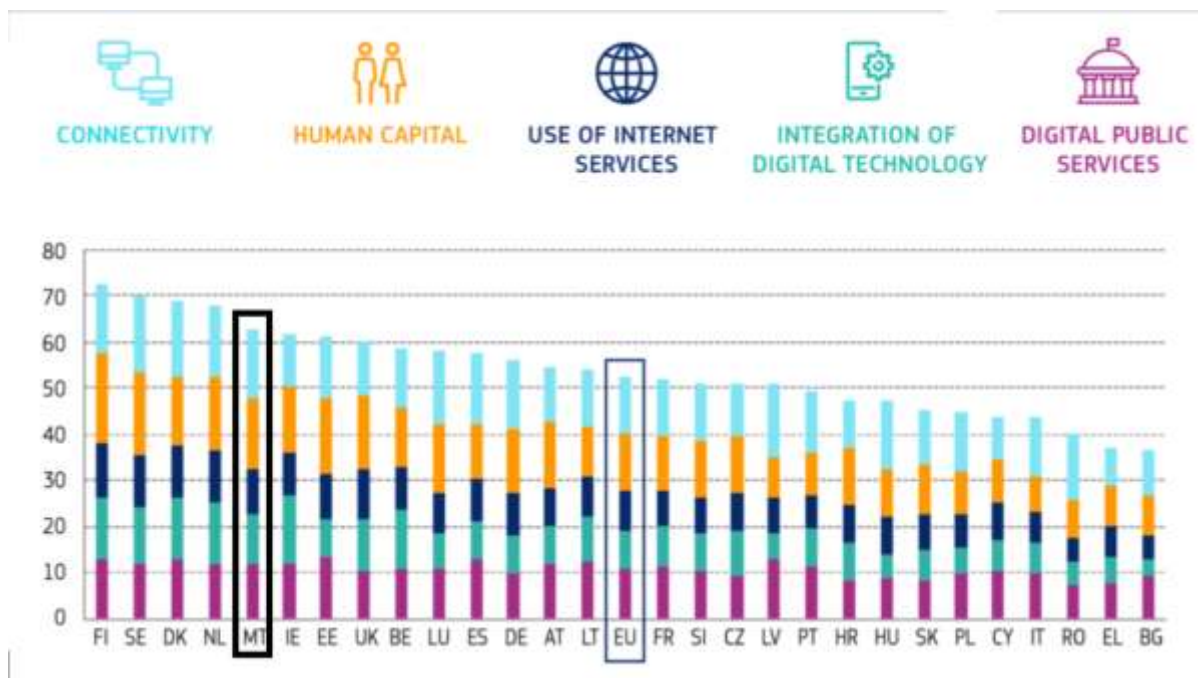


FIGURE 4.6 – DIGITAL ECONOMY AND SOCIETY INDEX SCOREBOARD, PUBLISHED JUNE 2020

In recent years, Malta has witnessed maintained investment in ICT-related infrastructural facilities, helping to underpin and maintain the sector's growth and expansion, including, *inter alia*, upgrades and investments at the University of Malta, upgrading the computer systems and computer labs and an expansion of the Institute of Electrical and Electronics Engineering at MCAST Malta and Gozo; and the extension of the Xewkija Industrial Park (Gozo Innovation Hub). Furthermore, the Malta Life Sciences Park has dedicated space for companies and entities working within the digital sector.

Niche Areas of Focus – Digital Technology as Smart Specialisation Area

In recent years, the Maltese government has taken several steps to prioritise policies that promote and embrace investments in future digital technologies. Through the desk-based analysis reviewing various related research and innovation projects, national policies and strategies in place, and the feedback from the EDP process, the following niche areas show potential:

- **Artificial Intelligence (AI)** – Malta's AI goal is to transform the country into the "Ultimate AI Launchpad", whereby local and foreign companies and entrepreneurs develop, prototype, test and scale AI, and showcase the value of their innovations. The aim behind this aspiration is to create the conditions for Malta to act as an international testbed for digital technologies. Moreover, the government's AI plans include the prioritisation of and investment in applications and services for public sector usage, such as traffic management, education, healthcare, customer services, tourism and energy consumption.⁸⁴ In addition, the Planning Authority is also investing in technologies that will provide the basis on which AI-assisted

decisions will be taken and then monitored. Similarly, the academic community is becoming more actively involved in R&I in AI and support digital transformation, innovative entrepreneurship and industrial engagement and contribute to the socio-economic development of Malta in the R&I sectors of AI.

- **The Internet of Things (IoT)** – The Maltese government will undertake a range of sensory and device infrastructural investments in order to enable and leverage IoT applications. Specifically, Malta will seek to develop a registry that provides information on all government sensor and IoT networks, identify where Distributed Ledger Technologies (DLTs) can add enhancements, including decentralised authentication services and digital trust at scale, and design and prototype applied DLTs within a sensor and IoT network. The intention is to use the results of these activities to develop and draft an official national strategy.⁸⁴
- **Cybersecurity** – As digital technologies become more ubiquitous, the need for investment in cybersecurity becomes more and more important. In line with European regulations, Malta maintains an established Critical Information Infrastructure Protection Directorate, which also operates the national Computer Security Incident Response Team. Malta is currently prioritising the awareness of implications of cybersecurity and exploring its role as part of an ever-growing integrated cyberspace. Moreover, Malta is also considering the pursuit of measures that establish the necessary security requirements, both physical and cyber, to safeguard national and public security from external threats, hazards and vulnerabilities.⁸⁴ Cybersecurity is part of the backbone of any innovation in digital technologies. Hence, it is important to strengthen the area and continue prioritising cybersecurity in tandem with future digital technologies. With this in mind, Malta should also follow developments in quantum communication at the European level, and its possible applications in the area of cybersecurity.
- **Chatbots** – The Government is preparing the use of chatbots to strengthen and boost the efficiency and provision of its services. The main, public portal providing information on government services, ‘servizz.gov’, will be revamped in 2022 using chatbot technology to assist the government in processing requests promptly, comprehensively, and as accurately as possible.
- **Distributed Ledger Technologies (DLT – Blockchain)** – Malta’s distributed ledger technologies (DLT) legal framework covers virtual financial assets, crypto-currencies and innovative technology arrangements and services, with the aim of fostering legal certainty, industry growth and the exploitation of new enabling technologies.⁸⁵ Malta’s regulation is internationally recognised and described as one of the most detailed and comprehensive.⁸⁸ Moreover, Malta has also signed the Declaration creating the European Blockchain Partnership (EBP) and co-operates in the establishment of a European Blockchain Services Infrastructure (EBSI) to support the provision of cross-border digital public services.
- **High-Performance Computing (HPC)** – Over the past few years, Europe has seen a renewed drive to improve its global position in supercomputing capacity, acknowledging that high-performance computing is key to deliver innovation in a wide array of areas, from climate to health to transport to spatial planning through geospatial imagery and data and beyond. Malta’s drive to position itself as an early adopter of future digital technologies necessitates an in-depth evaluation of the need for increased investment in super-computing capacity at the national level, keeping in mind developments and opportunities that can be tapped into at European level such as the environmental and climate change impact on the societal milieu

⁸⁸ <https://www.mondaq.com/fin-tech/717836/malta-becomes-world39s-first-blockchain-island-following-new-regulation> [last accessed 05.04.2021]

that requires real-time data capture devices, spatial data and analytics and big data-hungry algorithms leading to evidence-based integrated spatial policy decision making.

- **Digital Games** – Digital games research can be applied broadly in diverse sectors with applications related to health, education and artificial intelligence. Innovations in games have wider social impacts and potential for technology spill-over. Malta has launched its National Video Game and eSports strategy⁸⁹ where it highlights the importance of the video games sector as a key driver of technology development such as its influence on the development of the speed of chip processing, to screen resolution and internet connectivity. The University of Malta has one of the leading game research institutes globally and local development of research capacity in this area can be built sustainably on existing infrastructure and talent. More broadly the University of Malta has been active in research in this sphere involving the Faculty of ICT, Digital Arts, and many more. As Gaming Malta works to attract studios to Malta the potential for cross-sectoral collaboration increases and the ecosystem will permit for start-ups that can drive research and innovation through games. Digital games offer a unique interdisciplinary research focus where industry and both the University of Malta and the Malta College of Arts, Science, and Technology will be able to contribute as part of a dynamic and innovative sector.

Recalling Malta's favourable performance in the Digital Economy and Society Index (Figure 4.5) coupled with government drive in these specific future looking areas, there is scope for supporting the realisation of the above priorities, which in turn offer exciting prospects for the private sector. Due to its size, Malta can act as a test-bed for these technologies at the nascent stages of their deployment.

Horizontal Applications – Digital Technologies as Innovation Enablers

The EDP has reconfirmed consensus for the dual role of digital technologies as both sources of innovation and enablers of innovation in other areas, in particular the identified smart specialisation areas, as detailed hereunder.

1. Big Data and Data Analytics

Data is the basis for many new products and services, an essential resource for start-ups and SMEs to help create new products and services, drives productivity and resource efficiency gains across all sectors of the economy and allows for more personalised products and services. It also fosters better policy-making and the upgrading of government services.

The widespread use of digital technologies and applications has led to the collection of ever-increasing quantities of data. Whether it is geographical information, climate, weather, research, transport, energy consumption or health data, understanding 'big data' can lead to breakthrough innovations in a wide array of areas, as well as the development of new tools and new skills.

On a European level, the European Commission recently launched 2020 *'European Strategy for data.'*⁹⁰ The Strategy lays out the policy measures and investments necessary to build a European data

⁸⁹ <https://www.gamingmalta.org/wp-content/uploads/2019/05/01272-Strategy-Game-Development-Industry-Strategy-Game-Development-I....pdf> [last accessed 05.04.2021]

⁹⁰ <https://ec.europa.eu/digital-single-market/en/policies/building-european-data-economy> [last accessed 05.04.2021]

economy over a five-year period and outlines the approach needed to increase the use of, and demand for, data and data-enabled products and services throughout the EU's Single Market. Moreover, the EU is currently working on the preparation of the launch of the future High-Performance Computing Joint Undertaking (EuroHPC JU) for the period 2021-2033. The aim of this public-private partnership is to pool European resources to develop top-of-the-range exascale supercomputers to process big data, stimulate a technology supply industry, and enable application uses for public and private users. Beyond 2020, the EuroHPC JU plans to, *inter alia*, further develop a world-class supercomputing and data infrastructure within the EU; develop and deploy a quantum computing and quantum simulation infrastructure integrated with the HPC infrastructure as well as provide secure cloud-based supercomputing services for a wide range of public and private users across the EU.⁹¹

As part of the National AI Strategy⁸⁴, Malta intends to invest in and adopt big data technologies to enable the processing of complex data to improve decision-making in critical areas such as finance, healthcare, transport, utilities and the environment. By way of an example, a project in traffic management is envisaged, in which a mobility analytics dashboard will be designed to leverage big data derived from Malta Public Transport (MPT) information sources. Smart specialisation areas such as sustainability and health also provide ample potential for innovation through big data technologies.

2. Open Data

Making sure that high-quality, high-value data is widely and freely available is a key factor in accelerating innovation. Moreover, beyond economic considerations, open data increases transparency and encourages evidence-based policymaking.

In following the EU's recently updated 'Open Data Policy'⁹², further effort needs to be made in Malta to facilitate the access and re-use of data by both the public and private sectors, with minimal or no legal, technical and financial constraints. Particular focus should be placed on high-value data sets such as statistics or market information. These datasets have a high commercial potential and can speed up the emergence of a wide variety of value-added information products and services.

All the smart specialisation areas in this strategy are a combination of various economic sectors interlinked to tackle common challenges. To prevent duplication and hence, waste of resources, ensuring the accessibility to open data can ensure that the various sectors do not duplicate results and build on existing research. Availability of data can unlock the sectors' innovation potential at the nexus of the thematic areas.

Malta is in the process of drafting the national 'Open Access' policy. The policy is planned for completion in 2021 and will identify the potential investments required to further align the country with European and international initiatives in this area.

3. Smart Space Applications

Smart space applications and technologies are used in a wide range of formats, covering land, marine and atmosphere monitoring. The use of the technology for this purpose is referred to as the 'downstream sector' and includes the companies and institutional actors whose activities revolve

⁹¹ <https://ec.europa.eu/digital-single-market/en/high-performance-computing> [last accessed 05.04.2021]

⁹² <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L1024&from=EN> [last accessed 05.04.2021]

around the processing of Earth Observation (EO) data and the creation of Value Added Services (VAS) based on this data.⁹³

In April 2017, Malta launched its first national space policy.⁹⁴ The policy centres around the use of space data for smart applications, targeting predominantly the downstream sector. To implement part of the policy, Malta created the 'Space Research Fund', a national instrument funded by the MCST to support projects involving the downstream application of space technology.⁹⁵

Various governmental entities and ministries have shown a keen interest to exploit the use of space technology. The Malta Planning Authority (PA), for example, is using EU funding to analyse space-related data and digital technologies to strengthen their services and build capacity.

As an EU member, Malta participates in various EU space initiatives, such as the Copernicus⁹⁶ and the Galileo⁹⁷ programmes. The Copernicus programme provides digital satellite imagery, while the Galileo project focuses on satellite positioning. The datasets are provided globally free of charge and are available and accessible to any individual or organisation. In addition, Malta takes part in the MED 7 initiative, a project designed to correspond to the need to have targeted policies and instruments to enhance R&I in the Mediterranean area. The project also conducts activities relating to the use of space technology.

Despite the potential and attraction of this stable yet fast-growing sector, Malta's involvement and use of downstream technology, by both the public and private spheres, is still in its infancy. During public consultations, stakeholders from the shipping and environmental sectors were the industry players to show potential interest, pointing to the prospective use of downstream space applications to process data concerning ship registers and to facilitate scenario planning, early warning systems, disaster risk management and adaptation strategies to mitigate the effects of climate change.^{98 99}

4. Human-Centric Applications (Digital Health, Patient Data, etc.)

The health sector can benefit considerably from the use of digital and data technology. Strengthening and extending the use of health data helps healthcare authorities to make evidence-based decisions to improve the accessibility, effectiveness, efficiency and sustainability of the healthcare systems, thus increasing the quality of healthcare, while simultaneously decreasing costs. Moreover, better access to health data can significantly support the work of regulatory bodies in the assessment of medical products and demonstration of their safety and efficacy.¹⁰⁰

Investments in digital health and better access to patient data can support doctors to tailor the right therapeutic strategy to the needs of the patient in a more timely manner, and quickly determine the patient's predisposition to a disease and deliver timely and targeted prevention.¹⁰¹ The local interest and capacity for telemedicine became more evident during the COVID-19 pandemic, through the

⁹³ https://www.copernicus.eu/sites/default/files/PwC_Copernicus_Market_Report_2019.pdf [last accessed 05.04.2021]

⁹⁴ <http://mcst.gov.mt/wp-content/uploads/2017/04/The-Malta-National-Space-Policy-2017.pdf> [last accessed 05.04.2021]

⁹⁵ <https://mcst.gov.mt/space-directorate/space-research-fund/> [last accessed 05.04.2021]

⁹⁶ <https://www.copernicus.eu/en> [last accessed 05.04.2021]

⁹⁷ https://ec.europa.eu/growth/sectors/space/galileo_en [last accessed 05.04.2021]

⁹⁸ <https://www.transport.gov.mt/ship-registration> [last accessed 05.04.2021]

⁹⁹ <https://maltaprofile.info/article/maritime-shipping-2017> [last accessed 05.04.2021]

¹⁰⁰ https://ec.europa.eu/info/sites/info/files/communication-european-strategy-data-19feb2020_en.pdf [last accessed 05.04.2021]

¹⁰¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0066&from=EN> [last accessed 05.04.2021]

launch of several telemedicine services. Whether the demand for such services will remain over time still needs to be determined.

5. Digitizing Industries

Digital transformation is a key driver of economic growth with potential benefits to all sectors of the economy to capitalise on the opportunities it offers for innovation. During Malta's RIS3 consultations, the need for digital transformation across the economic spectrum appeared to be well understood. However not all economic sectors are equally prepared and able to undertake this transformation. The manufacturing sector and the tourism sector are identified, for the reasons outlined below, as having a particularly high degree of potential for innovation through digitisation in the context of RIS3.

'Industry 4.0' and 'Smart Manufacturing' aim to collect and apply real-time data and information by means of networking all individual elements, in order to reduce the complexity of operations, while increasing the efficiency and effectiveness with a long-term cost reduction target.^[1] These concepts are anchored in the expansion of research using applications of ICT and aim to operationalise manufacturing purposes by using innovative technologies such as the Internet of Things (IoT), AI, Blockchain, etc. The stakeholder consultations undertaken indicate that the manufacturing sector in Malta is very willing to evolve and embrace novel concepts such as these. Doing so will help traditional companies to overcome the challenges associated with the use and understanding of data, and spur on the investments needed to make operations more efficient and data-focused. Even though the interest is clear, many companies lack the directionality, guidance and support to become more 'data-driven'. Furthermore, from the perspective of the ICT sector, companies are reluctant to invest in developing applications and processes. Given this, it is clear that a paradigm shift is required, in which all the relevant sectors are holistically supported and encouraged to take the necessary steps and enable an ecosystem of digitalised factories and companies, and integrated products and services.

Further to the impacts brought about by COVID-19, there is widespread consensus that a paradigm shift in the tourism sector is needed, with a higher focus on quality. The tourism industry in Malta has been one of the main sectors contributing to the growth of the economy for the past decades. In 2019 alone, the total tourist expenditure was calculated to be EUR 2.2 billion.^[2] Hence, Malta is highly dependent on the tourism industry, with approximately 17% of GDP reliant on the sector and is one of the largest employers of the country.^[3] However, following the 2020 COVID-19 pandemic, tourism industries were highly impacted globally, and Malta was no exception. As an example, it has been estimated that Malta lost €251 million in tourism revenue in July 2020 alone, with visitor spending dropping by 88% in this period and an 84% drop in actual visitor numbers.¹⁰⁵

Therefore, for the tourism industry to survive, it is even more pertinent than before that the sector embraces digitalisation and evolves its services and operations to adapt to the new situation, in the short to medium term. Several operators have in fact already innovated and adapted their operations, one immediate example is the exponential increase of restaurants offering delivery services through ICT platforms. In this case, the ICT platforms already existed and hence, a transition was rather straightforward. However, this is not the case for the whole sector, and several operators, especially SMEs, are struggling to remain in business. Therefore, there is scope to assist operators within the

[1] <https://www.sciencedirect.com/science/article/pii/S235197891730728X> [last accessed 05.04.2021]

[2] <https://www.mta.com.mt/en/file.aspx?f=32328> [last accessed 05.04.2021]

[3] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7528869/> [last accessed 05.04.2021]

tourism industry to invest in digitalisation in order to innovate their operations and services in order to remain competitive.

6. Sustainable Use of Resources for Climate Change Mitigation and Adaptation

The EDP recommended that Malta should look to further strengthen its R&I expertise in innovative digital solutions for water and energy. As shown in Chapter 4.1.2, significant academic capacity at the University of Malta and MCAST exists in water and energy research, and a number of companies are known to conduct R&I activities in water treatment, desalination services, efficiency in water and energy use, renewable energy technologies, and solutions for islands and industry. The pursuit of innovations linked to Earth Observation Data and down-stream space technologies could also prove useful in these sectors, monitoring issues related to Malta's high levels of water scarcity.

Land transport, congestion and the resultant environmental and health impacts remain a major challenge for Malta. The large number of vehicles on Maltese roads requires novel solutions and approaches. The solutions to this are of course various and multifaceted, spanning different policy areas, planning and prioritisation. Digital technological investments, such as AI and the IoT and the provision of real-time data to continually monitor and act in real-time, can be a useful component of the toolkit to address Malta's land transport challenges to help lower congestion, decrease emissions and improve air quality. Future digital technological investments could build on and integrate the existing data streams from various ERDF funded projects like SIntegraM, as well as CONvErGE, data from the major infrastructural projects and information emanating from Malta's membership in international fora (such as the EEA dataflows) and the European Commission reporting cycles.

CHAPTER 5

5.1 Recommendations

The aim of a smart specialisation strategy is to identify economic niches which have a high potential for growth through innovation in the short- to medium-term. It is not a substitute for a national strategy for research and innovation, though it is of course an important aspect of such. Indeed, Malta is currently looking into updating its national R&I Strategy, with the aim of strengthening the Maltese R&I landscape in its broadest sense. The Peer Review undertaken with the support of the European Commission's Policy Support Facility and concluded in June 2019 provided the starting point to this work and will continue to shape the post-2020 national R&I strategy as it is developed.

The existence of a smart specialisation strategy is an enabling condition for accessing ERDF funding during the 2021-2027 programming period. At the time of writing (September 2020), the legal text of the ERDF regulation is not yet finalised. The magnitude of the ERDF funding pot for R&I for Malta is not yet known. Despite the existing fluidity of the situation, it is safe to assume that ERDF funding by itself will not be enough to fulfil the aspirations and objectives for each of the RIS3 areas identified in this document. The aim of this chapter is to identify the role of ERDF, in conjunction with other interventions (financial or otherwise) that are foreseen to be necessary to achieve this document's goals, including the improvement of the national R&I system, supporting industrial transition and internationalisation.

Based on the Entrepreneurial Discovery Process and the desk-based analysis undertaken, the following recommendations are being put forward to ensure effective, holistic implementation of the smart specialisation strategy in Malta using different funding sources and strategic frameworks.

5.1.1 Supporting RIS3 through Structural Funding (ERDF)

In their own different ways, identified RIS3 sectors would benefit from ERDF support directed towards the following intervention areas:

a) Investment in Research Infrastructures. The public sector and higher education institutions require support to invest in research infrastructure that would serve the needs of various smart specialisation areas identified, including digital technologies, health services and marine and maritime technology. The infrastructure must serve to foster better industry-academia interactions, knowledge transfer, build R&D capacity and address shortcomings in the current R&I ecosystem in Malta. Care must be taken to reduce fragmentation and not duplicate efforts and continue building on the investments that have been made in the previous programming periods.

b) Supporting Internationalisation Initiatives. The disadvantages brought about by small size and insularity make internationalisation a crucial component of Malta's support framework for the researcher community and innovative businesses. Internationalisation helps build networks, share

ideas and identify new market opportunities. To do this, the local research community needs to build its networks through collaborations. The 2021-2027 framework programme for research, Horizon Europe, will see the setting up of several European-level partnerships. These thematic partnerships will provide access to European funding that needs to be complemented by national funds. There is therefore scope to explore the possibility of using Structural Funds to support Malta's participation in partnerships. Selection of partnerships to be funded through ERDF should be in line with Malta's RIS3 areas, as well with the strategic process for identification of partnerships that Malta should participate in, being undertaken by the MCST.

c) Supporting Excellence in R&I. The European Framework Programme 2021-2027, Horizon Europe, will continue to support excellence in R&I and Malta should continue striving to increase its participation in the programme and strengthen the quality of its R&I. The 'Widening Programme' under Horizon 2020 sought to address the causes of low participation of certain Member States by fully exploiting the potential of Europe's talent pool. It sought to ensure that the benefits of an innovation-led economy are both maximised and widely distributed across the European Union, and synergies with European Structural and Investment funds are an important component. The main actions under Horizon 2020, Teaming, Twinning and ERA Chairs, required that applicants align to their regions' Smart Specialisation Strategies. For certain actions, like Teaming, a national contribution is also required. Whilst the detailed modalities of these actions under the new Horizon Europe Framework are not yet known, it is recommended that for Teaming applications that are of national importance and address the needs of this RIS3 Strategy, the ERDF programme could be considered as a possible source of funding to support the national contribution.

In addition, MCST will continue supporting Maltese researchers to actively participate in programmes such as COST and Marie-Sklodowska Curie Actions (MSCA), with a particular focus on building networks and experience in the smart specialisation areas identified in this document. Supporting MSCA can be done through the 'Seal of Excellence', a quality label awarded to project proposals submitted for funding under Horizon 2020. It is given to those projects which succeeded in passing all the stringent selection and award criteria of the evaluation but could not be funded under the available call budget. A holder of the certificate can then approach alternative funding sources and present the certificate as proof of a high-quality project proposal. ERDF could be one such alternative funding source and therefore, Malta should explore the possibility of developing a mechanism whereby such projects can have an "*accelerated pathway*" to access structural funds. An in-depth analysis should be carried out to identify the type of Horizon Europe programme (example MSCA, SME Instrument etc.) that can make use of the "*accelerated pathway*". Projects funded through ERDF should of course be in line with Malta's RIS3 priorities.

d) Incentives for Industry Stakeholders to Innovate. Consultations through the EDP have highlighted that access to finance for R&I remains a struggle for the private sector. This struggle is exacerbated further by the economic impact of the COVID-19 pandemic. There is scope for continued support to industry, through ERDF, to continue undertaking R&I projects in the RIS3 areas to support industrial transition and improve the national R&I ecosystem. Malta should evaluate the current take-up of funds, and adapt new funding mechanisms to this end. The consultations undertaken indicate that private companies lack awareness of the different type of funds available. Companies have also called for more support dedicated to the actual application process. Moreover, whilst the consultations have shown that there has been a substantial improvement in the quality and quantity of research output in Malta, one remaining hurdle is commercialising this research, bringing it to market, and subsequently, effectively diffusing that innovation within local and global markets. From the observations made, companies in Malta tend to favour incremental innovation approaches, and there

are very few examples where the private sector has truly partaken in breakthrough or disruptive innovations. Thus, the immediate necessity is to create a funding mechanism that can support the private sector to bring new products and services to market. The pressing need to sustain business through innovation incentives and industry-driven R&D has also been identified in Malta's National Post-Pandemic Strategy¹⁰².

5.1.2 National Funding in Support of RIS3

Whilst it is recognised that structural funds constitute a significant proportion of Malta's R&I expenditure, this strategy emphasises the importance of complementary funding sources to reach the goals of smart specialisation. National funds can and should be tailored to provide support that complements projects, schemes and measures funded through ERDF. An overview of possible avenues follows hereunder:

(a) Supporting excellent research. An identified gap in Malta's national R&I system concerns supporting excellent research at the earliest TRL levels. This was highlighted by various stakeholders, both private and public. Indeed, low TRL research can lead to the innovations of the future in new upcoming areas as well as in the currently identified RIS3 areas. The National R&I Programme, FUSION, will be supporting such project proposals. A new pilot programme is being launched that can support researchers to develop their ideas from level 0 to 3 in the Technology Readiness Level scale. Furthermore, the new European Framework Programme, Horizon Europe, will continue supporting academic research based on excellence and can provide substantial grants for such pursuits. The Malta Council for Science and Technology is committed to continue supporting applicants to access such funding opportunities and continue increasing Malta's participation in these programmes.

(b) Striking a better balance between competitive and institutional funds. Excellent research requires excellent academic institutions that support their researchers in their pursuit of knowledge. Whilst competitive (national and European) funding ensures that the best research gets funded, it is also important to ensure adequate institutional research funding to public research performing organisations. Such funding can support smaller projects that can have a snowball effect and later lead to applications for more substantial grants and larger collaborative projects. Institutions should also dedicate a part of such funding to supporting research in the identified RIS3 areas.

(c) Support industry-academia collaboration for innovation. The current FUSION programme will continue supporting industry-academia collaborations in the new proposed smart specialisation areas. This mechanism remains an important tool to break down silos and bring applied research closer to the market. The private sector needs to be better exposed to the opportunities and economic potential of investing in research, and hence such programmes will continue building on this premise and encourage the private sector to take on larger and more innovative projects within the smart specialisation areas.

¹⁰² <https://mfer.gov.mt/en/Documents/NPPS%20EN%20Doc.pdf> [last accessed 06.10.21]

(d) Increasing national efforts towards internationalisation. To build effective research teams, both locally and internationally, fostering joint collaborations will be essential to increase the sectors' internationalisation potential. MCST has recognised this importance and has formed a dedicated unit to explore internationalisation initiatives for research and innovation. Whilst the scope of MCST's support extends beyond the smart specialisation areas identified, there is a dedicated effort to identify and prioritise internationalisation initiatives in the identified RIS3 sectors.

(e) Business support to innovation. Industry transformation and digitalisation are keystone requirements for the success of Malta's smart specialisation strategy. Hence, support needs to be provided to business to complement the assistance provided through ERDF funds to ensure holistic coverage of the business cycle. Entities such as Malta Enterprise are therefore crucial to the vitality of our private sector, and it would be recommended that they continue to support the identified smart specialisation areas and ensure competitive growth. In order to further support business innovation endeavours, this RIS3 calls for the promotion of inter-agency collaboration in support of enterprises and inter-agency coordination in order to raise awareness on R&I funding schemes. Efforts will also be made to ensure the simplification of procedures related to application for funding and provision of guidance to potential beneficiaries in a more targeted and effective manner. In addition, public-private cooperation will be encouraged to transform research results into market-ready solutions, building on existing instruments such as FUSION.

(f)

(g) Access to risk finance. Some of the smart specialisation areas selected could particularly benefit from easier access to risk finance. Business enterprises within economic sectors such as digital technologies and smart manufacturing, often require more flexible funding mechanisms, since innovation and production of new technology is faster than in other sectors, where more applied research and testing might be necessary. Hence, Malta should look into alternate risk finance mechanisms that could help address this current gap in the research and innovation supporting framework.

(h) Support for public procurement of innovation. Whilst the mechanisms for supporting the private sector to innovate through public procurement have been in place in Malta for a number of years, there seems to be very little use of this tool in practice. Malta should look into the barriers preventing the public sector from utilising this method to incentivise innovation, and promote its use especially in the selected smart specialisation areas.

5.1.3 National Policies to Support RIS3

Whilst this smart specialisation strategy seeks to set the right framework for the identified RIS3 areas, RIS3 does not and cannot exist in a vacuum but relies on the development of supporting strategies and policies to ensure a thriving research and innovation system that allows the identified areas, and others, to flourish. The following strategies in particular will identify and complement the RIS3:

(a) National Research and Innovation Strategic Plan. In parallel to the RIS3, the National R&I Strategic Plan seeks to identify and address a broader set of overarching R&I challenges and

priorities up to 2024 and beyond, building on the outcomes and recommendations of the PSF Peer Review of 2019. It will address both public and private sector needs and opportunities and for the medium- to long-term, thus requiring sustained investments. The Strategic Plan and the RIS3 Strategy are 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 prioritize 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 initiatives and resources at national and international level.

(b) Development of Thematic Strategies. As part of the desk-based analysis undertaken in the EDP, various national thematic strategies were essential to identify the political direction, gather a baseline understanding of the current scenario, as well as take note of the various goals and objectives therein. Therefore, the RIS3 ensured alignment to the strategies and policies identified.¹⁰³ Moreover, there are new strategies in development that could further support RIS3, for example the new Health Strategy currently being drafted by the Ministry for Health. Malta should continue supporting the development of thematic strategies and it would be recommended that thematic strategies address research and innovation and RIS3 as a crucial pillar to support their objectives.

5.1.4 Capacity Building through ESF in Support of RIS3

Whilst the available data shows that the selected RIS3 sectors support a significant proportion of the local workforce, many stakeholders have expressed concerns about finding the right skilled personnel, especially to undertake research and innovation activities. With the inevitable transitions taking place to embrace Industry 4.0 as well as the digitisation phenomenon, the need to upskill and re-train the workforce is more necessary than ever across all sectors. The following are possible mechanisms that could support such transitions:

(a) Scholarships for Post-Graduate Studies and Post-Doctoral Positions. To build R&I capacity a larger pool of researchers and entrepreneurs needs to be fostered. Scholarships that support researchers to take on post-graduate studies, notably doctoral degrees and positions, in the smart specialisation areas identified, will support capacity building in the medium-term. National funds as well as funds from the European Social Fund (ESF) can be used to support this goal.

(b) Training and Re-skilling the Workforce. The ESF has been successfully used for training of all aspects of the workforce and has ranged from supporting basic ongoing training to very

¹⁰³ National AI Strategy; National Strategy for Research and Innovation in Energy and Water; A Mental Health Strategy for Malta 2020-2030; National Strategy for the Elimination of Hepatitis C Virus (2018-2025); Transgender Healthcare; National Cancer Plan (2017-2021); A National Health Systems Strategy for Malta 2014-2020; National Breastfeeding Policy & Action Plan 2015-2020; Diabetes: A National Public Health Priority, A National Strategy for Diabetes 2016-2020; Communicable Disease Control Strategy; Food & Nutrition Policy & Action Plan for Malta 2015-2020; A Healthy Weight for Life: A National Strategy for Malta 2012-2020; National eSkills Strategy, Digital Malta Strategy 2014-2020, National eCommerce Strategy 2014-2020; National Aquaculture Strategy (2014-2025)

specific and intensive courses. Whilst all training should be supported, it is recommended that a synergy is found between ERDF and ESF to specifically address the training requirements identified in this strategy, and support the private sector to transition to Industry 4.0.

5.1.5 Improved Governance System to Support Implementation of RIS3

The governance system that was set up in response to the National R&I Strategy 2014–2020, has proven effective in bringing together key stakeholders within the government sector and begin addressing fragmentation. Also, the governance system was successful in identifying key actions to implement the previous strategy and RIS3. However, the implementation of the RIS3 in the National R&I Strategy 2020 was highly focused on the use of structural funds. The RIS3 2021-2027 aims to take a wider approach, looking at a wider variety of instruments, measures and policies that need to be addressed to unleash the full potential for innovation in the identified thematic areas. In order to achieve this, the current governance structure needs to be enhanced to ensure that implementation of RIS3 goes beyond what was achieved in the previous strategy, supports the implementation of the recommendations in this chapter and keeps the EDP ongoing in a more formalised structure. Hence, the following structures should be in place:

(a) Set up thematic committees answerable to the Minister responsible for R&I. The new Ministry responsible for Research and Innovation will appoint experts in thematic committees, one committee per thematic area of the RIS3, to bring together relevant actors of the quadruple helix during the implementation stage of the Strategy. Each Committee will be composed of a Chair, one member representing each strand of the quadruple helix (government, academia, business, and civil society) on an ex-officio basis, one representative of each relevant funding body, one representative of each relevant policy body and MCST. These committees will be mandated to continue analysing the needs of each sector in order to identify key actions for implementation which would unlock the innovation potential of each area as identified in the RIS3. The committees will advise on the operationalisation of the identified thematic priorities by, inter alia, looking at the adequacy of available instruments and potential new measures in order to make recommendations to the Minister as necessary. The committees will be supported by the MCST RIS3 implementation team, who will support the group by sourcing and gathering required intelligence, and preparing background information/reports for discussion in the thematic group. The new MCST RIS3 team will also act as an intermediary between the thematic groups, the Steering Group and Core Group and the various programme managers within MCST. The Ministry secretariat will, support the Chair with the administrative aspects of meetings and reports, and undertaking follow up work as agreed during meetings. The Ministry secretariat will also be responsible for logistical and technical preparations for the meetings.

(b)

The Thematic Committees will be set up by the first half of 2022 and are expected to meet at least once every quarter. However, the Committee may identify the need for extraordinary meetings as necessary. Meetings shall be convened by the Chair. The Committees are envisaged to run until end 2029.

- (c) **Increasing MCST's thematic technical capacity.** To strengthen governance of RIS3 as explained above, an MCST RIS3 implementation team is to be set up to support the thematic groups' work by increasing MCST's expertise and capacity to focus on the implementation aspects of each identified thematic area.

The effective implementation of the smart specialisation strategy in its totality requires that inclusivity and gender equality are adopted as cross-cutting principles across the whole implementation process. Any form of implementation mechanism needs to ensure that there are no barriers preventing equal access to and participation by all, and that all research and innovation output is gender mainstreamed.

Furthermore, the implementation of the Smart Specialisation Strategy should strive to avoid direct and indirect environmental impacts in all its aspects. In so doing, the strategy's implementation would also be in alignment with the scope of this strategy towards sustainability, innovation and tailor-made solutions; all of which are key principles of this strategy document.

CHAPTER 6

6.1 Monitoring and Evaluation

A key function of any strategy is having a monitoring system in place as a crucial component of the policy cycle. Monitoring encompasses all activities that have to do with the collection and processing of information on the degree of implementation of policy measures and the achievement of expected results and desired effects, according to the planned logic of intervention. Specifically, RIS3 monitoring focuses on tracking the developments related to policy interventions within the specific priority areas identified in the strategy. The monitoring mechanism seeks to capture and follow the relevant expected changes that are foreseen in each RIS3 priority by a select choice of input and result indicators.

Further to support received through the Horizon 2020 Policy support Facility, in 2016 Malta started setting up the first research and innovation monitoring system to follow the implementation of the National R&I Strategy 2014-2020, which included the Smart Specialisation Strategy and the respective areas. It was the first comprehensive monitoring system meant to oversee the development of the whole R&I ecosystem. The development of the monitoring system was carried out in conjunction with owners of measures and incentives to ensure that the indicators chosen were appropriate and that data was available. 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. 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. The report also served to identify certain issues regarding the indicators for smart specialisation monitoring, since data confidentiality and the restructuring of data sources (such as the Community Innovation Survey) were major obstacles in the data collection process.

Therefore, as part of the new Smart Specialisation Strategy, Malta has also updated the monitoring system by targeting the identified obstacles and by identifying indicators for the specific areas selected. Moreover, it is recognised that in the enabling condition on monitoring for the 2021-2027 period also calls for established evaluation systems to be in place. The monitoring system being proposed will feed into an external and independent mid-term evaluation, that will assess whether the objectives being put forward in this Strategy will be achieved in the programming period.

6.2 Monitoring Mechanism

The monitoring system for this RIS3 builds on the successes of the current system. Whilst data collection and analysis based on proposed indicators are a key component, qualitative information further contextualises and provides information on the progress of the implementation of the

Strategy. This will be achieved through the regular meetings of the established Steering Group and Core Group, and the ongoing entrepreneurial discovery process, whereby information gathered through the consultative process can support the data monitoring. New structures will strengthen the EDP at the implementation stage, as already explained. The technical and political groups will continue receiving regular updates on the progress based on this information and analysis, and decisions will be taken on whether the implementation process of the strategy will need to be amended or updated.

6.3 Indicators

Based on the selected smart specialisation areas, the data sources available, and the experience gained from the current monitoring system on the validity and robustness of certain indicators, the following indicators have been identified:

Indicator	Definition
T-Z1: Gross value-added in relevant NACE codes as a percentage of total value-added	Gross value-added (GVA) measures the value of goods and services made by an individual producer, industry or sector to the Gross Domestic Product (GDP). GVA is the value of output minus the value of intermediate consumption.
T-Z2: Business R&D Expenditure in the selected NACE codes as a percentage of total Business R&D Expenditure	The amount of R&D funds spent by enterprises in the RIS3 thematic areas as a proportion of total business R&D expenditure.
T-Z3: Exports in relevant NACE codes as a percentage of total exports	Intra- and Extra-EU exports in the thematic area sectors (classified by NACE codes) as a proportion of total Intra- and Extra-EU exports.
T-Z4: Employment by Tertiary Education attainment in relevant NACE codes as a percentage of total employment	The number of individuals with a tertiary education (International Standard Classification of Education (ISCED 2011) levels 5 to 8) employed in thematic area sectors as a proportion of total employment.
T-Z5: Number of SMEs introducing innovations (all types) as percentage of total SMEs in relevant NACE codes	The number of small to medium enterprises (SMEs) classified within the thematic area NACE codes that have introduced innovation (product, process, organisation etc.) as a percentage of all SMEs classified within the thematic area NACE codes.
T-Z6: SMEs in relevant NACE codes introducing innovation (all types) as a % of total SMEs	The number of small to medium enterprises (SMEs) classified within the thematic area NACE codes that have introduced innovation (product, process, organisation etc.) as a percentage of all SMEs in Malta.

T-Z7: Turnover from innovation as a percentage of total turnover in relevant NACE codes	The revenue made by an enterprise as a result of a type of innovation (product, process, organisational etc.) as a proportion of total revenue made by enterprises classified in thematic area NACE codes.
T-Z8: Turnover from innovation in relevant NACE codes as a percentage of total innovation turnover in all NACE codes	The revenue made by an enterprise as a result of a type of innovation (product, process, organisational etc.) as a proportion of total revenue made by all enterprises in all NACE codes.
T-Z9: Researchers in relevant NACE codes as a percentage of total number of researchers	The number of researchers employed in economic sectors related to the thematic areas as a proportion on total researchers in Malta.
T-Z10: FDI attracted in relevant NACE codes as a percentage of the whole	Foreign Direct Investments made in the thematic area economic sectors defined by NACE as a percentage of total Foreign Direct Investments made in Malta.
T-Z11: Patents filed in relevant NACE codes as a percentage of total patents filed	Patents filed by Maltese individuals with the European Patent Office (EPO) using IPC codes corresponding with the thematic and niche areas as a proportion of total patents filed by Maltese individuals in all IPC codes.

The proposed monitoring system will use select NACE Codes REV2¹⁰⁴ as a proxy for monitoring the identified economic areas in the RIS3. Moreover, since one of the indicators proposed also aims to measure progress in patent applications within the smart specialisation areas, the codes established by the International Patent Classification (IPC)¹⁰⁵ that best align to the economic areas, were also identified:

Economic Areas	Relevant NACE codes	Relevant IPC codes
Digital Technologies	J58.2 J61 J62 J63	G16
Health & Well-being	Q86 S96.04	A61 (all except A61D) G16B G16H
Marine & Maritime Technology	A3.2 (A3 if breakdown is not available) C30.1 H50	A01K 61/00, A01K 63/00, A01K65/00, A01K67/00 (pisciculture), B63B, B63C, B63H
Sustainable Use of Resources for Climate	E36 water collection, treatment and supply	

¹⁰⁴ <https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF> [last accessed 05.04.2021]

¹⁰⁵ <https://www.wipo.int/classifications/ipc/en/> [last accessed 05.04.2021]

Change mitigation and Adaptation	E38.2 waste treatment and disposal E38.3 materials recovery E39 remediation activities F41 construction of buildings F43 specialised construction activities	C02, C04, E04
Smart Manufacturing	C – ALL manufacturing M74.1 specialised design activities	A21-A24, A41-A47, B21-B33, B41-B44, B81, B82, B99, C01, C03, C05-C14, C21-C23, C25, C30, C40, D01-D07, D21, F01-F04, F15-F17, F21-F28, G01-G12, H01-H05
Aviation and Aerospace	C33.6 - Repair and maintenance of aircraft and spacecraft H51 – Air transport 52.23 – Service activities incidental to air transportation	B64 (ALL except B64G Cosmonautics)

Granularity of data and the resultant confidentiality issues are of particular concern in the context of a very small country. In order to ensure that confidentiality is maintained, indicators will continue to be monitored in an aggregated form.

MCST will be responsible for implementing the monitoring framework described above and will liaise with data providers accordingly. Data pertaining to these indicators will be collected on a yearly basis from Malta's National Statistics Office and the Commerce Department and will be presented to the thematic committees to further inform their work. Periodic reports will also be compiled and published.

6.4 Evaluation

In addition to the regular monitoring described above, the RIS3 2021-2027 will undergo a mid-term evaluation in 2024-2025. The evaluation will complement the monitoring activities, and its timing will allow for policy corrections should these be necessary.

While taking into account the overall objectives and scope of RIS3 (economic transformation aiming towards higher value added, productivity and more efficient use of resources through innovation), the mid-term evaluation will focus primarily on the progress made in the implementation of the measures, the effectiveness or otherwise of the governance structure to keep the EDP alive and the status of expected outputs and impacts.

It is envisaged that while outputs and impacts might be somewhat limited in 2024-2025, an initial assessment would nonetheless be undertaken at this stage with a view to provide a reasonable interim evaluation baseline. Subsequently, an ex-post evaluation would be carried out towards the end of the lifecycle of the RIS3 Strategy, with this comprehensive ex-post evaluation to be undertaken to inform the preparation of the ensuing Smart Specialisation Strategy within a post-2027 timeframe.

While the regular monitoring described in Section 6.3 will be led by MCST, the mid-term evaluation will be undertaken by independent experts, who will lead the development of the exact evaluation questions and the methodology with the support of MFER and MCST, these being the principal policy making and implementing entities who would be making most use of the outcomes of the mid-term evaluation. It is expected that the monitoring framework will be an important input into the evaluation, and itself might need to be updated as a result of the mid-term evaluation. In addition, other qualitative and quantitative information sources will need to be considered by the experts.

CHAPTER 7

7.1 Conclusions

This Smart Specialisation Strategy provides a snapshot of the economic and research and innovation potential of Malta, as it stands in 2020. The Entrepreneurial Discovery Process is described as ongoing, as it is important that the feedback mechanism continues collecting evidence through data gathering, monitoring and consultations and updating the rationalisation of smart specialisation. Since Malta is a microstate with a very open economy, most stakeholders agreed that in seven years the economic landscape can change significantly. Whilst the analysis carried out is robust and the information and outcomes presented in this Strategy 2021-2027 best reflect the current scenario, it is difficult to predict the longer-term changes.

This reality has become more evident in the past year due to the COVID-19 pandemic, and events have shown us how quickly priorities may need to be shifted. Whilst previously certain economic predictions could be made, the economic impact on the next few years is still not understood well enough and hence, the situation might change even more radically than anticipated. Therefore, it is imperative that the EDP is kept alive and the present document updated as necessary. Moreover, the setting up of the new governance system focused more on implementation will be crucial to ensure that the recommendations put forward are followed up, and adjusted according to the EDP outcomes. Consequentially, it would be encouraged that programmes, calls or incentives designed on the guidance of the Smart Specialisation Strategy ensure a level of flexibility so that if the EDP calls for changes in the strategic direction, the implementation will also effectively and efficiently reflect the prevailing situation.