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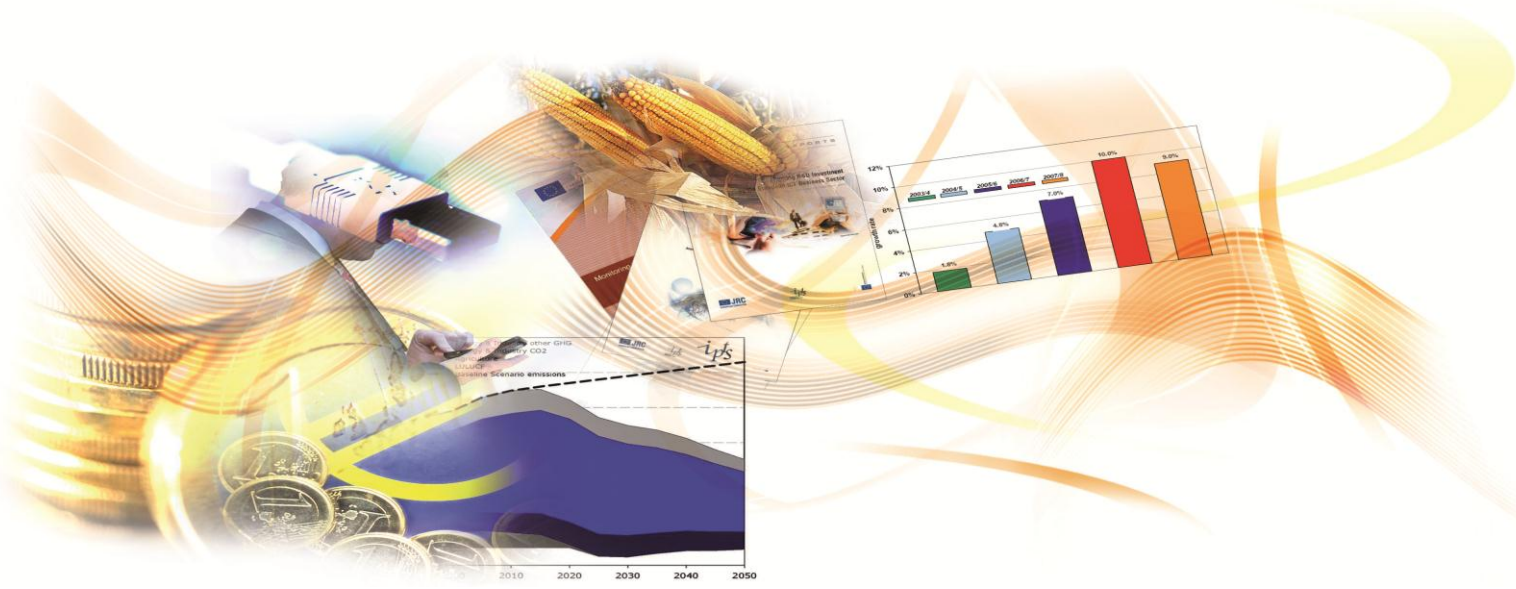

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Abstract

The Analytical Country Reports analyse and assess in a structured manner the evolution of the national policy research and innovation in the perspective of the wider EU strategy and goals, with a particular focus on the performance of the national research and innovation (R&I) system, their broader policy mix and governance. The 2013 edition of the Country Reports highlight national policy and system developments occurring since late 2012 and assess, through dedicated sections:

- national progress in addressing Research and Innovation system challenges;
- national progress in addressing the 5 ERA priorities;
- the progress at Member State level towards achieving the Innovation Union;
- the status and relevant features of Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3);
- as far relevant, country Specific Research and Innovation (R&I) Recommendations.

Detailed annexes in tabular form provide access to country information in a concise and synthetic manner.
The reports were originally produced in December 2013, focusing on policy developments occurring over the preceding twelve months.

ACKNOWLEDGMENTS AND FURTHER INFORMATION

This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). ERAWATCH is a joint initiative of the European Commission's Directorate General for Research and Innovation and Joint Research Centre.

The Country Report 2013 builds on and updates the 2012 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges**,** highlighting the latest developments, their dynamics and impact in the overall national context.

The first draft of this report was produced in December 2013 and was focused on developments taking place in the previous twelve months. In particular, it has benefitted from the comments and suggestions of Marcelino CABRERA from JRC-IPTS. The contributions and comments from Fondazzjoni Temi Zammit, the Ministry for Social Dialogue and Civil Liberties, the Planning and Priorities Co-ordination Division, the Employment Training Corporation, the University of Malta, the Ministry for Finance, the Permanent Representation of Malta to the EU Malta Enterprise, the Ministry for Education and Employment and the Commerce Department are also gratefully acknowledged.

The report is currently only published in electronic format and is available on the ERAWATCH website. Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

EXECUTIVE SUMMARY

With preparations for Malta's accession to the EU in 2004, research was given increased prominence and research policy in Malta gained substantial momentum. Malta's vision is to place R&I at the heart of the Maltese economy in order to spur knowledge-driven and value-added growth and to sustain improvements in the overall quality of life.

The first Maltese national strategy for R&I was developed in 2007, with its main thrust being the development of a research framework and building research capacity in the areas of human resources and infrastructure. The strategy had a strong business orientation, emphasising the importance of collaboration between industry and academia as well as the exploitation of research results for economic benefit.

In February 2014 a new National R&I Strategy 2020 was formally published. This builds upon the previous strategic plan, introducing a number of new elements whilst retaining the same underpinning vision. The strategy articulates three main goals as follows: (1) building a comprehensive R&I ecosystem, (2) developing a stronger knowledge base, and (3) smart specialisation.

R&D expenditure in 2012 was only 0.84% of GDP compared to an EU 27 average of 2.07%, with Malta ranking twenty-first within the EU. Nevertheless, this is a significant improvement over the 2009 figure which stood at just 0.54% of GDP. The business sector is the largest R&D performer, accounting for 60% of GERD, while the higher education sector accounted for 36% of GERD in 2012. R&D expenditure by public research organisations at just over 3% of GERD is almost insignificant and is the component which is the lowest compared to the EU average.

Industry in Malta consists of a small number of large foreign-owned manufacturing enterprises and a large number of indigenous SMEs which undertake little R&D. Most of this research is undertaken in the pharmaceuticals and electronics sectors, as well as service-oriented sectors such as consultancy and information programming activities.

Malta has one public university, the University of Malta, which has an old pedigree and traces its origins back to the 16th century. It is the main research performer in the academic sector, with its research activity focused on Social Sciences followed by Medical Sciences, Engineering, Humanities and Natural Sciences in that order.

Many of the developments in the research and innovation system in recent years relate to the availability of funding, with the introduction by Malta Enterprise of a number of schemes in 2009 and 2010. Concurrently, national funding for the R&I programme administered by the MCST more than doubled over the period 2009 to 2011. Funding schemes for PhD grants were also introduced utilising both national and EU finance. ERDF funding was also leveraged to strengthen the research infrastructure at the University of Malta with significant funds being allocated to the development of a number of laboratories.

Despite the great strides that have been made in recent years, a number of challenges prevail of which the most significant are listed below:

- Investing in human capital researchers;
- Smart specialisation;
- Increasing funding for research and innovation;
- Broadening the base of enterprises undertaking R&I activities;
- Closing the loop by bringing research to market.

In most cases the identified challenges are already being addressed through existing initiatives, or have been identified in the National R&I Strategy 2020 as areas requiring attention. A persistent weakness is the lack of impact assessments which would shed light on the effectiveness of initiatives and measures taken in recent years.

With reference to Innovation Union Commitments, Malta's approach is that while it agrees in principle and strives to participate as actively as possible, due to its limited resources and relatively unsophisticated state of development of its R&I system, in a number of cases it is not possible to participate actively in the relevant initiatives. For example, it has not yet allocated any funding for ESFRI projects but is participating in two such projects. Public procurement of research is rarely undertaken. Malta's involvement in cooperation or coordination of research programmes with other member states is still limited, although recent improvements can be noted such as Malta's participation in the ENIAC Joint Undertaking. International cooperation does take place, especially in the academic sector, but there is no formal policy and limited funding for such activity.

The national R&I system is in tune with many of the principles underpinning the ERA vision, although policies and measures specifically addressing broader integration into the ERA have not been articulated. This probably arises from the fact that Malta's research ecosystem is still in its infancy, and in view of current limitations it may be considered premature to aspire to fuller participation in the ERA. Efforts for the immediate future are mainly focused on building and strengthening internal capacity, hopefully leading to improvements which would enable shifting focus to fuller integration in the ERA in the near future.

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1 BASIC CHARACTERISATION OF THE RESEARCH AND INNOVATION SYSTEM

With a GDP of €6.5 billion and a total population of just over 421,000 inhabitants in 2013, Malta is the smallest EU Member State accounting for under 0.1% share of the EU-28 total population. In 2012 the GDP per capita stood at €16,300, well below the EU28 average of €25,500. Real GDP growth was negative in 2009 but was positive in subsequent years, with a value of 2.4% in 2013 compared to 0.1% for the EU as a whole (Eurostat March 2014).

Innovation expenditure for 2010 amounted to 1.5% of GDP, with manufacturing activity accounting for 65% of all innovation expenditure (NSO 216/2012, Nov 2012). R&D expenditure (GERD) in 2012 stood at 0.84% of GDP compared to an EU 27 average of 2.07%. Spending on R&D remained almost flat in absolute terms over the period 2006 – 2009, while experiencing an annual decline when expressed as a percentage of GDP from 0.60% in 2006 to 0.53% in 2009. This negative trend was reversed in 2010, with significant increases year on year reaching 0.66% in 2010, 0.72% in 2011 and 0.84% in 2012 (Eurostat March 2014).

Despite this positive performance, Malta still ranks twenty-first in the EU in terms of R&D intensity. It has set itself a rather ambitious target of achieving an R&D expenditure of 2% of GDP by 2020 (National Research and Innovation Strategy, February 2014), but no details are yet available regarding how this increase will be financed and achieved.

Due to Malta's small size, in common with other policy areas research and innovation policy development and implementation are addressed at a national level and there is no regional dimension.

There exist two public bodies with responsibility for promoting research and innovation in Malta. The first is the Malta Council for Science and Technology (MCST) which previously reported to the Office of the Prime Minister, but since the general election of March 2013 reports to the Ministry for Education and Employment. A Parliamentary Secretary (junior minister) within this Ministry has responsibility for Research, Innovation, Youth and Sport.

The MCST has four key areas of responsibility. It is responsible for research and innovation policy and strategy, it acts as a central point for all science popularisation activities in Malta, it is the contact point for the EU research framework programme, and it is responsible for managing the national Research and Innovation (R&I) (funding) Programme as well as for the Commercialisation Voucher Programme.

The second public body which has a very prominent role in the national R&I ecosystem, Malta Enterprise, forms part of the Ministry of Economy, Investment and Small Business. Malta Enterprise is the national development agency and is responsible for the growth and development of Maltese enterprise, as well as for promoting and facilitating overseas investment in Malta. It operates a number of schemes including R&D and innovation grant schemes targeted at business enterprise.

The figure below gives a snapshot of the Maltese R&I system that integrates facets of both research and innovation governance.

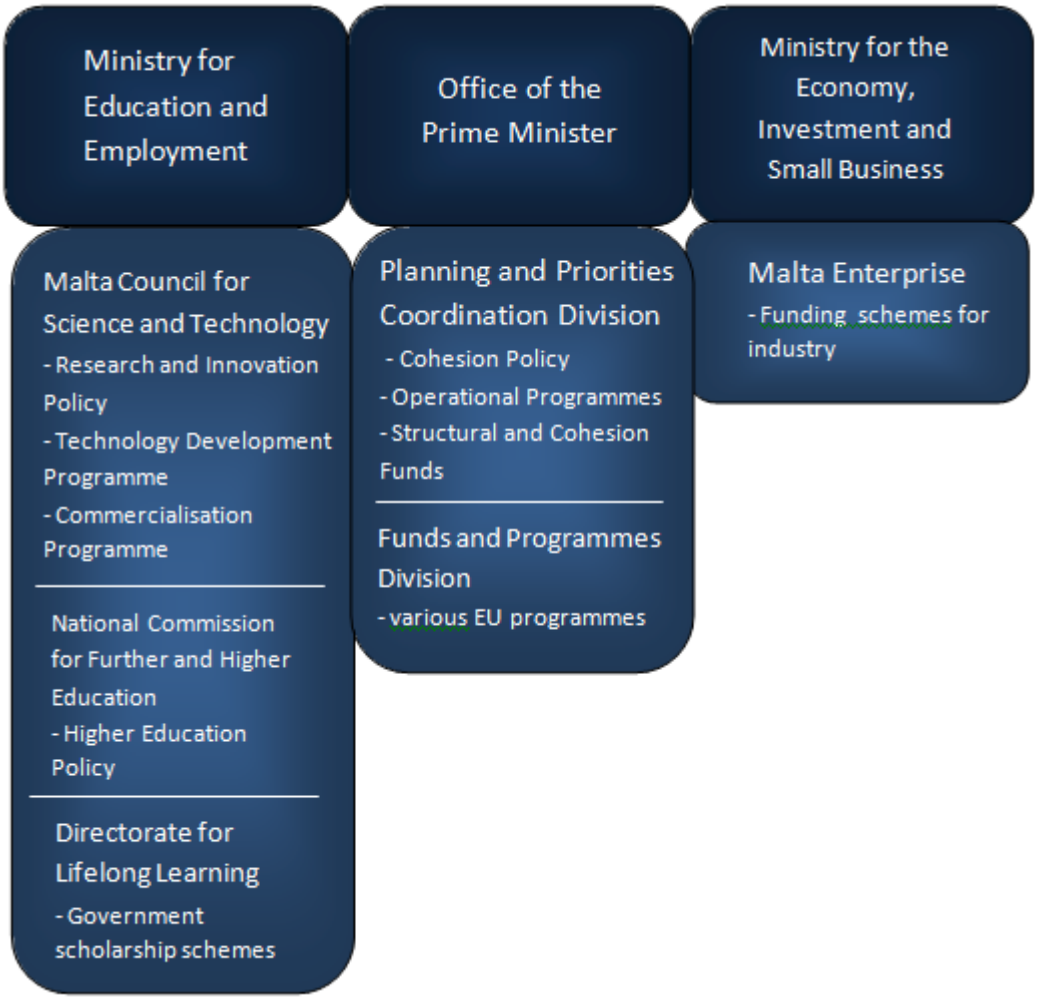

Figure 1: The Maltese R&I system

The business sector is the largest R&D performer, with an expenditure of €34.4m (60% of GERD) in 2012. This has increased significantly in recent years and the 2012 figure represents an increase of 71% over 2009. R&D activity is clustered around a few sectors (Engineering and Technology, Natural Science and Medical Sciences).

R&D as % GDP, 2012	Malta	EU27
Business Enterprise sector	0.50%	1.31%
HEIs	0.30%	0.49%
government sector	0.03%	0.26%
Total R&D	0.84%	2.07%

The University of Malta is the main research performer in the higher education sector, and over the period 2009 - 2012 its research expenditure has more than doubled to €20.8m (36.3% of GERD). Most of the research is conducted in the field of Social Sciences followed by Medical Sciences, Engineering, Humanities and Natural Sciences in that order.

R&D expenditure by public research organisations is less than 4% of GERD and is the lowest of any country in the EU. This is not surprising considering that Malta has only one public research organisation, the Malta Aquaculture Research Centre. A number of government departments may be involved in research activities to a small degree, but do not have a dedicated research budget.

R&I policy is guided by a multi-annual strategy which was first articulated in 2007 to guide research and innovation policy over the subsequent four years. The main thrusts of this strategy were the development of a research framework and the strengthening of research capacity in terms of human resources and infrastructure. Malta's vision was, and still is, to place R&I at the heart of the Maltese economy in order to spur knowledge-driven and value-added growth, thus contributing to improvements in the overall quality of life. The strategy had a strong business orientation, emphasising the importance of collaboration between industry and academia as well as the exploitation of research results for economic benefit. The strategy also identified four priority sectors where the country's limited human and financial resources were to be channelled.

An updated National R&I Strategy was published in February 2014, building upon the previous strategic plan and retaining the same vision and underpinning principals. The overarching strategy has been complemented through the development of thematic research strategies for manufacturing and for health. In addition, a digital games strategy was launched in 2012 and while this is not primarily an R&D strategy it does address the field of research to some degree.

The Smart Specialisation strategy has been finalised and incorporated into the national strategy, and identified the following seven areas of specialisation:

- tourism product development;
- maritime services;
- aviation and aerospace;
- health, with a focus on healthy living, active ageing and e-health;
- resource-efficient buildings;
- high value-added manufacturing with a focus on process and design, and
- aquaculture.

In addition, ICT was identified both as a horizontal enabler across all identified specialisation areas, as well as a smart specialisation niche in itself. R&I opportunities in rural development were also highlighted.

2 RECENT DEVELOPMENTS IN THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1 National economic and political context

Malta has few natural resources and a minor primary sector, and its economy centres around manufacturing and services. While tourism and electronics have been important pillars of the local economy for a number of years, other sectors have recently emerged such as aircraft maintenance, financial services, on-line gaming and pharmaceuticals, indicating a shift in the economy towards higher value-added sectors and areas which are more knowledge intensive. Over the last decade, the Maltese economy underwent a gradual change from manufacturing towards services. Whereas in 2003 industry accounted for 25% of Gross Value Added (GVA), in 2012 it only accounted for 17%. On the other hand, the services sector contributed to 81% of GVA in 2012, up from 73% in 2003 (Malta Economic Survey 2013).

Maltese enterprise consists predominantly of microenterprises (94.% compared to 92% in the EU) and SMEs (2.9%), with around 81 large companies (0.1%), many of which are subsidiaries of overseas enterprises and corporations (NSO 089/2012, May 2012, SBA Factsheet Malta 2013).

Malta has weathered the recent economic downturn well, and did not suffer a collapse of its financial markets largely because it has a strong and conservative domestic banking and financial sector (Assessment of the 2012 NRP and Stability Programme for Malta, EC May 2012). Unemployment is low at 6.9% compared to an EU average of 10.7 in December 2013 (Eurostat Dec 2013). The economic environment did not impact on the financial allocations for R&I that were already earmarked for particular interventions outlined in the Operational Programmes of Malta's Cohesion Policy.

2.2 Funding trends

2.2.1 Funding flows

Malta has set itself a target of achieving an R&D intensity of 2% of GDP by 2020 (National Research and Innovation Strategy, February 2014). This target appears somewhat ambitious, given that in 2012 GERD accounted for only 0.84% of GDP, but significant increases in R&D expenditure in recent years may have spurred the country to take this bold step. Nevertheless, Malta has yet to come forward with details of how the increased R&D intensity is to be achieved. The R&I Strategy makes reference to the development of a rolling action plan to implement the action lines identified in the Strategy to achieve its goals.

The increased spending on R&D in recent years resulted from increases in both educational and business spending.

Business

The business sector is the largest R&D performer, with an expenditure of €34.4m (60% of GERD) in 2012. This has increased significantly in recent years and the 2012 figure represents an increase of 71% over 2009. R&D activity is clustered around a few sectors (Engineering and Technology, Natural Science and Medical Sciences). Most of the expenditure is on personnel costs (62% in 2011), followed by other recurrent costs (34% in 2011) (Eurostat Mar 2014).

The increase in R&D expenditure was driven by increases in both personnel and other recurrent costs, although not in equal measure. The increase in personnel costs was accompanied by an increase in R&D personnel (FTE), indicating a genuine increase in the volume of R&D work undertaken.

This increase appears to be partly attributable to the R&D Grant Scheme introduced by Malta Enterprise in 2009, but may also be the result of improved reporting of R&D expenditure by Maltese industry.

Innovation expenditure for 2010 amounted to 1.5% of GDP, with manufacturing activity accounting for 65% of all such expenditure. 17% of enterprises undertaking innovation activity were engaged solely in technological innovation, 37% in non-technological innovation, and 46% per cent were involved in both technological and non-technological innovation (NSO 216/2012, Nov 2012).

Academia

The University of Malta is the main research performer in the higher education sector, and over the period 2009 - 2012 its research expenditure more than doubled, reaching €20.8 million (36% of GERD) in 2012. Most of the research is conducted in the field of Social Sciences followed by Medical Sciences, Engineering, Humanities and Natural Sciences in that order. Personnel costs accounted for 70% while recurrent costs accounted for 20% of R&D expenditure in 2011 (Eurostat Mar 2014).

The increase in overall expenditure was driven by increases in both personnel and other recurrent costs, although not in equal measure. While the number of R&D personnel (FTE) remained static in recent years, the personnel costs increased substantially due to a new collective agreement which saw University staff benefitting from significant salary increases. The increase in R&D expenditure was therefore not indicative of a genuine increase in the volume of R&D work undertaken.

Recent years also saw a significant increase in expenditure on buildings and instrumentation, where a number of infrastructure projects funded through ERDF for new laboratories at the University of Malta got underway. It is expected that the level of expenditure could taper off in 2014 and subsequent years following the completion of the current ERDF projects. While it is expected that there will be further investment in infrastructure funded through the next ERDF programming period, it is likely that there will be some delay until these get underway which could lead to a temporary dip in R&D expenditure in the higher educational area.

R&D expenditure by public research organisations is below 4% of GERD and is the component which is the lowest compared to the EU average.

Table 1. Basic indicators for R&D investments

	2009	2010	2011	2012	EU27 2012
GDP growth rate	-2.8%	4.1%	1.6%	0.6 (2012) 2.4 (2013)	-0.4 (2012) 0.1 (2013)
GERD (% of GDP)	0.54	0.66	0.72	0.84	2.07
GERD (euro per capita)	77.3	101.4	114.3	137.3	531.4
GBAORD – total R&D appropriations (€ million)	9.48	14.64	14.77	20.43	90,345
R&D funded by Business Enterprise Sector (% of GDP)	0.34%	0.41%	0.48%	0.50%	1.26%
R&D performed by HEIs (% of GERD)	31.9%	34.0%	30.0%	36.3%	23.7%
R&D performed by government sector (% of GERD)	4.7%	3.7%	3.6%	3.7%	12.3%
R&D performed by Business Enterprise sector (% of GERD)	63.4%	62.3%	66.4%	60.0%	63.1%
Share of competitive vs institutional public funding for R&D	12 / 88	29 / 71	15 / 85	n/a	n/a

	2005	2006	2007	2008	EU27 2008
Venture Capital as % of GDP (Eurostat table code tin00141)	-	-	-	-	-
Employment in high- and medium-high-technology manufacturing sectors as share of total employment *(Eurostat table code tin00141)*	7.76	6.50	6.04	5.51	-
Employment in knowledge-intensive service sectors as share of total employment (Eurostat table code tsc00012)	30.44	30.77	32.82	32.67	
Turnover from Innovation as % of total turnover *(Eurostat table code tsdec340)*	-	28.6	-	15.2	13.3

p – Provisional
s - EUROSTAT estimate
Data Source: EUROSTAT March 2014

Sources of Funding

Local sources of funding account for between 82% and 90% of GERD (83% in 2012). Cross-funding between sectors is very low, with businesses largely funding their own research and central government providing funding for higher educational institutions and public research (Eurostat Mar 2014). Since 2010 EU structural funds have been utilised for research infrastructures at the University of Malta as well as for research funding schemes for industry.

The main source of foreign funding is business enterprise, which generally accounts for between 60% and 70% of foreign funds, while the EU research framework programme (FP7) is another important source of funds accounting for most of the rest.

2.2.2 Funding mechanisms

2.2.2.1 Competitive vs institutional funding

In Malta allocation of public research funds for higher educational institutions, government departments and research organisations does not involve performance considerations, certainly not in any formal sense. There exists no algorithm for allocation of public funds, and there is no history of institutional performance assessments to feed into such a mechanism. Funding is allocated primarily on the basis of what was allocated in previous years, and there has been no mention of changing this approach either in the national strategy or in any other document.

Precise figures for institutional vs competitive funding are not available, but it is estimated that approximately 92% of public funding allocated in 2012 could be considered institutional. The remainder was allocated on a competitive basis, and includes the R&I Funding Programme as well as structural funds which are secured following a call for proposals.

The University of Malta accounts for most of the higher education related research on the island, estimated at €20.8 million in 2012. Nevertheless its discretionary budget dedicated to research support was only in the order of €600,000 in 2010 which imposes severe constraints on the research initiatives it is able to fund internally (Camilleri, 2010).

The main permanent source of competitive funding from central government is the Technology Development Programme, which provides grants for collaborative research projects by consortia involving both industry and academia. The funding for this Programme increased from €0.7 million in 2010 to €1.6 million in 2012 (Budget Speech 2012) and has remained at that level.

A significant portion of Malta's Structural Funds allocation for the period 2007 – 2013 (ERDF & ESF) were earmarked for research and innovation, and approximately €13.5m have been secured to build infrastructures at the University of Malts, while another €9.9m were allocated to fund Masters and Doctoral bursaries in a number of subjects including science and technology.

Looking at the broader context of the R&I system, participation in the EU's Framework Programme for Research and Technology Development (FP) has served to leverage financing for R&I activity across public and private sector actors. In financial terms, Malta secured €10 million in FP6 and by March 2013, 155 FP7 projects were approved for funding equivalent to around €20 million (MCST, private correspondence).

2.2.2.2. Government direct vs indirect R&D funding

Government incentives for private sector R&D are the responsibility of Malta Enterprise, and involve a combination of both direct and indirect instruments. Indirect funding in the form of a tax incentive scheme has been in place for a number of years, but it is believed that this has not been effective and there have been few beneficiaries to date. In contrast, the ERDF R&D Grant Scheme introduced for the first time in 2010 was eagerly welcomed by industry and was fully subscribed, with a projected grant value of €4.15m for projects valued at €9.57m over the period 2010 - 2013 (MCST, private correspondence).

Public procurement of R&D services is not commonplace. One of the few examples is the MCST Manufacturing Research Project, which involved outsourcing of manufacturing research

to performers from university and from the private sector.

Availability of venture capital funding in Malta has been a problem area for a number of years, and although there have been some past attempts by the government to set up such schemes these were never met with success. Nevertheless, plans for a hybrid venture capital fund were announced in the 2014 Budget Speech ((Budget Document 2014, pp31).

Seed capital is less of a problem and Malta is a participant in the JEREMIE initiative in collaboration with a local bank (https://www.bov.com/page.asp?p=13355). In 2010 Malta Enterprise launched a scheme targeted at small start-ups which has funded a number of beneficiaries. This was funded through ERDF funds and comes to a close in 2013. Plans for the launching of a seed capital fund are once again in the pipeline (Budget Document 2014, pp30), with the intention of setting up a fund with a budget of €11 million over a 5-year period financed through the ESF structural funds. It is expected that the start-up grants will help finance between fifty and one hundred Knowledge-Intensive start-ups.

There exists no single programme which caters for the entire value chain from fundamental research through to market innovation. However, in 2012 the MCST launched the Commercialisation Voucher Programme which funds non R&I activities associated with putting new products on the market.

2.2.3 Thematic vs generic funding

The funding available through the Technology Development Programme (formerly the National R&I Programme) can be considered as thematic since it is reserved for projects in the priority areas established in the national R&I strategy 2007 - 2010. Within the programme, however, funds are not ring-fenced for each thematic area. Research funds for public research organisations are also allocated on a thematic basis. Most of the public funding in Malta is however generic, and it is estimated that in 2012 only 7% of funding was allocated on a thematic basis.

2.2.4 Innovation funding

Most public finance is dedicated to R&D since this goes directly to the HEI and PRO sectors. However, the Technology Development Programme allows financing of both R&D as well as innovation activity, while the Commercialisation Programme focuses on innovation. In addition, the Innovation Actions Grant Scheme managed by Malta Enterprise is dedicated to innovation activity. It is estimated that in 2012, approximately 16% of public financing was targeted at or allowed the undertaking or innovation activity.

2.3 Research and innovation system changes

The structure of the research and innovation system in Malta is fairly stable, with the key organisations having been in place for well over a decade. One minor change at the political level came about following the general election and change of government in March 2013, when responsibility for research moved from the Office of the Prime Minister to the Parliamentary Secretary for Research, Innovation, Youth and Sport within the Ministry for Education and Employment.

With regard to governance structures, the biggest change has been strengthening of the Malta Council for Science and Technology complement, with its workforce increasing from 8 employees in 2009 to 42 employees in 2012 (MCST Annual Report 2012). This includes the creation of the science popularisation unit with a team of around 11 individuals whose tasks include overseeing the development of the new interactive science centre.

Many of the developments in the research and innovation system in recent years relate to the availability of funding, with the introduction by Malta Enterprise of a number of schemes in 2009 and 2010. Concurrently, national funding for the R&I programme administered by the MCST more than doubled over the period 2009 to 2011. Funding schemes for PhD grants were also introduced utilising both national and EU finance. ERDF funding was also leveraged to strengthen the research infrastructure at the University of Malta with significant funds being allocated to the development of a number of laboratories.

In recognition of the valuable research work undertaken by the Malta Centre for Fisheries Sciences on breeding of various marine species, in 2012 its research mandate was strengthened and it was renamed the Malta Aquaculture Research Centre (MARC). This is the foremost public research centre in Malta and its work focuses on the diversification of species to be produced for agriculture. Its work over the last two decades was instrumental to the development of the fish farming industry in Malta.

A second public research organisation is being set up in Gozo by the Ministry for Gozo in collaboration with the University of Malta. The new facility will be known as the Centre for Innovation in Rural Sciences and Environmental Management (CIRSEM) (NRP under the Europe 2020 Strategy, April 2012).

A major public initiative worthy of mention is the Life Sciences Centre (www.lifesciencepart.com), the development of a state-of-the-art industrial park dedicated to the life sciences sector estimated to cost around €30 million (NRP under the Europe 2020 Strategy, April 2012, pp 119). This got underway in late 2011 and is scheduled for completion in late 2014. The initiative will promote the development of a knowledge cluster between the University of Malta, Mater Dei Hospital, the Malta Council for Science and Technology, the Malta College of Arts, Science and Technology and the Life Sciences industry. It is expected that this initiative will lead to a 0.33% increase in R&D expenditure as a percentage of GDP with 100 direct jobs created by the end of 2020.The Life Sciences Park will have 50 labs / working units of various sizes.

2.4 Recent policy developments

A major change in research and innovation policy has come about with the conclusion of the smart specialisation exercise led by the Malta Council for Science and Technology over the past year or so. The results of this exercise have been published in the National R&I Strategy 2020 (National R&I Strategy 2020, Feb 2014). This marks a major shift from the previous strategy, with the identification of eight areas of specialisation as opposed to the original four thematic areas. While there is an element of overlap in the areas of focus, the eight areas identified in the smart specialisation strategy also embrace some new domains. It is important to point out the conceptual differences between the priority thematic areas and the smart specialisation areas, with the latter being more business-driven, innovation-focused and cross-thematic. Nevertheless, the underlying principles behind the strategy such as the business orientation have been retained.

Other relevant developments in the area of policy include the preparation of two thematic strategies, the Manufacturing Research Strategy and the Health Research and Innovation Strategy, both of which were launched in early 2013.

Another striking development has been the new target for R&D expenditure which has been set at 2% of GDP in 2020 (National R&I Strategy 2020, Feb 2014), up from the previous conservative target of 0.67%. This may be the result of a genuine political perception of research and innovation as a critical component of government policies for economic competitiveness, growth and jobs. It appears to indicate a firm resolve to boost the level of R&I together with a degree of confidence in the success of existing policy measures. However, the national strategy does not provide any significant detail on how this increase will be financed and achieved, but it is expected that the rolling action plan will provide the necessary detail once this is developed

In support of the national drive to promote research and innovation, recent years have seen a significant increase in government funding for research, both that derived from national funds as well as that coming from EU structural funds. This involved the boosting of existing funding programmes as well as the establishment of new programmes.

The central government allocation for the National R&I Funding Programme was boosted from €0.7 million in 2010 to €1.1 million in 2011 and again to €1.6 million in 2012. This programme is the main programme for funding of competitive research. In 2009 Malta Enterprise launched the '20 million for industry' programme which included a number of schemes aimed at encouraging R&I in industry.

Another recent development is the launching of the Commercialisation Programme in 2012 by the Malta Council for Science and Technology, and of its successor the Commercialisation Voucher Programme in 2013. This provides funding for a variety of upstream activities related to commercialisation but excludes funding for the product development itself. The Programme is targeted at Maltese companies, academia and non-governmental organisations (NGOs), and has a financial allocation of €200,000.

Many of the funding schemes in force in recent years were financed through EU structural funds rather than national funds. This heavy dependence on structural funds poses a risk of disruption as schemes from the previous programming period come to an end and the resulting delay until new programmes come into effect. This could well lead to a temporary dip in the R&D expenditure.

2.5 NRP 2013

Malta's latest NRP, released in April 2013, reports on the progress and status of a number of initiatives including the National R&I Strategy 2020, incentives for R&D in industry, innovation in the agriculture and food sectors, the doctoral and post-doctoral scholarship scheme, the Life Sciences Centre, the Health R&I Strategy, the National R&I fund, and the setting up of the National Interactive Science Centre (NRP 2012, pp 117). Most of these are reported in some detail in other sections of this document.

However the NRP does not always adequately assess progress on commitments made in earlier versions. For example, the 2012 NRP had stipulated that the financial allocation for the Technology Development Programme (formerly the National R&I Programme) was to increase to Euro 3.8 million in 2013, whereas the actual allocation for that year remained static at € 1.6m.

In contrast to earlier NRP documents which included details of the planned expenditure, the 2013 NRP contains little such detail, and does not establish any specific indicators or targets. It reports on a number of past industry incentives but does not mention any plans in this area. In general the document focuses on past achievements and is rather short on concrete measures planned for coming years. This may be because it was published shortly after a change of government which did not allow sufficient time for proper stocktaking and planning by the new administration. Furthermore, the NRP was published when the national research strategy was undergoing revision, possibly leading to difficulty in committing to any course of action in the resulting policy vacuum.

Two new measures which are articulated in the NRP include the undertaking of an Internationalisation Scoping Exercise and the setting up of a Centre to Strengthen Research on Business and the Self-employed at the University of Malta. These are positive initiatives but more detail on these particular measures would have been welcome.

The NRP also addresses the issue of the European Research Area, but provides little detail on plans in this particular area. It emphasises that while the national R&I system and main policy documents are very much in tune with the principles underpinning the ERA vision, Malta's research and innovation ecosystem is still in its infancy. Malta's strategy is tailored to the national contextual framework and needs, and its priorities therefore lie in strengthening internal capacity, hopefully leading to progress which would then enable shifting focus to fuller integration in the ERA.

Two new measures which are articulated in the NRP include the undertaking of an Internationalisation Scoping Exercise and the setting up of a Centre to Strengthen Research on Business and the Self-employed at the University of Malta. These are positive initiatives but more detail on these planned measures would have been welcome.

2.6 Recent evaluations, consultations, foresight exercises

The culture of consultation in the development of research policy documents is now firmly engrained in the Maltese psyche. The National Strategy published in February 2014 was developed by the Malta Council for Science and Technology on the basis of widespread consultation with all relevant public sector entities as well as with academia, the private sector,

private sector representatives and social partners. Around 20 meetings with top government officials, public entities and social actors as well as one-to-one meetings with a number of private sector stakeholders were held. Focus group meetings with private stakeholders and meetings at political level were also held. The smart specialisation strategy which constituted part of the national strategy was submitted for peer review in June 2013 under the aegis of the JRC peer review workshops initiative prior to finalisation.

Other initiatives which have adopted this consultative approach in recent years include the Manufacturing Research Strategy, the Health Research Strategy and the Digital Gaming Strategy.

Formal evaluation of the impact of research policy measures is not routinely carried out, and no such evaluation reports are available in the public domain. Similarly there is no evidence of foresight exercises, surveys or intelligence gathering to improve the knowledge base for policy conceptualisation and design having been undertaken in recent years. On the positive side, there do exist isolated initiatives such as the FP7 project (ERA PRISM) on policy requirements for research and innovation in small EU member states, which was conceived and coordinated by Malta, as well as the internationalisation scoping exercise described in Malta's NRP.

This is not to say that policy is decided without a proper analytical phase. The National R&I Strategy 2020 clarifies that the thematic areas for smart specialisation were identified through a process involving desk-based analysis of macro-level statistics, statistics on doctoral graduates, R&D expenditure, innovation expenditure, publications and participation in international programmes. However, it appears that there is a great reliance on analysis, reports and statistics produced by the EC (e.g. the innovation union scoreboard and related reports) or national statistics authorities rather than on any studies undertaken specifically for the purpose.

Such an approach is likely due to resource constraints rather than to a lack of appreciation of the importance of such exercises. Indeed, the final chapter of the National R&I Strategy 2020 identifies knowledge-based policy design as one of the lynchpins of future strategy development and reads as follows:

> *Policy support tools which ensure the ongoing improved design of policies and take into account the highly dynamic and competitive environment within which R&I operate should contribute to informing the review and updating of this Strategy. These should include, among others, mapping exercises, benchmarking studies, improved design and gathering of R&I indicators, greater emphasis on audit, evaluation and impact assessment studies, peer review, increased use of anticipatory intelligence, foresight and horizon scanning to identify emerging opportunities and threats.*

2.7 Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3)

During the course of 2013 the Malta Council for Science and Technology was working on the development of a Smart Specialisation Strategy which was developed following a comprehensive consultation exercise involving all relevant stakeholders. As part of the strategy development process, a comprehensive analysis of the research and innovation landscape was undertaken including a SWOT analysis (National R&I Strategy 2020, Feb 2014).

The Smart Specialisation Strategy has been incorporated into the national R&I strategy and identifies seven areas of specialisation as follows:

1. Tourism product development;
2. Maritime services;
3. Aviation and aerospace;
4. Health with a focus on healthy living, active ageing and e-health;
5. Resource-efficient buildings;
6. High value-added manufacturing with a focus on process and design, and
7. Aquaculture.

In addition to these, ICT has been identified as a key enabling technology cutting across the thematic specialisation areas as well as a specialisation area in its own right.

In line with many strategy documents, the regional innovation strategy does not make specific mention of the smaller island of Gozo.

The National Strategy proposes the establishment of a core steering group which will meet at least twice a year to oversee the design and facilitate coordination in the development and implementation of new measures as well as the evaluation of any measures implemented. The committee will be chaired by the Malta Council for Science and Technology which will also be responsible for providing the secretariat. The steering group will include representation from key government bodies as well as from the higher education sector. The steering group will be supplemented by focus group meetings with the private sector and social partners to be held every two years.

The National Strategy (and smart specialisation strategy) is a high-level document and there is little or no detail regarding specific measures, funding levels, funding instruments or timeframes. It does, however, stress that both national and EU funds will be leveraged to finance the initiatives. It is expected that the National Strategy will be followed by a more detailed document providing such information.

In the final chapter, the national strategy identifies a small number of targets and indictors by means of which progress will be monitored. However, these indicators are generic rather than specific to the identified areas of specialisation.

Policy support tools which ensure the ongoing improved design of policies and take into account the highly dynamic and competitive environment within which R&I operate should contribute to informing the review and updating of this Strategy. These should include mapping exercises, benchmarking studies, improved design and gathering of R&I indicators, greater emphasis on audit, evaluation and impact assessment studies, peer review, increased use of anticipatory intelligence, foresight and horizon scanning to identify emerging opportunities and threats.

2.8 Policy developments related to Council Country Specific Recommendations

n/a.

3 PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM

3.1 National Research and Innovation policy

Table 2

Indicator	Score actual/normalised
ENABLERS: Human Resources	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	0.2 / .033
Percentage population aged 25-64 having completed tertiary education	21.1 / 0.236
ENABLERS: Open, excellent and attractive research systems	
International scientific co-publications per million population	328 / 0.168
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	7.06 / 0.376
ENABLERS: Finance and support	
R&D expenditure in the public sector as % of GDP	0.24 / 0.104
Public Funding for innovation (innovation vouchers, venture/seed capital, access to finance granted by the public sector to innovative companies)	n/a
FIRM ACTIVITIES: Firm Investments	
R&D expenditure in the business sector as % of GDP	0.49 / 0.199
Venture capital and seed capital as % of GDP	n/a
FIRM ACTIVITIES: Linkages & entrepreneurship	
Public-private co-publications per million population	8.4 / 0.216
FIRM ACTIVITIES: Intellectual assets	
PCT patents applications per billion GDP (in PPS€)	0.29 / 0.067
PCT patents applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	0
OUTPUTS: Economic effects	
Medium and high-tech product exports as % total product exports	0.92 / 0.499

Knowledge-intensive services exports as % total service exports	13.63 / 0.154
License and patent revenues from abroad as % of GDP	0.3 / 0.410S

Source: Innovation Union Scoreboard 2013

Malta experienced growth in the Innovation Union Scoreboard (IUS) over the period 2008 to 2010 but then slipped in subsequent years, with its score in 2012 falling below that of 2008. While in 2008 it ranked twentieth in the EU27, in 2012 it fell to twenty-second place with a score of 0.284 compared to an EU average of 0.544. The Innovation Union Scoreboard 2013 report states that the innovation divide between the member states is widening, and this certainly appears to be the case for Malta. Despite having registered growth in a number of indicators, Malta failed to keep up with average EU growth rates and thus its normalised score has decreased and its ranking fallen.

Malta belongs to the group of moderate innovators, ranking eighth out of nine countries in this category. Its performance is only marginally above the minimum threshold for this group, and it is at risk of being relegated to the group of modest innovators if its performance does not keep up with the EU average in coming years.

With reference to the eight innovation dimensions, Malta scores moderately well (but below the EU27 average) on *firm investments*, but scores poorly on all other dimensions ranking eighteenth or lower in all cases. It is particularly weak in *finance and support* and in *human resources*, and ranks last within the EU in terms of doctorate graduates per 1000 population aged 25-34 with an estimated 9 – 14 such graduates annually. The STEPS doctorate grant scheme which was introduced in 2010 funded 77 doctoral students in total (NRP 2020, April 2013, pp201) and should lead to significant improvement on this score. The results of this initiative should hopefully become evident within the next two years when the beneficiaries of this scheme obtain their doctorate. However, many of these doctoral students pursue their studies overseas, and may not be included in the official figures.

On a positive note, Malta scores above average in a number of indicators including *international scientific co-publications, non-R&D innovation expenditures, community trademarks*, and *employment in knowledge-intensive activities*. Strong growth was observed in *new doctorate graduates, international scientific co-publications, most-cited scientific publications, non-EU doctorate students, public-private co-publications, community trademarks*, and *SMEs introducing innovations*. However, its previous strong performance in *medium and high-tech exports* and *sales of new to market innovations* has been lost and it now scores below the EU average on both indicators.

A recurring concern with the IUS for Malta has been the problem of scalability of indicators to Malta's micro level. Small shifts in absolute numbers result in big percentage shifts which however may not necessarily be linked to real progress or regression on the ground.

3.2 Structural Challenges of the National R&I System

The key structural challenges have been identified on the basis of the achievements in the R&I ecosystem in recent years, on the current state of play and on the perceived requirements for further progress. Recent improvements have addressed a number of earlier weaknesses leading to a new set of challenges (e.g. increased number of PhD graduates leading to the requirement for developing opportunities for such researchers). In other cases earlier weaknesses have been addressed to some extent but further measures are necessary to maintain momentum (e.g. funding for research and innovation).

The principal structural challenges that Malta faces are outlined below:

1. Investing in human capital

Malta ranks last within the EU in terms of doctorate graduates per 100 population aged 25-34, although the doctorate grant schemes introduced in 2010 should address this bottleneck to a great extent. Nevertheless, the lack of funding for post-doctoral research in higher education leads to a lack of openings for researchers and presents a major obstacle to the development of a pool of experienced researchers.

This has consequences beyond the narrow confines of research activity. The lack of a pool of experienced researchers creates a disincentive to foreign industry potentially interested in establishing R&D facilities in Malta. It also makes it very difficult for the University to participate in the FP7 Ideas Programme, thus losing out on a potential source of additional funding. Furthermore, it contributes to a brain drain and to the loss of important talent as researchers seek opportunities overseas.

The setting up of a post-doctoral grant scheme has been mentioned in a number of policy documents (National R&I Strategy, July 2006; NRP 2011, July 2011), but such a scheme has not yet been implemented. It is paramount that such a scheme is put in place in the near future.

2. Smart specialisation

In a small country characterised by limited human and financial resources, specialisation is essential to enable concentration of resources in areas which are seen to be most appropriate or favourable to the country's context. This will enable the development of superior capacity in a few select areas, thus reaping the benefits that result from advanced expertise. At the same time, specialisation can incur its own risks for a small, open economy which is vulnerable to external shocks.

In late 2013 Malta published its smart specialisation strategy, and the challenge now is to put in place the necessary measures and advance with all possible haste in the development of the required expertise in the identified areas of specialisation, whilst retaining some level of flexibility to respond to emerging opportunities and external shocks.

3. Increasing funding for research and innovation

The level of expenditure as a percentage of GDP by public research organisations and higher educational institutions in Malta is the lowest in the EU (IU Scoreboard 2013), and increasing the level of funding for research in this area presents a major challenge. Over the past five years,

the R&I system has benefited from an injection of Structural Funds (ERDF and ESF), and it is crucial that in the future this source of funding is fully exploited to provide continued financing for various components of the R&I ecosystem.

With reference to central government funding for the Technology Development Programme (formerly the National R&I Programme), this was more than doubled between 2010 and 2012 but is still very low and there is no indication of plans for further increases.

In order to increase the funding for research, efforts to tap alternative sources of funding from the private sector need to be stepped up. The establishment of the University Trust Fund in 2011 was a step in the right direction, but unfortunately had not managed to attract significant funding by 2012 (RIDT Annual Report 2012).

4. Broadening the base of enterprises undertaking R&I activities

R&I activity in industry is largely attributable to a small number of firms including large multinational manufacturing operations in the pharmaceuticals and electronics sectors as well as service-oriented sectors such as consultancy and information programming activities. (NSO News Release 216/2012, Nov 2012). Of the (mainly indigenous) SMEs that represent the majority of the enterprise sector in Malta, only 35% reported carrying out R&I activities, compared to 72% of large enterprises in 2010. Overall, only 36% of enterprises employing 10 persons or more undertook innovation activity.

More than 80% of all business enterprise R&D is performed by foreign-owned companies (Research and Innovation Performance in Malta, Country Profile 2013, EC), while indigenous Maltese industry is traditionally more focused on manufacturing or provision of services. This is easier to accomplish as well as being less risky and capital intensive than research and innovation. Also, the smaller enterprises often lack the personnel and expertise to develop ideas and undertake R&I projects. In fact, the main reasons cited for not undertaking innovation included the high costs of innovation, lack of funding (both within the enterprise as well as external funding), and the risks associated with developing innovative products and services (NSO News Release 216/2012, Nov 2012).

A number of schemes introduced in recent years such as the R&D Grant Scheme, the Innovation Actions Grant Scheme and the Loan of Highly Qualified Personnel Scheme seek to address these barriers and their full impact may not have been captured in the latest available statistics which relate to 2010. Nevertheless, broadening the industry base involved in R&I to include SMEs clearly remains a challenge for Malta.

5. Bringing research to market

Capitalising on the investment in research through the development of marketable products and services presents another challenge for Malta. Applied research conducted by industry is generally undertaken with this objective in mind, but marketing a new product or service still presents a challenge and demands a different set of skills to the technical skills involved in developing the product. SMEs in particular could well be lacking such skills, or the finance to buy in the required expertise.

In the case of research conducted by academia, results which have the potential for commercialisation may be achieved but there are no documented cases of such activity or of the creation of spinoffs. However, the University of Malta is actively seeking to encourage such

activity and has taken a number of initiatives such as the setting up of the knowledge Transfer Office in 2009, and the Centre for Entrepreneurship and Business Incubation in 2013. The University has also launched a Masters programme in technology entrepreneurship, with the aim of encouraging innovation-driven entrepreneurship from both within and outside campus.

The Commercialisation Voucher Programme launched by the Malta Council for Science and Technology in 2013 funding focused on activities related to the commercialisation potential of innovative ideas.

3.3 Meeting structural challenges

Challenge	Policy measures/actions	Assessment in terms of appropriateness, efficiency and effectiveness
Investing in human capital	• MGSS and STEPS doctoral schemes introduced in 2006 and 2010 respectively. • Recommendations and plans for a post-doctoral grant scheme have been mentioned in various strategy documents for a number of years.	• The requirement to develop a pool of researchers has been adequately addressed through the MGSS and STEPS scholarship schemes implemented in 2009 /2010. The schemes attracted a large number of applicants. The proposed postdoctoral scheme referred to in various strategy documents are exactly what is needed. However, no such scheme has been implemented to date, and the relevant documents do not include any financial targets or timeframes.
Smart specialisation	• Malta has developed a Smart Specialisation Strategy which has been incorporated into the National R&I Strategy 2020.	• The smart specialisation strategy has recently been articulated as a high-level policy, and a more detailed implementation plan is now required. The strategy appears to be well-designed and appropriate to the national context, but some time will have to elapse before an assessment can be made regarding its effectiveness.
Increasing funding for research and innovation	• Various initiatives co-financed by ERDF funds for new research infrastructures in higher educational institutions were implemented from 2010 onwards. • Various schemes co-financed by ERDF funds to finance R&I in industry were introduced in 2010. • central government funding for the National R&I Funding	• ERDF funding for academia was applied intelligently to develop research infrastructure in important areas. • ERDF funding schemes proved attractive to industry and were fully utilised. • Increased funding for the crucial National R&I Funding Programme was an excellent initiative but the programme is still under-funded and further increases

	Programme was more than doubled between 2010 and 2012. • The University of Malta Research, Innovation and Development Trust was set up in 2011 with initial funding from the central government.	are necessary. • The establishment of the university RIDT trust fund is a positive initiative aimed at tapping private sector financing for research but has not succeeded in attracting significant funding as of 2012.
Broadening the base of enterprises undertaking R&I activities	• A variety of incentives to stimulate R&I in industry including the R&D Grant Scheme, R&D Tax Credit, Innovative Actions Grant Scheme, Loan of Highly Qualified Experts, R&D Feasibility Grant Scheme and support for participation in Eureka and EUROSTARS.	• The R&D Grant Scheme and Innovation Actions Grant Scheme were well received by industry and were fully taken up. Other schemes were less successful. It is believed that the schemes were effective in addressing the challenge, although lack of a proper evaluation report or recent data on industry research make it difficult to draw firm conclusions.
Bringing research to market	• A Commercialisation Programme was launched by MCST in 2012, later replaced by the Commercialisation Voucher Programme in 2013. • Setting up of the technology transfer office at the university of Malta in 2009.	• The Commercialisation Voucher Programme is seen as a very useful measure but it is still too early to assess its effectiveness. The financial allocation for this programme is very small and increasing the allocation should prove useful. • The setting up of a technology transfer office at the University of Malta is a positive initiative

Table 3. Meeting the grand challenges

4 National Progress in Innovation Union Key Policy Actions

4.1 Strengthening the knowledge base and reducing fragmentation

Promoting excellence in education and skills development

The number of FTE researchers in Malta accounts for 0.43% of the total active population, compared to 0.67% in the EU-27 in 2012 (Eurostat). This is surprisingly high, considering that GERD in Malta is only 0.84% of GDP compared to an EU average of 2.07%.

The table below shows the relative importance of the private sector for researcher employment compared to the average in the EU-27:

	BEI	HEI	PRI
Malta	65%	32%	3%
EU-27	46%	40%	12%

Figures for supply and demand of researchers in Malta are not available, however anecdotal evidence suggests that the supply of researchers exceeds the demand. It is not often that one sees advertisements for research positions in the local press.

The number of PhD graduates (per 1,000 population aged 25-34) stood at just 0.2 compared to the EU-27 average of 1.5% in 2012, and is the lowest score in the EU. However, the STEPS doctorate grant scheme which was introduced in 2010 should lead to significant improvement on this score.

There are no Maltese organisations which have to date formally endorsed the Charter and Code, although most of the principles enshrined in these documents are in fact observed by the University of Malta and to a lesser extent by public research institutes.

The National R&I Strategy 2020 recommends that public employers should be encouraged to formally endorse the Charter and Code, but stops short of detailing how such encouragement should be achieved and does not propose any concrete actions.

The planned post-doctoral fellowship scheme, although not clearly linked to the principles of the Charter and Code, should contribute to the development of a competitive environment for researchers at the University of Malta.

Research Infrastructures

In recent years there has been a growing awareness of the importance of participating in European R&D infrastructures and in 2012 Malta signed the first cooperation agreement with the European Space Agency. Malta also has ongoing collaboration with CERN and is working towards a similar cooperation agreement with the European Molecular Biology Laboratory.

The National R&I Strategy 2020 specifies that Malta will adopt a strategic approach towards participation and collaboration with major research infrastructures, focusing primarily on those infrastructures which are closely linked to the identified areas of specialisation (National R&I Strategy, Feb 2014, section 7). It also proposes that a core subset of local research infrastructures should be able to form part of European and/or international networks of such infrastructures. Through the European Strategic Forum on Research Infrastructures (ESFRI), Malta will endeavour to participate in the development of pan-European research infrastructures by linking with identified priority themes and investments in national research infrastructures. In addition, diplomatic efforts will endeavour to ensure access and availability of major research infrastructures to local Maltese researchers even in cases where it is not economically feasible for Malta to be a full member of these infrastructures.

However, as at March 2014 there exist no national or other funds ring-fenced for the construction and operation of ESFRI, global, national and regional RIs of pan-European interest, and the national strategy does not establish any financial commitments in this regard.

In spite of this, Maltese entities are participating in European research infrastructure projects such as the Bio banking and Bio molecular Resources Research Infrastructure (BBMRI) among others.

It is believed that there are no legal barriers to cross-border access to research infrastructures. However there has not been any in-depth assessment of the subject, and neither has there been any recommendation for the undertaking of such a study. The main barrier limiting the participation of Maltese researchers in international infrastructures is the lack of funding, and lack of bilateral agreements.

Malta does not have any large national infrastructures or scientific technological platforms which may be of interest to other EU countries.

4.2 Getting good ideas to market

Improving access to finance

In recent years a number of schemes aimed at promoting innovation in industry have been launched by Malta Enterprise. These include the Loan of Highly Qualified Personnel scheme, the Preparatory Technical Feasibility Studies Scheme, the Registration for Intellectual Property Tax Credits for SMEs and the Royalty Income from Patents scheme. Unfortunately the uptake of these schemes has been very low (Malta's National Reform Programme under the Europe 2020 Strategy, April 2013, pp 117), although it is not clear whether this is because the schemes do not meet industry needs, because of lack of interest in innovation by industry, or for some other reason. These schemes have bureaucratic procedures similar to other local schemes which have been very successful, and it does not appear that this is a cause of their poor success.

The Commercialisation Programme launched by the Malta Council for Science and Technology in 2012 offered funding in the form of grants to assist researchers and innovative companies to access specialist advice and services in order to prepare a viable business plan for the commercialisation of technology and is open to locally registered companies, public and private research organisations and non-governmental organisations (NGOs). In 2013 this was changed to a Commercialisation Voucher Programme, which focuses on supporting the analysis of commercialisation potential prior of innovative ideas.

Similarly the Innovation Actions Grant Scheme managed by Malta Enterprise was very successful, although this finances both the development as well as the procurement of innovative products and services and it is not clear how much of this was utilised for the development of innovation. Similarly the JEREMIE package offered by a local bank enjoyed a high level of demand, but once again this finances a number of activities besides innovation.

There is no evidence of formal evaluation of such schemes or of benchmarking against comparable schemes in other countries.

Protect and enhance the value of intellectual property and boosting creativity

Maltese legislation is in line with the WTO TRIPS Agreement and also with the EU *Acquis*. Malta is a member of the Paris and Berne Conventions, the WIPO Copyright and WIPO Performers and Producers of Phonograms Treaty, the Patent Cooperation Treaty and the European Patent Convention. Statistics relating to IP registrations are published yearly and also submitted to WIPO and EPO for their own publications.

In addition, through the European Structural Funds Project 1.125 "Creating a Knowledge Transfer Framework and Technology Entrepreneurship Training Programme", the Centre for Entrepreneurship and Business Incubation (CEBI) at the University of Malta has developed and started offering an Intensive Training Programme and Masters Programme in Technology Entrepreneurship, with the aim of providing hands on training in Entrepreneurship, Creativity and Innovation. The goal is for a substantial percentage of the graduates of the course to set up their own innovation-driven start-up.

Through the same project the Knowledge Transfer Office (KTO, http://www.um.edu.mt/knowledgetransfer) received funds to set up a framework for Technology Transfer at the University. As a result the Knowledge Transfer Office is now a fully functional unit within the University, amongst other things dealing with protection and valorisation of Intellectual Property.

The University of Malta has also recently launched a business incubator on campus under the direction and management of CEBI and the KTO, with the aim of encouraging innovation- and creativity-driven entrepreneurship.

Public procurement

There is rather limited evidence of progress in the leveraging of public procurement of innovative goods and services. One such case study was reported in the final report of the ERA-PRISM project (ERA-PRISM final report, Sep 2011), which gives an account of procurement undertaken by the Maltese national IT agency MITA. This involved the purchase of ICT infrastructure for the Active-Active Data Centre. Rather than specifying a set of technical

requirements, the tender stipulated a set of business requirements with the objective of increasing the potential innovativeness of this project. The key adjudication criterion was value for money, expressed as the lowest long term cost over the lifetime of the project.

4.3 Working in partnership to address societal challenges

Cooperation and coordination of research programmes with other member states may be a desirable objective, but places a strain on the limited financial and human resources arising from the small size of the country. As a consequence, Malta has adopted a strategic approach to such cooperation, focusing on areas which are considered a priority and where Malta has a relative strength. Malta is a member of the Urban Europe JPI and has observer status in the Antimicrobial Resistance JPI, the Neurodegenerative Diseases (JPND) JPI and the Healthy Diet for Healthy Living (HDHL) JPI (Malta's National Reform Programme under the Europe 2020 Strategy, April 2013, pp 125).

Whilst it should be possible to leverage EU structural funds for the purpose of transnational cooperation, there have not been any such initiatives to date.

4.4 Maximising social and territorial cohesion

Because of Malta's small size, the regional element is generally not relevant although the smaller island of Gozo is sometimes given special mention in a few policy documents. In general, however, all policy, initiatives and action operate at a national level. In the case of R&I, the level of infrastructure and activity in Gozo is so low as to be almost nonexistent and there is no specific mention of Gozo in the smart specialisation strategy.

4.5 International Scientific Cooperation

Despite significant progress in recent years with respect to researcher skills, research infrastructure, and research funding, Malta still lacks the advanced facilities required to attract top talent from outside the EU. The Life Sciences Centre currently under development has the stated aim of attracting research to Malta, but one will have to wait and see to what extent this will yield the expected results.

The National Reform Programme states that while transnational cooperation is a priority for Malta, the practical aspects of international cooperation place a burden on the national system which is disproportionately high. Funding considerations remain a major obstacle in international cooperation. As a consequence, Malta has sought to adopt a strategic approach to international cooperation, focusing on areas which are considered a national priority and where Malta has a relative strength (Malta's National Reform Programme under the Europe 2020 Strategy, April 2013, pp 125).

The National R&I Strategy (National Research and Innovation Strategy, February 2014) likewise acknowledges the importance of international scientific cooperation, but rightly points out that the differences in size, economic structure and maturity of the R&D system restrict the direct applicability and transferability of R&I policy approaches from one country to the other. In consequence, each country has to find its own way to contextualise the EU-level policy

dimension into national policy and strategy and tailor its responses and activities accordingly. It goes on to say that

> *As a country which is still developing its R&D activity, Malta's collaborations are largely 'under construction' and the collaboration profile is evolving over time.*

The National R&I Funding Programme allows the participation of foreign partners but does not provide funding for such partners. Neither does it provide funding for local institutions participating in projects coordinated by overseas institutions. It does not draw any distinction between EU and other countries. Funding for participation by local enterprises in the Eureka and Eurostars initiatives is possible through the Cross-border Collaborative Grant Scheme.

An Internationalisation Scoping Exercise got underway in October 2012 with the aim of identifying opportunities for Maltese researchers to be engaged in international cooperation opportunities. The exercise had not been finalised at the time of publication of this report (Malta's National Reform Programme under the Europe 2020 Strategy, April 2013, pp 124).

5 NATIONAL PROGRESS TOWARDS REALISATION OF ERA

As an overall assessment, the national R&I system is in tune with many of the principles underpinning the ERA vision, although policies and measures specifically addressing broader integration into the ERA are somewhat lacking. The rationale behind this is that Malta's research ecosystem is still in its infancy, and in view of existing limitations it may be premature to aspire to fuller participation in the ERA. The policy imperative for the immediate future is building and strengthening internal capacity, hopefully leading to improvements which would enable shifting focus to fuller integration in the ERA in the near future. An analysis of local policy in the context of the five ERA objectives is undertaken below.

5.1 More effective national research systems

It is estimated that in 2012 92% of public funding was allocated as a block vote, rather than on a competitive basis. Most of this goes to the University of Malta, which allocates a small percentage to a research fund which is disbursed through a system of internal assessment of departmental requests for finance.

Public funding which is allocated on a competitive basis through open calls includes the National R&I Programme, Commercialisation Programme, various funding schemes operated by Malta Enterprise, and the MGSS and STEPS scholarships. However, impact assessments and peer reviews of the funding systems have not as yet been undertaken.

With reference to institutional funding for public research organisations, as at March 2014 there exists only one such organisation in Malta (the Malta Aquaculture Research Centre) although one or two other government departments may be involved in some research activity. Allocation of funding on the basis of performance is therefore not a practical proposition.

5.2 Optimal transnational co-operation and competition

The National R&I Funding Programme allows the participation of foreign partners but does not provide funding for such partners. Neither does it provide funding for local institutions participating in projects coordinated by overseas institutions. Such funding is, however, available for participation by local enterprises in the Eureka and Eurostars initiatives through the Cross-border Collaborative Grant Scheme.

The National R&I Strategy 2020 document mentions international cooperation on a number of occasions. However, it is not closely aligned with the ERA approach and there is no mention of joint research agendas, allocation of funding for joint research. It does, however, refer to the recognition of the evaluation results of proposals submitted under the EC's Horizon 2020 Programme which are not awarded funding through this programme..

Cooperation and coordination of research programmes with other member states may be a desirable objective, but would place a strain on the limited financial and human resources arising

from the small size of the country. Whist it should be possible to leverage EU structural funds for the purpose of transnational cooperation, there have not been any such initiatives to date.

5.3 Open labour market for researchers

The process for recruitment of researchers both at the University of Malta and in the public sector is open, transparent and based on merit. University positions are publicised on the Euraxess portal through a link to the University website, although individual positions are not uploaded onto the portal and are thus not captured by the Euraxess search functionality.

There are no Maltese organisations which have formally endorsed the Charter and Code, although most of the principles enshrined in these documents are in fact observed. The national R&I strategy recommends that public employers should be encouraged to formally endorse the Charter and Code, but stops short of detailing how such encouragement should be achieved. It may be that the R&I Action Plan currently under development will provide such details.

Portability of national grants is observed to some extent in the local PhD fellowship schemes, where beneficiaries are free to pursue their studies at their University of choice. Other grant schemes primarily target organisations rather than individuals, and portability is not an option in this case.

The principles of innovative doctoral training have not yet been incorporated into the University's approach.

5.4 Gender equality and gender mainstreaming in research

The issue of gender equality is not specifically addressed in the National R&I Strategy 2020. However, at a national level the gender strategy (Gender Equality Action Plan, ETC, 2009/2010) proposes a number of measures with the aim of achieving a more equitable gender situation, and includes a number of economic measures aimed at encouraging females to either retain their current employment or to return to work following a break to take care of their family.

Recent legislative and other incentives aimed at encouraging women to continue working include an extension of maternity leave allowance, introduction of additional free childcare centres, tax credits for those using private childcare centres, and tax credits for women returning to work after an absence of five years or more. The public service employment conditions promote teleworking opportunities and accreditation of social security contributions of the parents for the first two years of parental leave.

Gender figures for 2009 published by the European Commission (She Figures, EC, 2012) indicate that female researchers in Malta are in the minority, accounting for only 29% of the researcher population in the Higher Education Sector which is the lowest in the EU. On the other hand, 44% of researchers in the government sector and 27% in the business enterprise sector are females, both considerably higher that the EU average

5.5 Optimal circulation, access to and transfer of scientific knowledge

Despite support in principle on the subject of open access to scientific results arising from public funding, the reality on the ground is rather different, hampered by the absence of any local repositories. The National R&I Strategy 2020 touches upon the subject and recommends that

local academic institutions should adopt a policy in favour of open access and set up their own open access repository. The University of Malta is in fact in the process of developing its own institutional repository. The Technology Development Programme also promotes the open access concept by encouraging the publication of research results in open access mode, although it is not clear to what extent this initiative has met with success.

Interaction between industry and academia is strongly promoted through the Technology Development Programme (formerly the National R&I Programme), since the programme requires consortia to include partners from both camps. The University of Malta also strongly favours interaction with industry, and the Knowledge Transfer Office (http://www.um.edu.mt/knowledgetransfer) set up in recent years was established with this in mind. The University Trust Fund also works towards this objective and has resulted in a number of collaborative activities between the University and local industry.

Annex 1. PERFORMANCE OF THE NATIONAL AND REGIONAL RESEARCH AND INNOVATION SYSTEM

Feature	Assessment	Latest developments
1. Importance of the research and innovation policy	(+) Policy development is undertaken at a high level using a broad consultative approach. Funding is focused on specific priorities. (-) detailed policy implementation plans, financial targets and timeframes are not included in the current strategy document. However, the strategy advocates the preparation of a rolling action plan which should address these matters.	The updated national R&I strategy incorporating Malta's smart specialisation strategy was published in February 2014.
2. Design and implementation of research and innovation policies	(+)There is a multi-annual R&I strategy in place providing a long-term policy context to prioritise expenditure on R&I. (+) The strategy includes a smart specialisation strategy. (-) the national strategy lacks any financial budgetary commitments (-) the strategy does not adequately include joint programming and cross-border initiatives (-) there is no monitoring or review system in place.	
3. Innovation policy	(+) innovation policy is addressed in the National Research and Innovation Strategy (-) there is a focus on supply-side rather than demand-side measures.	
4. Intensity and predictability of the public investment in research and innovation	(-) no financial targets are included in multi-annual plans such as the National R&I Strategy (+) public funding aims to leverage greater private sector investment (-) innovative financing solutions such as PPP are not exploited	
5. Excellence as a key criterion for research and education policy	(-) only a small percentage of research funding is allocated on a competitive basis (+) some public funding such as the National R&I Programme is allocated on a competitive basis (-) most funding is not portable either within or outside national boundaries (-) Malta's socioeconomic climate does not permit remuneration frameworks which are attractive in comparison to international standards	
6. Education and training systems	(+) a number of policies and incentives are in place to encourage students at both undergraduate and at postgraduate level (-) however the level of youth completing tertiary education is still among the lowest in the EU (+) entrepreneurship training is strongly promoted at tertiary level (-) entrepreneurship training is not strongly promoted at secondary level	
7. Partnerships between higher education institutes,	(+) the Commercialisation Voucher Programme aims to facilitate the analysis of the commercialisation potential of	

research centres and businesses, at regional, national and international level	innovative ideas (+) the technology transfer office at the University of Malta facilitates knowledge transfer and collaboration with industry (-) there are no mechanisms in place to facilitate movement of researchers between public and private institutes	
8. Framework conditions promote business investment in R&D, entrepreneurship and innovation	(-) there is room for closer cooperation in the development of policies to promote innovation, entrepreneurship and enhance the quality of the business environment (-) there is currently no venture capital market (+) there are plans for the establishment of a venture capital fund (+) an efficient, affordable and effective IPR system is in place	
9. Public support to research and innovation in businesses is simple, easy to access, and high quality	(+) there is a good suite of support schemes which are well-designed and most of which attract a high level of interest from business (+) selection criteria are straightforward and time to contract and to payment are as short as possible. (-) funding schemes are not regularly evaluated and benchmarked (+) national funding is allocated through international evaluation procedures (-) there is no effort to align rules, procedures and time-tables to facilitate participation in EU programmes and co-operation with other Member States. (+) specific support schemes are available to young innovative companies to help them commercialise ideas rapidly and promote internationalisation	
10. The public sector itself is a driver of innovation	(-) the public sector is not generally considered to be a driver of innovation (-) public procurement is not generally used to foster innovation, and the life-cycle analysis approach is not promoted (-) government-owned data is not easily available.	

Annex 2. National Progress on Innovation Union commitments

		Main changes	Brief assessment of progress / achievements
1	**Member State Strategies for Researchers' Training and Employment Conditions**		There are no Maltese organisations which have formally endorsed the Charter and Code, although most of the principles enshrined in these documents are in fact observed. The draft National R&I Strategy 2020 recommends that public employers should be encouraged to formally endorse the Charter and Code, but stops short of detailing how such encouragement should be achieved.
4	**ERA Framework**		
5	**Priority European Research Infrastructures**	In 2012 Malta signed the first cooperation agreement with the European Space Agency. Malta also has ongoing collaboration with CERN and is working towards a similar cooperation agreement with the European Molecular Biology Laboratory.	(-) there is no national financial allocation for participation in ESFRI projects, nor any stated intention for participation.
7	**SME Involvement**		(-) There have been no initiatives in any of these areas
11	**Venture Capital Funds**		(-) There have been no initiatives in any of these areas
13	**Review of the State Aid Framework**	Malta has implemented a number of grant schemes promoting R&I based on the state aid framework.	Malta has made very good use of the state aid framework to promote R&I in industry.
14	**EU Patent**		(-) There have been no initiatives in this area
15	**Screening of Regulatory Framework**		(-) There have been no initiatives in any of these areas
17	**Public Procurement**		(+) Some isolated examples of public procurement of innovative goods and services (-) early initiative by MCST in 2008 was not followed up
20	**Open Access**		(+) National R&I Programme require that results be published in open access mode. However it is not clear to what extent this is enforced. (-) no progress on other measures
21	**Knowledge Transfer**	(+) Commercialisation Programme launched in 2012 and further developed into Commercialisation Voucher Programme in 2013 (+) various 'innovation' schemes for industry	(+) The National R&I Programme is based on the concept of knowledge transfer between academia and industry (+) Commercialisation Programme will facilitate exploitation of research results (+) innovation schemes for industry should facilitate innovation activities by private sector (-) however there remain numerous other possible policies under this heading which have not been addressed.

22	**European Knowledge Market for Patents and Licensing**	(+) the Business First centre run by Malta Enterprise provides information on a number of matters including IP to businesses	(+) the Business First centre run by Malta Enterprise assists private industry with any queries related to IP
23	**Safeguarding Intellectual Property Rights**		(+)over the years, the Commerce Department has carried out various IP awareness raising activities such as information talks and business distribution of various promotional material, and the organisation of the Malta Innovation Awards.
24	**Structural Funds and Smart Specialisation**	(+) Smart specialisation strategy has been finalised and incorporated into the National R&I Strategy 2020.	(+) Smart specialisation strategy will enable more focused efforts in R&I (-) a more detailed implementation plan including targets and timeframes has yet to be developed
25	**Post 2013 Structural Fund Programmes**		(+) the new SF programmes are at an advanced stage of development and will include significant funding for R&I
26	**European Social Innovation pilot**		(-) there have been no initiatives in this area
27	**Public Sector Innovation**		(-) there have been no initiatives in this area
29	**European Innovation Partnerships**		(-) there have been no initiatives in this area
30	**Integrated Policies to Attract the Best Researchers**		(-) there have been no initiatives in this area since a prior need is the building of capacity and specialisation to make Malta a more attractive research location.
31	**Scientific Cooperation with Third Countries**		(+) Malta is signatory to a number of cooperation agreements with other countries, (-) however there is no funding allocated for such cooperation and little or no concrete activity resulting from the agreements. (-) however lack of funding means there is not participation in joint or coordinated calls.
32	**Global Research Infrastructures**		(+) Maltese organisations are involved in a small number of ESFRI projects (BBMRI).
33	**National Reform Programmes**	(+) NRP includes numerous R&I initiatives	(+) inclusion of R&I measures in NRP will facilitate progress

Annex 3. DELIVERING ERA

ERA Priority	ERA Action code	ERA Action	Recent changes	Assessment of progress in delivering ERA
ERA priority 1: More effective national research systems	**MS01**	Action 1: Introduce or enhance competitive funding through calls for proposals and institutional assessments		(-) the share of public funding allocated on a competitive basis is very low (-) institutional assessments are not carried out (-) the National R&I Strategy does not address the topic of competitive vs institutional funding
	MS02	Action 2: Ensure that all public bodies responsible for allocating research funds apply the core principles of international peer review		(+) evaluation of proposals in competitive funding programmes is broadly in line with the principles of international peer review (-) the programme regulations do not specify the participation of international reviewers.
ERA priority 2: Optimal transnational co-operation and competition	**MS06**	Action 1: Step up efforts to implement joint research agendas addressing grand challenges, sharing information about activities in agreed priority areas, ensuring that adequate national funding is committed and strategically aligned at European level in these areas		(+) Malta is participating in the ENIAC JU and has allocated substantial funds for this purpose (-) Malta does not have a clear strategy regarding participation in joint research agendas addressing grand challenges
	MS07	Action 2: Ensure mutual recognition of evaluations that conform to international peer-review standards as a basis for national funding decisions		(+) Malta has a funding programme to enable organisations to participate in EUREKA and Eurostars programmes (-) Malta does not have a clear strategy regarding this action point
	MS08	Action 3: Remove legal and other barriers to the cross-border interoperability of national programmes to permit joint financing of actions including cooperation with non-EU countries where relevant		(-)Malta does not have a clear strategy regarding this action point
	MS15	Action 4: Confirm financial commitments for the construction and operation of ESFRI, global, national and regional RIs of pan-European interest, particularly when developing national roadmaps and the next SF programmes		(-) Malta does not have a national research infrastructure roadmap and the National R&I Strategy 2020 fails to mention any such development (-) there is no allocation of national funds for participation in ESFRI projects (+) Malta is participating in a small number of ESFRI initiatives (CLARIN, BBMRI, GEANT).
	MS16	Action 5: Remove legal and other barriers to cross-border access to RIs		(+) there are no barriers to cross-border access to RIs (-)Malta does not have any large national infrastructures or scientific technological platforms which may be of interest to other EU countries.
ERA priority 3: An open labour market for researchers	**MS24**	Action 1: Remove legal and other barriers to the application of open, transparent and merit based recruitment of researchers		(+) recruitment of researchers is largely in line with the criteria for open, transparent and merit-based recruitment
	MS25	Action 2: Remove legal and other barriers which hamper cross-border access to and portability of national		(-) national funds are not accessible to non-Maltese entities

		grants		(-) national grants are not generally portable (+) doctoral scholarship grants are portable
	MS26	Action 3: Support implementation of the Declaration of Commitment to provide coordinated personalised information and services to researchers through the pan-European EURAXESS3 network		(-) there is no clear allocation of responsibility in relation to the EURAXESS network (-) the topic is not addressed in the National R&I Strategy 2020
	MS27	Action 4: Support the setting up and running of structured innovative doctoral training programmes applying the Principles for Innovative Doctoral Training.		(-) there is no specific initiative related to setting up and running of structured innovative doctoral programmes (+) doctoral training at the University of Malta is broadly in line with the required principles
	MS28	Action 5: Create an enabling framework for the implementation of the HR Strategy for Researchers incorporating the Charter & Code		(-) there are no Maltese organisations which have endorsed the Charter and Code
ERA priority 4: Gender equality and gender mainstreaming in research	**MS39**	Action 1: Create a legal and policy environment and provide incentives		(-) there are no such initiatives or policy objectives (+) there are no barriers to the recruitment or career progression of female researchers
	MS40	Action 2: Engage in partnerships with funding agencies, research organisations and universities to foster cultural and institutional change on gender		(-) there are no such initiatives or policy objectives
	MS41	Action 3: Ensure that at least 40% of the under-represented sex participate in committees involved in recruitment/career progression and in establishing and evaluating		(-) there are no related initiatives or policy objectives
ERA priority 5: Optimal circulation, access to and transfer of scientific knowledge including via digital ERA	**MS45**	Action 1: Define and coordinate their policies on access to and preservation of scientific information	The National R&I Strategy 2020 supports the Open Access principle	(+) the National R&I Strategy 2020 supports the Open Access principle but does not include any specific measures (+) the National R&I Programme promotes publication of research results in Open Access mode (-) the Open Access concept is not strongly promoted
	MS46	Action 2: Ensure that public research contributes to Open Innovation and foster knowledge transfer between public and private sectors through national knowledge transfer strategies		(+) the National R&I Programme promotes knowledge transfer by funding projects by consortia involving both industry & academia (+)The University of Malta strongly favours interaction with industry and set up a Knowledge Transfer Office to promote linkages with industry (+) the Life Sciences Centre currently under development will involve a knowledge cluster between the University of Malta, Mater Dei Hospital and the Life Sciences industry.
	MS47	Action 3: Harmonise access and usage policies for research and education-related public e-infrastructures and for associated digital research services enabling consortia of different types of public and private partners		(-)Malta does not have a national repository for storage of scientific data and publications, and there are currently no firm plans for developing one (+)The University of Malta has recently completed a project for the development of a supercomputer laboratory for use by academics as well as by research-performing SMEs
	MS48	Action 4: Adopt and implement national strategies for electronic identity for researchers giving them transnational access to digital research services		(-) there are no related initiatives or policy objectives

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