Interregional Key Networking for Open innovation empoWerment

Interreg Italia-Malta I KNOW

UNIVERSITÀ DEGLI STUDI DI ENNA "KORE"

DISCUSSION PAPER 5

Innovation from a national and regional perspective: evidence and implications from recent statistics on Italy, Sicily, and Malta

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Giuseppe Tesoriere, Deborah Gervasi

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Authors: *Giuseppe Tesoriere, Deborah Gervasi*

Project Research Team: *Raffaele Scuderi (coordinator), Guglielmo Faldetta, Vincenzo Fasone, Deborah Gervasi, Giuseppe Tesoriere*

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Introduction

During global crises policy agendas are oriented to find a solution to recover from shocks by increasing productivity, generating new jobs, and reducing inequalities. This is well evident from the current pandemic crisis. Currently, innovation is a key topic of national and regional governments across the globe. In particular, Europe is moving forward with a new recovery plan, in which the improvement of green technologies, digitalization, and innovations cover a substantial part of the new European financial package to sustain the economy of the continent.

With this respect, this report aims to describe the current situation of Europe in the innovation field, focussing on Italy and Malta as target areas of the project IKNOW. At the Italian regional scale, we explore the innovation in Sicily, comparing the region with the rest of the country.

We investigate innovation from different perspectives using official statistics. From our analysis, three main messages can be drawn from our descriptive analysis.

1. Geographical differences across Europe and fragilities persist at the country level.
2. The public sector may have a key role in boosting innovation, especially in lagging Regions.
3. Improving cooperation and dialogue for innovation among all parties (enterprises, public sector, universities, research centres, etc.) is fundamental.

The report proceeds as follows. In the next Section, we present an overview of innovation across Europe based on key indicators and statistics. Then Section 2 analyses the innovation field by comparing Italy and Malta. Section 3 explores the innovation at the regional scale, describing relevant statistics on Sicily and the rest of the Italian regions. We then discuss policy implications and conclude.

1. Innovation in Europe: an overview

The role of innovation as key driver for economic growth has been the focus of a well-established academic literature (see among others Lipsey et al. 2005; Pianta and Vaona, 2007; Hall et al., 2009; Antonioli et al. 2010; Ghisetti et al., 2015; Marzucchi et al., 2015), both at macroeconomic and microeconomic level.

At the firm level, innovation opens new markets and builds stronger competitiveness. At the aggregate level, innovation creates additional knowledge spillovers and increases favourable industrial dynamics, leading to greater efficiency and higher growth (Porter, 1998). In general, innovation benefits go beyond productivity and improve welfare through channels such as longer longevity; about one-third of the increase in longevity in Europe, for instance, is due to pharmaceutical innovation (Mckinsey, 2019).

Europe has long been an important driver of worldwide innovation. Given its relatively high wage costs and low reliance on natural resources, the importance of innovation to the continent's economic and social system is well evident. While European companies still account for one-quarter of total industrial R&D in the world, over the past ten years, US companies have continued to increase their share, reinforcing their leadership position, and China and South Korea have been catching up the three main types of innovation related to product, process, and organization (Mckinsey, 2019).

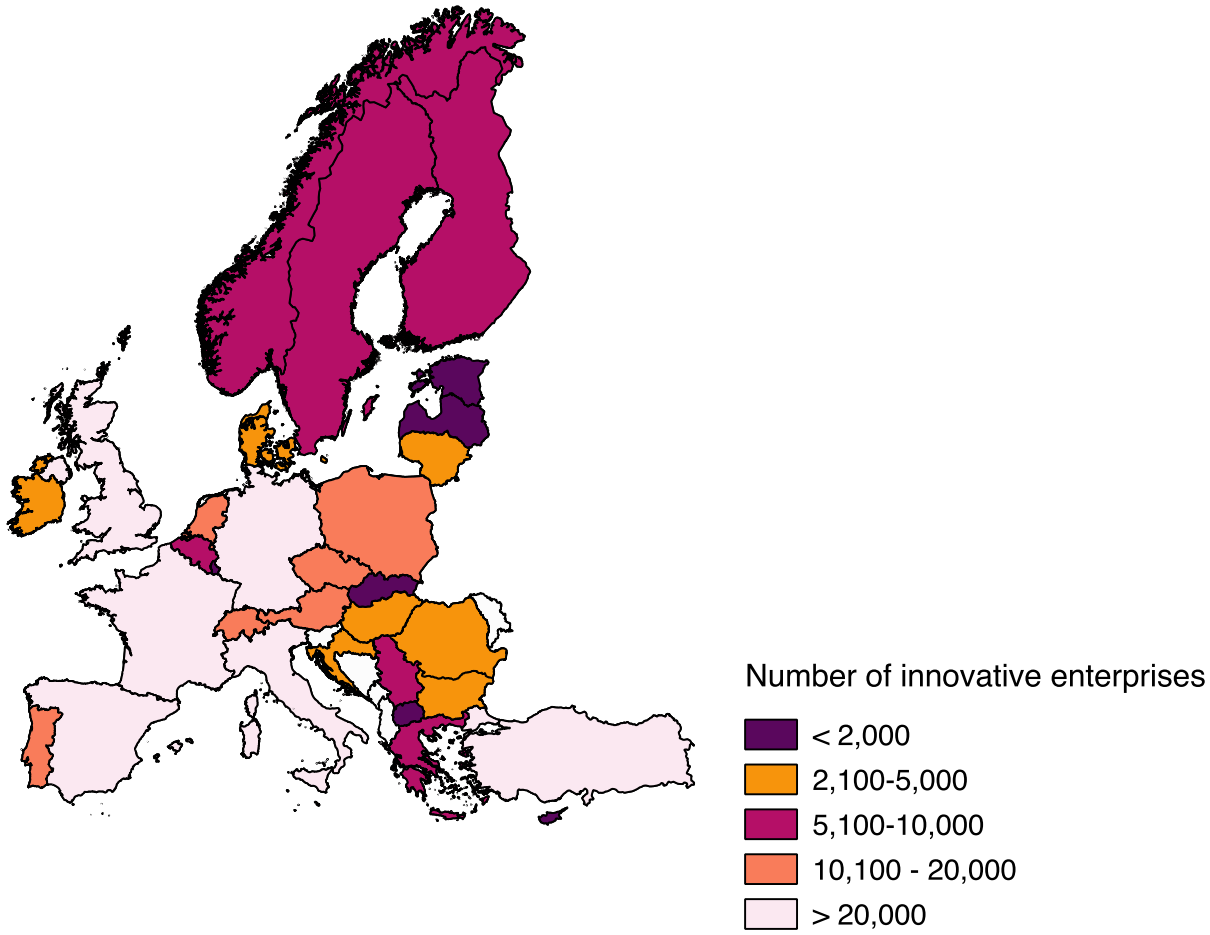

Figure 1. Number of innovative enterprises in 2016 - Source: Elaboration from Eurostat data (2021)

Looking at the data from Eurostat (2016), we observe that innovation in Europe is led by three main countries, namely Germany, France, and Spain (Figure 1 and Table 1). Italy is ranked as fourth leading area. OECD/Eurostat (2005) defines innovative firms as those that had innovation activities during the period under review, including those with ongoing and abandoned activities. Innovation activities are all scientific, technological, organizational, financial, and commercial steps

which actually, or are intended to, lead to the implementation of innovations. Some innovation activities are themselves innovative, whereas others are not novel activities but are necessary for the implementation of innovations. Innovation activities also include research and development (R&D) that is not directly related to the development of a specific innovation (OECD/Eurostat 2005).

Table 1. Number of innovative enterprises in 2016, population in bold, and ratio in italics - Source: Elaboration from Eurostat (2021)

< 2000		*2,100 -5,000*		*5,000-10,000*		*10,100 - 20,000*		*> 20,000*	
	1,772		4,136		9,528		10,473		91,192
Est.	**1,315,944**	Den.	**5,707,251**	Bel.	**11,311,117**	Cze.	**10,553,843**	Ger.	**82,175,684**
	0.0013		*0.0007*		*0.0008*		*0.0010*		*0.0011*
	639		3,941		6,297		15,397		24,204
Cyp.	**848,319**	Ire.	**4,726,286**	Gre.	**10,783,748**	Neth.	**16,979,120**	Spa.	**46,440,099**
	0.0008		*0.0008*		*0.0006*		*0.0009*		*0.0005*
	1,453		3,157		5,499		10,488		41,611
Lat.	**1,968,957**	Cro.	**4,190,669**	Fin.	**5487308**	Aus.	**8,700,471**	Fra.	**66,638,391**
	0.0007		*0.0008*				*0.0012*		
	1,179		3,948		*0.0010*		12,891		*0.0006*
Lux	**2,888,558**	Lith.	**2,888,558**		9,741	Pol.	**37,967,209**		61,952
	0.0004		*0.0014*	Swe.	**9,851,017**		*0.0003*	Ita.	**60,665,551**
	308		4,642		*0.0010*		12,842		*0.0010*
Malta	**450,415**	Hun.	**9,830,485**		6,669	Por.	**10,341,330**		55,591
	0.0007		*0.0005*	Nor.	**5,210,721**		*0.0012*	UK	**65,379,044**
	1,166		2,925		*0.0013*		16,596		*0.0009*
Mac.	**2,071,000**	Rom.	**19,760,585**		5,619	Swi.	**8,327,126**		53,206
	0.0006		*0.0001*	Ser.	**7,076,372**		*0.0020*	Tur.	**78,741,053**
	1,767		2,312		*0.0008*				*0.0007*
Slov.	**2,064,188**	Slo.	**2,064,188**						
	0.0009		*0.0011*						
			3,986						
		Bul.	**7,153,784**						
			0.0006						

Following the evidence of Balland et al. (2014), we can give further evidence on the relationship between innovation and GDP, and the relationship between innovation and urbanization measured as the population living in cities. Indeed cities represent a powerful force to attract human capital and spread innovation through the mechanism of matching, sharing and learning, known as agglomeration economies (Cappello, 2001; UN-Habitat, 2020). As Balland et al. (2020) suggest, innovative economic activities tend to be more concentrated in large urban areas because they require deeper division of knowledge and labour.

To measure innovation, we use two different indicators (Regional Innovation Scoreboards, 2019). On the one hand, in Figures 2 and 3 we consider the individual capacity of the firm to develop innovation in terms of introduction of a new product or a new process. On the other hand, in Figures 4 and 5 we consider the R&D expenditures in the government sector as a percentage of GDP. We correlate each of them with urban population and GDP.

From Figure 2 we find some evidence of positive correlation between the share of urban population and the capacity of firms to introduce product/process innovation. The plot confirms that the relationship varies between countries, sometimes noticeably (Vahter et al., 2014). This can be a first indication that innovative performance of enterprises can be characterised by spatial inequality (Balland et al. 2020). In Figure 3 we show the correlation between wealth and firms' innovative capacity. Also in this case, the correlation is positive. In both cases, we would like to remark the values of Germany and Italy, where the relative position in their innovation capacity seems to outperform their ranking in both urban

population share and per capita GDP.

Similar suggestions emerge when we consider R&D expenditure. We find again a positive correlation with both the share of urban population and GDP (Figures 4 and 5). We should remark that the dependence and volatility of public finance might be a constraint for innovation, especially during times of crisis, as it may impact on R&D investments and innovative performance (Bronwyn et al., 2015). Again, the heterogeneity across countries remarks how location matters to investigate the field of innovation across the European context (Porter and Stern, 2001).

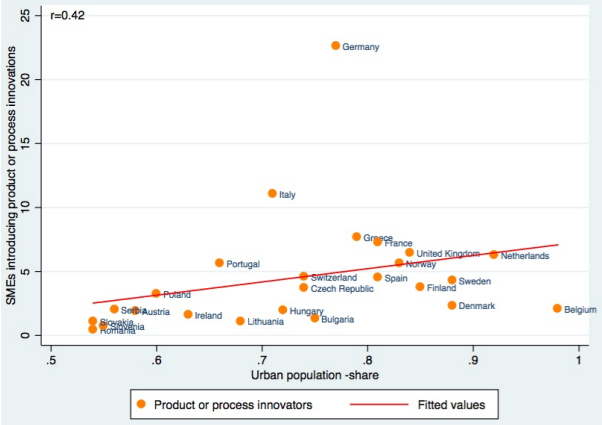

Figure 2. Relationship between product/process innovations from SME and share of urban population in 2019 - Source: Elaboration from Regional Innovation Scoreboards (2021)

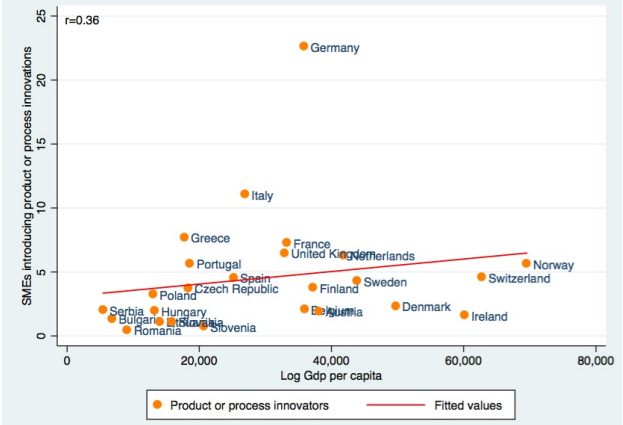

Figure 3. Relationship between product/process innovations from SME and Gdp per capita in 2019 - Source: Elaboration from Regional Innovation Scoreboards (2021)

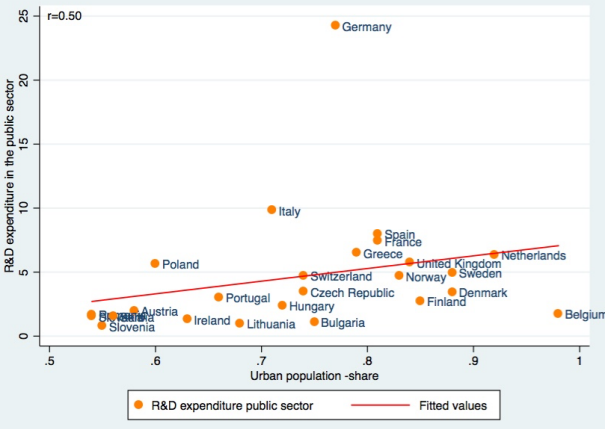

Figure 4. Relationship between R&S expenditure and share of urban population in 2019 - Source: Elaboration from Regional Innovation Scoreboards (2021)

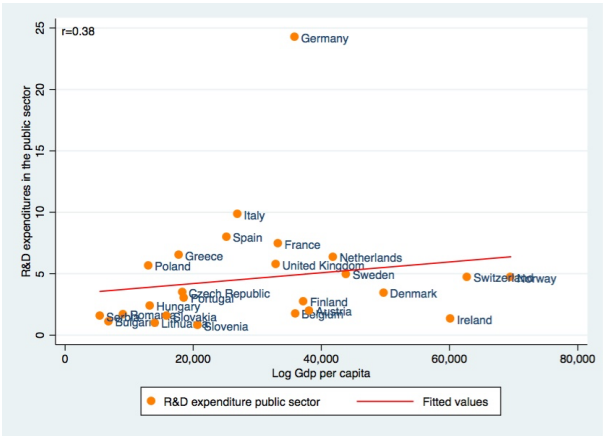

Figure 5. Relationship between R&S expenditure and Gdp per capita in 2019 - Source: Elaboration from Regional Innovation Scoreboards (2021)

Overall, the number of innovative firms is well concentrated in specific countries. Germany is the main player in the innovation process across Europe, followed by Spain, France, Italy, and the UK. As evidenced in Balland et al. (2020), the general tendency for economic activities to agglomerate (e.g., matching, learning, and sharing) is confirmed by other key statistics. Cities are powerful drivers for innovation in Europe, accelerating the spread of innovation by attracting highly skilled workers, private capital, and investments. As to the two innovation indicators we already reported, is interesting to notice the positive correlation between them, which is a first suggestion of the role of the public sector in the innovative process in the European continent (Figure 6).

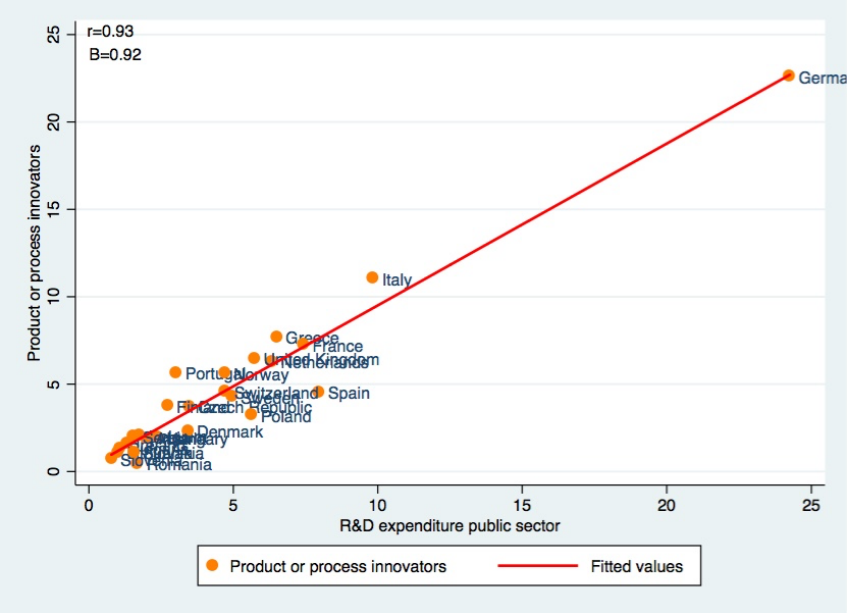

Figure 6. Relationship between R&D expenditure and product/process innovation in SME in 2019 - Source: Elaboration from Regional Innovation Scoreboards (2021)

Looking at the data from McKinsey (2019), we can explore the most dynamic sectors in terms of R&D investments (Figure 7). From these, the main findings are that R&D giants are concentrated in few sectors. Most of the European investments are in automotive. This posits a great difference between Europe and the US, where US-based tech companies invest more in R&D lead by the six largest companies – Amazon, Apple, Facebook, Google, Microsoft, and Netflix. Google has been the most active, spending $12.6 billion on acquiring more than 300 startups between 2013 and 2018 (McKinsey 2019).

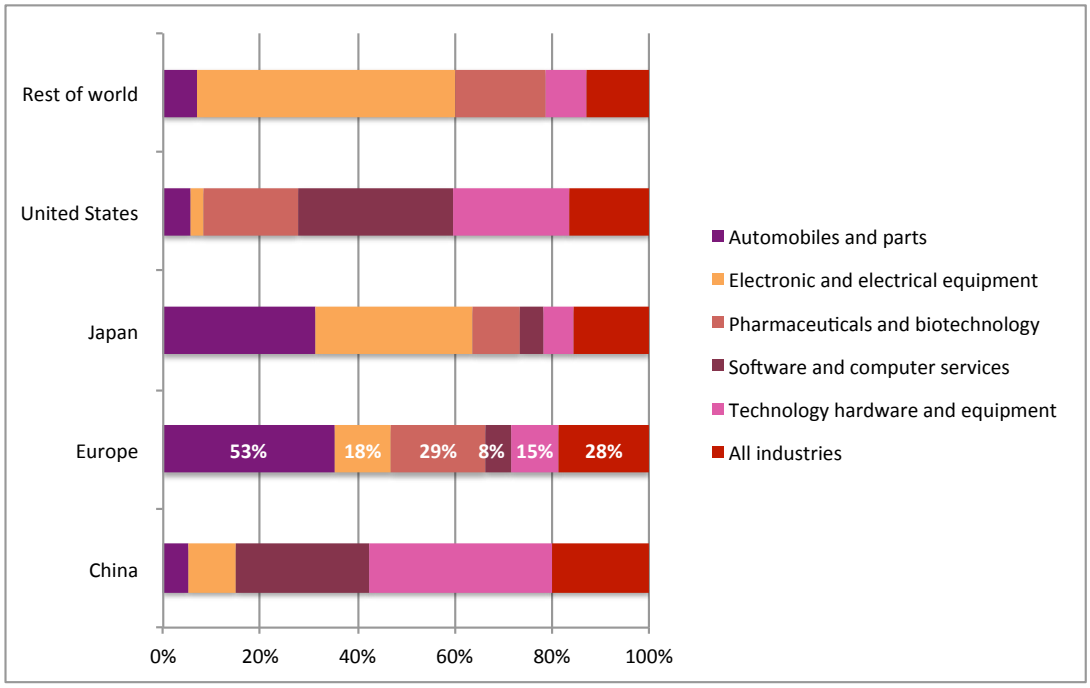

Figure 7. R&D expenditure from global top 250 R&D spenders in 2017–18 - Source: McKinsey (2019)

Summing up the evidence, the main highlights from our analysis are the following ones.

- The richer European countries lead innovation. Germany is absolutely the leader.
- Larger European cities play an important role in accommodating a higher percentage of products and processes, innovating SMEs, and impacting R&D public expenditure.
- There are evident sectorial differences between Europe and the rest of the world. Looking at the global top 250 R&D, we may conclude that investments in Europe are highly concentrated in the automotive sector.

2. Italy and Malta: a comparison of different indicators

To analyse the innovation level of Italy and Malta, we present some different indicators that could help the understanding of the strengths and weaknesses of the two countries.

One first useful indicator is the Global Innovation Index (GII, 2020). The GII ranks world economies according to their innovation capabilities. Consisting of roughly 80 indicators, the GII aims to capture the multi-dimensional facets of innovation.

Thanks to the modality of the GII analysis, namely the assignment of marks, it is possible to compare and contrast Italy and Malta without size constraints.

In 2020 Italy ranked 28th among the 131 economies featured in the GII, whereas Malta ranks 27th. Their ranking is very close; however, important differences emerge from a more in-depth analysis of the GII.

Consistently with the aim of the present work, namely the understanding of indicators that give insights on the state of innovation and particularly of Open Innovation, we analyzed specific pillars and sub-pillars of the GII.

More in detail, seven pillars compose the GII.

1. Institution – political, regulatory, and business environment.
2. Human Capital and Research – education, tertiary education, and Research and Development.
3. Infrastructure – Information and Communication Technologies, general infrastructure, and ecological sustainability.
4. Market Sophistication – credit, investment, trade, competition, and market scale.

5. Business Sophistication – knowledge workers, innovation linkages, and knowledge absorption.
6. Knowledge and Technology Outputs – knowledge creation, impact, and diffusion.
7. Creative Outputs – intangible assets, creative goods and services, and online creativity.

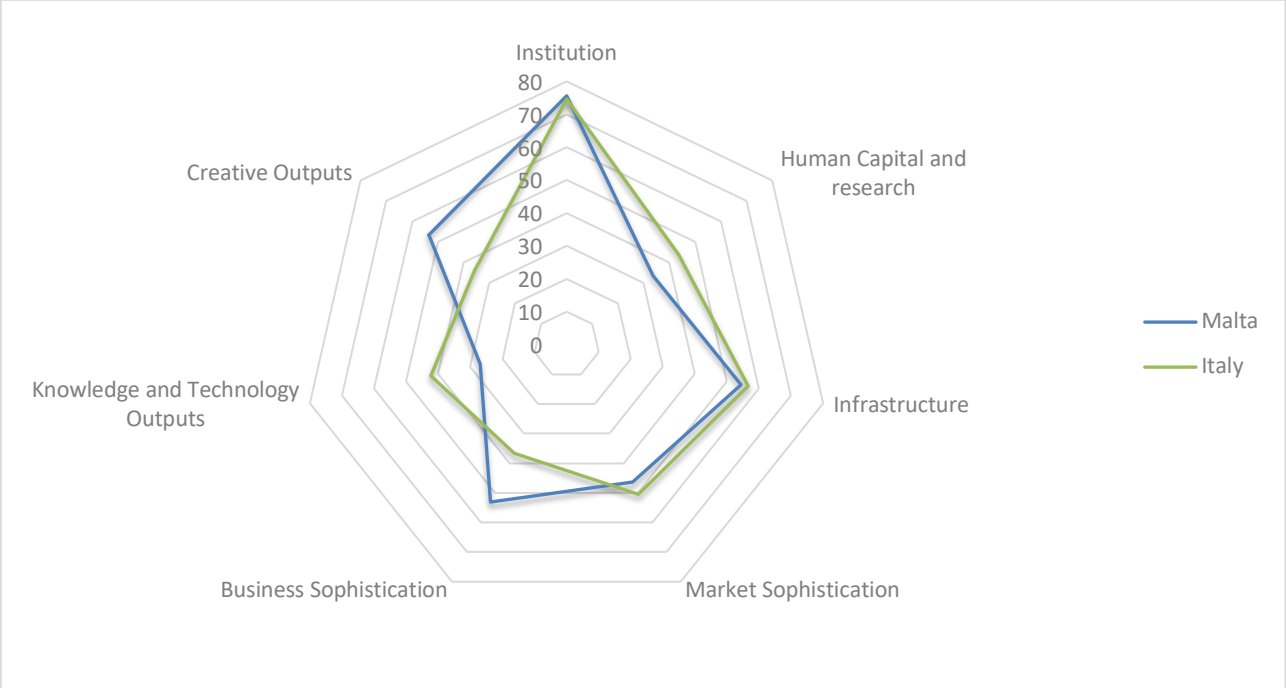

Figure 8 – Global Innovation Index Pillars: Comparing Italy and Malta - Source: Elaboration from GII (2020)

Figure 8 gives a first overview of the differences between Italy and Malta on the cited seven pillars. At a first glimpse, it is possible to understand that major differences concern Knowledge and Technology Outputs, where Italy performs

Partner
Università degli Studi di Enna "Kore"
Cittadella Universitaria - 94100 Enna (EN)

better than Malta, and Creative Outputs and Business Sophistication, where, on the contrary, Malta has better results.

Business Sophistication is the pillar that could give more insights about the state of innovation, and more specifically of the Open Innovation, as it tries to capture the level of innovative activities of firms. Within it, we identify three sub-pillars. The first sub-pillar, namely "Knowledge Workers", gives information about the degree of sophistication of human capital employed. "Innovation Linkages" is the second sub-pillar, and it registers public/private/academic partnerships essential to innovation. Finally, the third sub-pillar, i.e., "Knowledge Absorption", tries to capture how economies are good at absorbing, using, and exploiting the innovation that has been produced.

Figure 9 analyses the scores performed by Italy and Malta in a 0-100 range. It is possible to see that Malta has better results than Italy in all the sub-pillars of Business Sophistication. In other words, Maltese firms succeeded better in organizing partnerships with private and public sectors, performed better in absorbing knowledge workers in the job market, and absorbed produced innovation better than Italy.

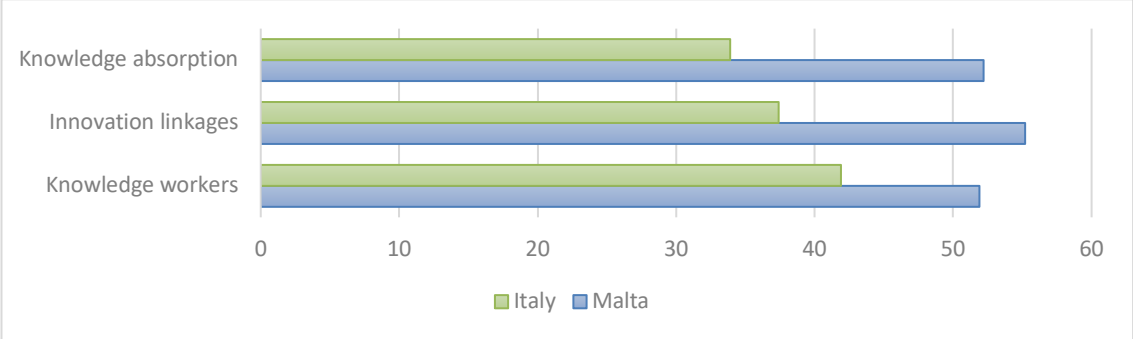

Figure 9. Global Innovation Index – Business sophistication sub-pillars: Italy-Malta comparison - Source: Elaboration from GII (2020)

To better analyse what these sub-pillars mean, it is important to view their single indicators. Knowledge Workers includes employment in knowledge-intensive services, the availability of formal training, the level of R&D performed by business enterprises (GERD) as a percentage of GDP, and the percentage of total gross expenditure of R&D that business enterprises finance. This sub-pillar also gives information about gender labour distribution. In other words, this sub-pillar gives information about the degree of sophistication of the local human capital employed. Figure 10 gives an overview of the comparison between Italy and Malta for each of the indicators.

It is possible to see that Malta and Italy have similar characteristics in the share of women employed in advanced degrees, GERD financed by business, and knowledge-intensive employment. On the contrary, there are substantial differences in the percentage of GERD performed by businesses on GDP and the number of firms that give formal training. Specifically, while Italy performs better in the first one, Malta has a greater percentage of firms offering formal training.

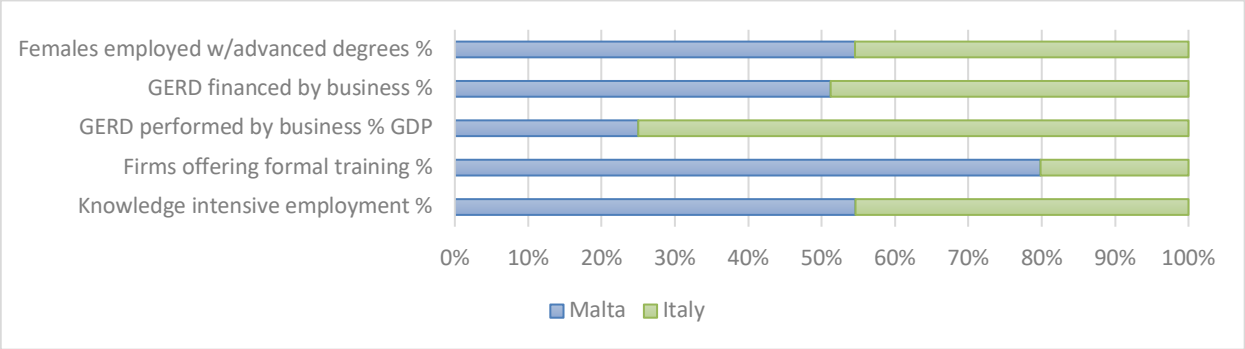

Figure 10. Global Innovation Index – Business sophistication sub-pillars, Knowledge workers indicators: Italy-Malta comparison - Source: Elaboration from GII (2020)

The second sub-pillar is particularly useful to understand the progress of the countries in Open Innovation. Innovation Linkages gives insights into the public/private/academic partnerships. The sub-pillar draws on qualitative and quantitative data regarding business/university collaboration on R&D, the prevalence of well-developed and deep clusters, the gross R&D expenditure financed abroad as a percentage of GDP, and the number of deals on joint ventures and strategic alliances. In addition, it considers the total number of Patent Cooperation Treaty (PCT) and national office published patent family applications filed by residents in at least two office proxies for international linkages. Figure 11 compares the indicators for Malta and Italy. As it is possible to see, the only indicator where the two countries have similar performance is the university/industry collaborations. Patent families and joint venture strategic alliances registered better performance in Malta, while the prevalence of well-

developed and deep clusters and the GERD financed abroad register better marks in Italy.

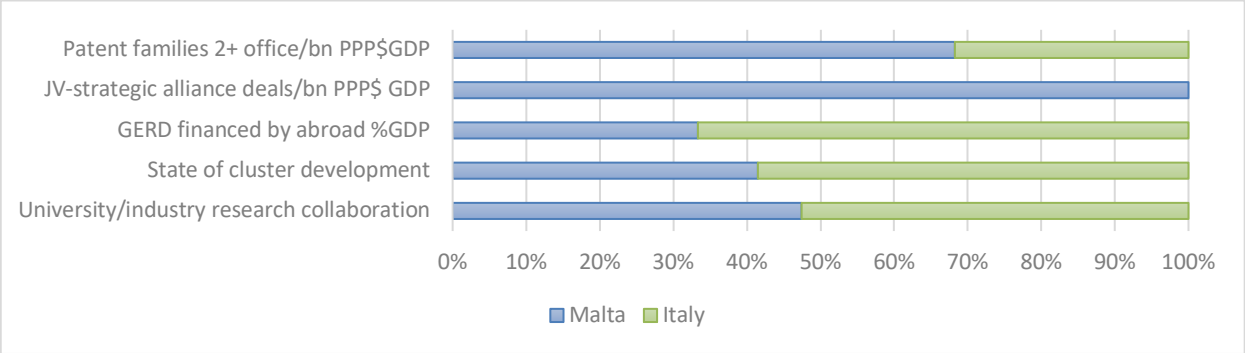

Figure 11. Global Innovation Index – Business sophistication sub-pillars, Innovation linkages indicators: Italy-Malta comparison - Source: Elaboration from GII (2020)

Finally, the sub-pillar Knowledge Absorption includes five key measures of innovation, namely: (i) intellectual property payments as a percentage of total trade (three-year average), (ii) high-tech imports as a percentage of total imports, (iii) computer and information services as a percentage of total trade, (iv) net inflows of foreign direct investment (FDI) as a percentage of GDP (three-year average), and (v) the percentage of research talent employed in business enterprises which provide a measurement of professionals engaged to the creation of new knowledge.

Figure 12 summarizes differences between Malta and Italy's indicators.

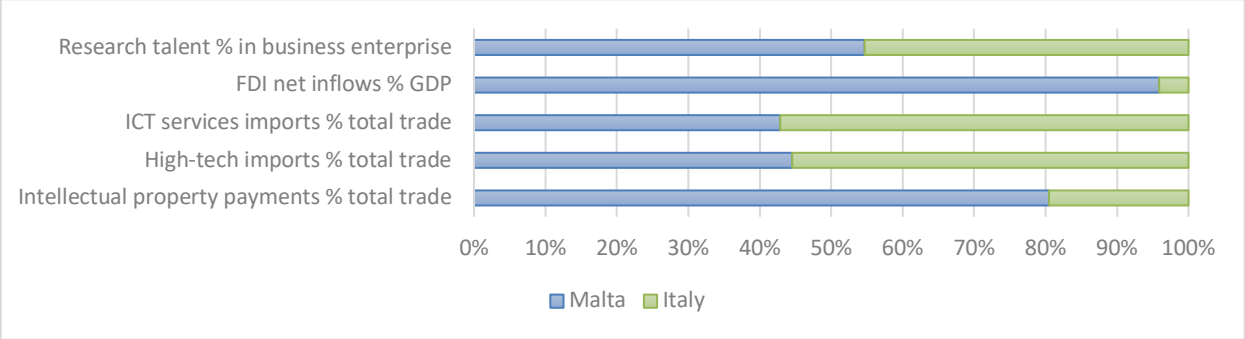

Figure 12. Global Innovation Index – Business sophistication sub-pillars, Knowledge absorption indicators: Italy-Malta comparison - Source Elaboration from GII (2020)

The only indicator where the two countries have similar performance is the percentage of research talent employed. Malta has better performance in FDI net inflows on GDP and intellectual property payments on total trade. On the contrary, Italy registers higher marks in ICT services and high-tech imports on total trade.

3. Innovation in Malta: an overview

A recent research conducted by the National Statistics Office of Malta (NSO)[1] on a sample of 865 firms showed that 37.6% of the surveyed enterprise undertook innovation activities.

1 In this Section we widely refer to the NSO news release available at https://nso.gov.mt/en/News_Releases/View_by_Unit/Unit_B4/Business_Registers/Pages/Business-Innovation.aspx

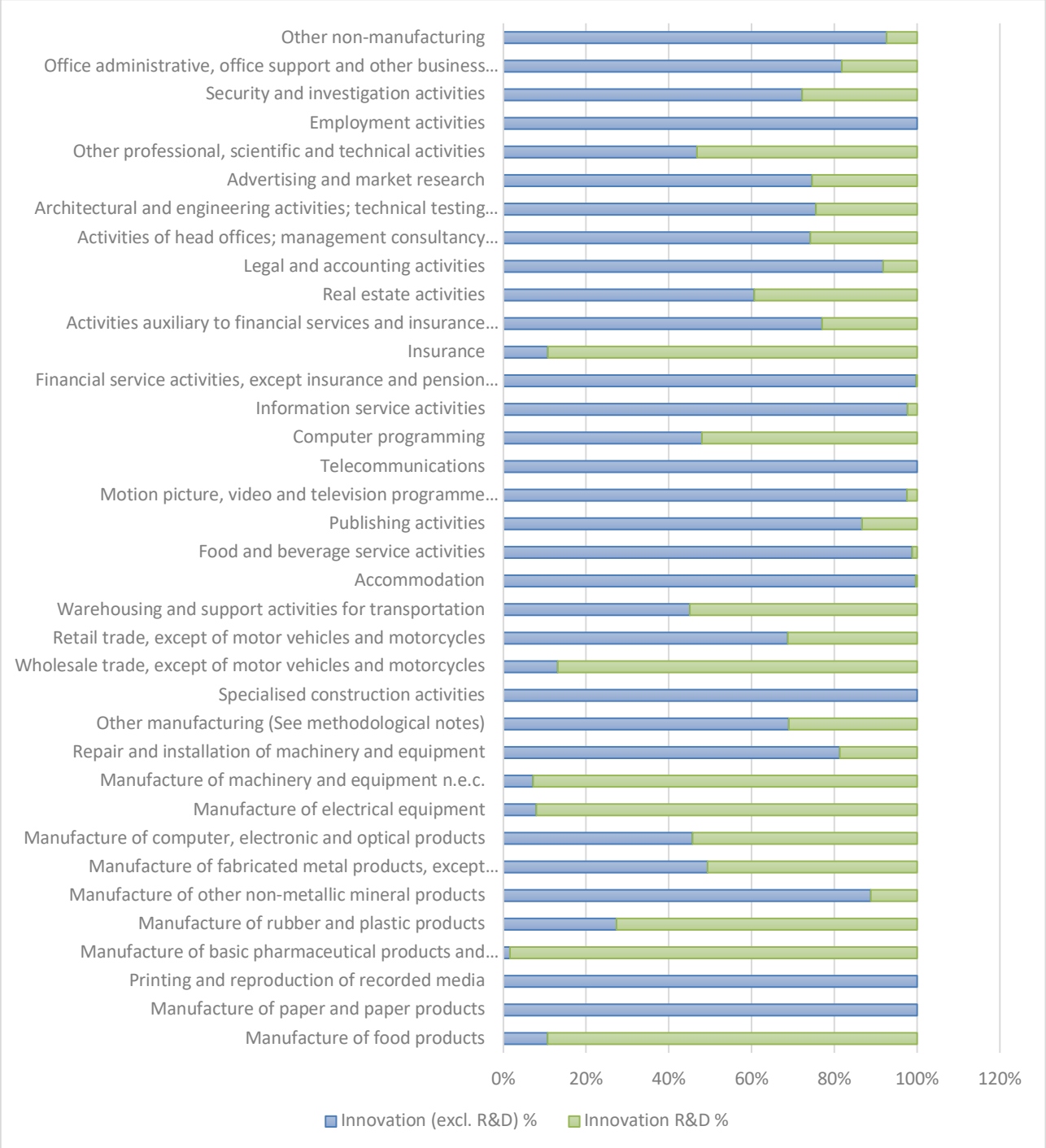

Figure 13. Innovation excluding R&D and R&D comparison - Source: Elaboration from NSO (2018)

Estimated innovation expenditure in 2018 was worth €175 million, 25.4% of which derives from intramural R&D. However, this data is sensibly variable depending on the industry. Figure 13 shows the composition of innovation expenditure, distinguishing between innovation excluding R&D and Innovation from R&D. As it is possible to see, sectors like office administrative and information activities have a predominance of innovation that does not come from R&D; on the contrary, industries like manufacturers of food or pharmaceutical products base innovation on R&D. All in all, many non-manufacturing industries base their innovation with activities not related on R&D, whereas in manufacturing industries R&D prevails.

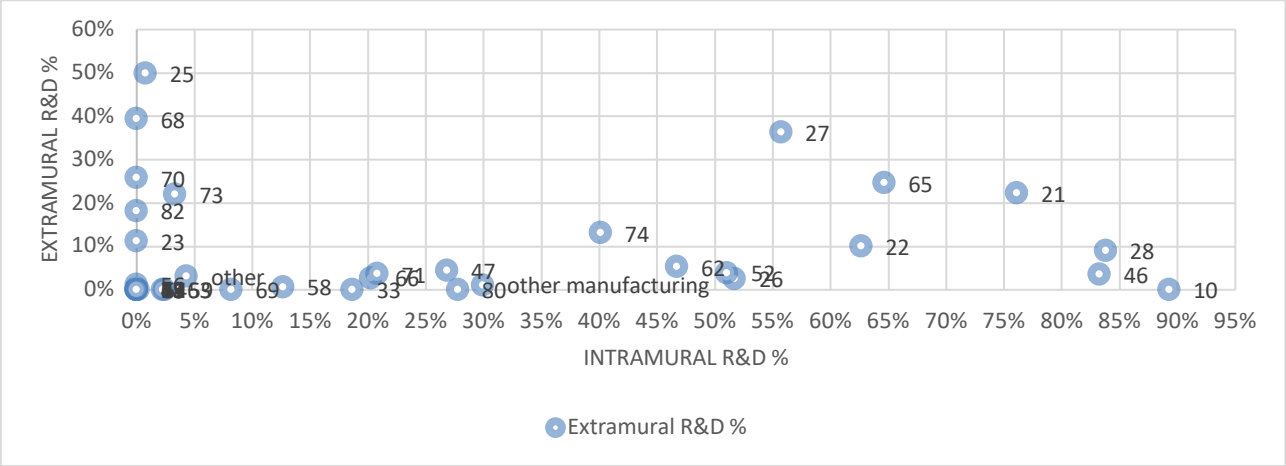

Figure 14. Intramural/Extramural R&D comparison (see Appendix for details on codes) - Source: Elaboration from NSO (2018)

It is also important to analyze the composition of R&D activities distinguishing between intramural and extramural R&D; indeed, the second one is related to the improvement of Open Innovation practices.

The bubble chart of Figure 14 shows the composition of R&D activities for industries (for the complete correspondence between numbers and industries, see Appendix). The majority of non-manufacturing industries resort to extramural R&D, e.g., head office activities (70), advertising and market research (73), real estate activities (68). On the contrary, many manufacturing industries still recur to intramural R&D, e.g., manufacture of machinery and equipment (28), manufacture of food products (10), repair and installation of machinery (33).

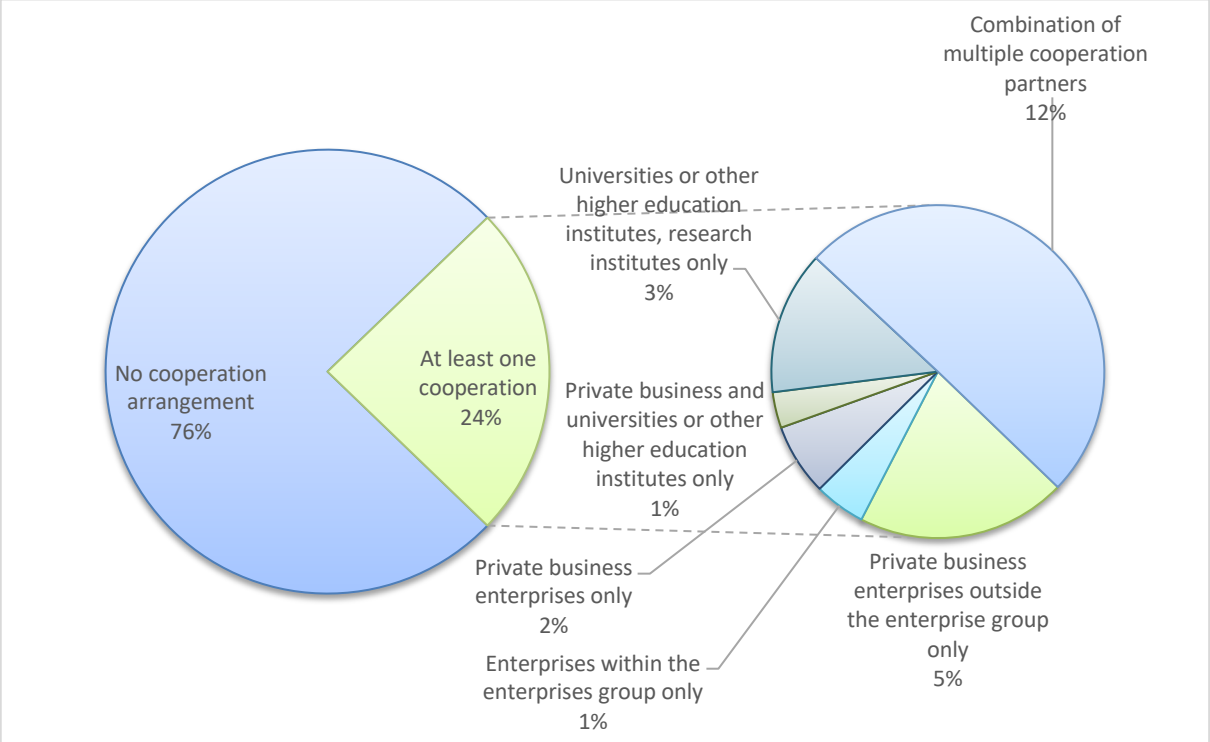

Figure 15. Cooperation arrangements typology in Malta - Source: Elaboration from NSO (2018)

Cooperation arrangements are not well diffused in Malta. Only 24% of the sample arranged at least one cooperation action. Combination of multiple cooperation partners is the most utilized modality (12%), followed by cooperation with private business (5%). Only 3% of the sample recurs to either universities or other higher education institutions (Fig. 15).

The number of enterprises applying for intellectual property is another important indicator to analyze the state of innovation. From Figure 16, it is possible to see that only 10% of the sample applied for at least one, of which the majority registered only one trademark (5%).

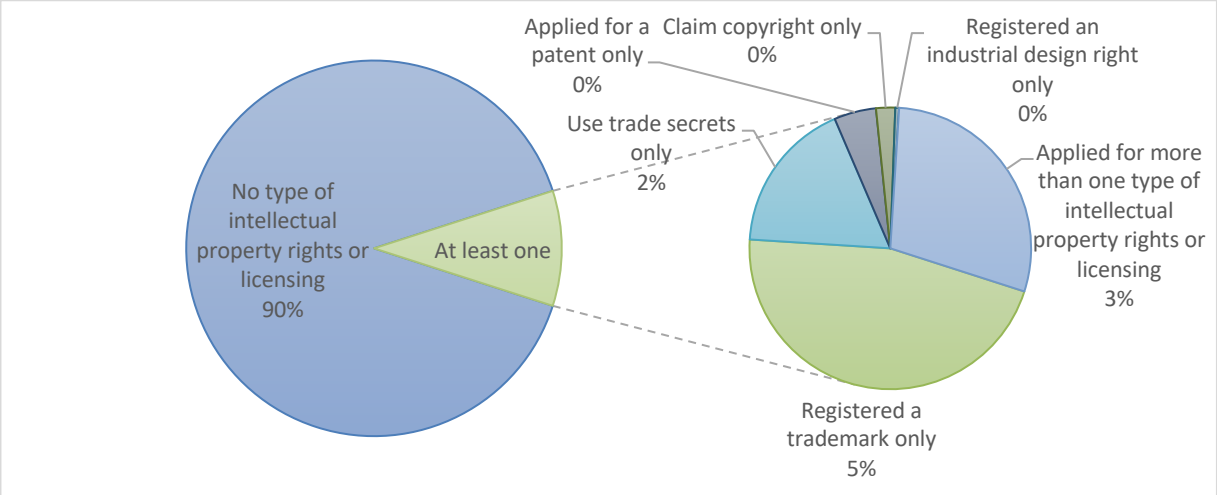

Figure 16. Enterprises applying for intellectual property rights or licensing - Source: Elaboration from NSO (2018)

As innovation in Malta presents large margins for improvement, it could be useful to detect the main obstacles of enterprises. Figure 17 shows the types of obstacles that non-innovative enterprises face to innovate. Lack of skilled employees within

the enterprise seems the principal reason. Cost is another element that hinders innovation, as well as the competition in the market. Open innovation practices can be a solution in order reduce the pressure on both these two aspects.

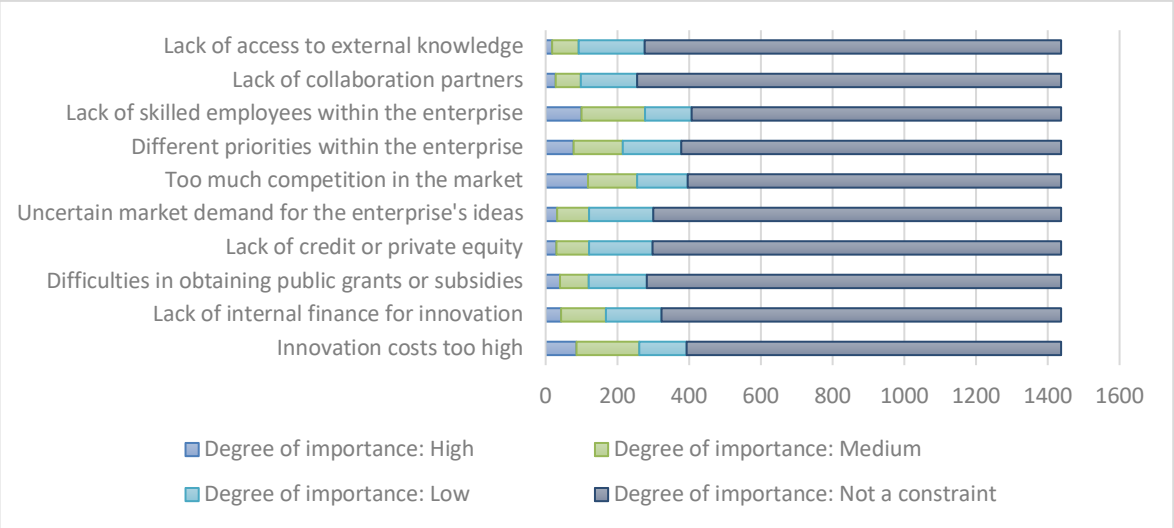

Figure 17. Non-innovative enterprises by type of obstacle to innovate - Source: Elaboration from NSO (2018)

Since cost is one of the major obstacles to business innovation, it could be interesting to understand where Maltese firms buy technical services. Figure 18 reveals that most of the firms acquires them only from other private business. Other types of partners, like those related to the public sectors, and among them research institute, can indeed implement the variety of actors.

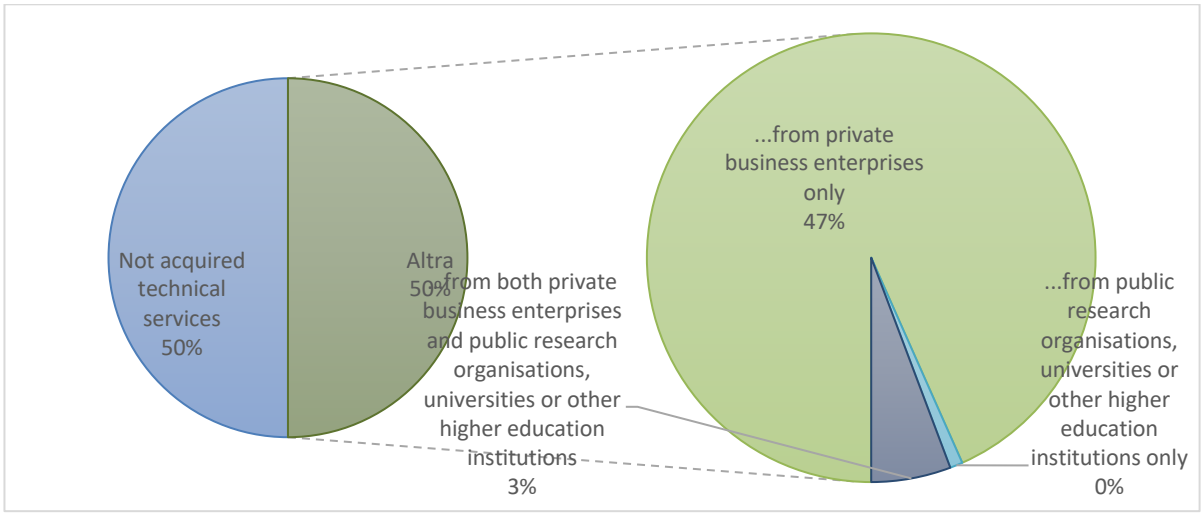

Figure 18. Innovative enterprises purchasing technical services - Source: Elaboration from NSO (2018)

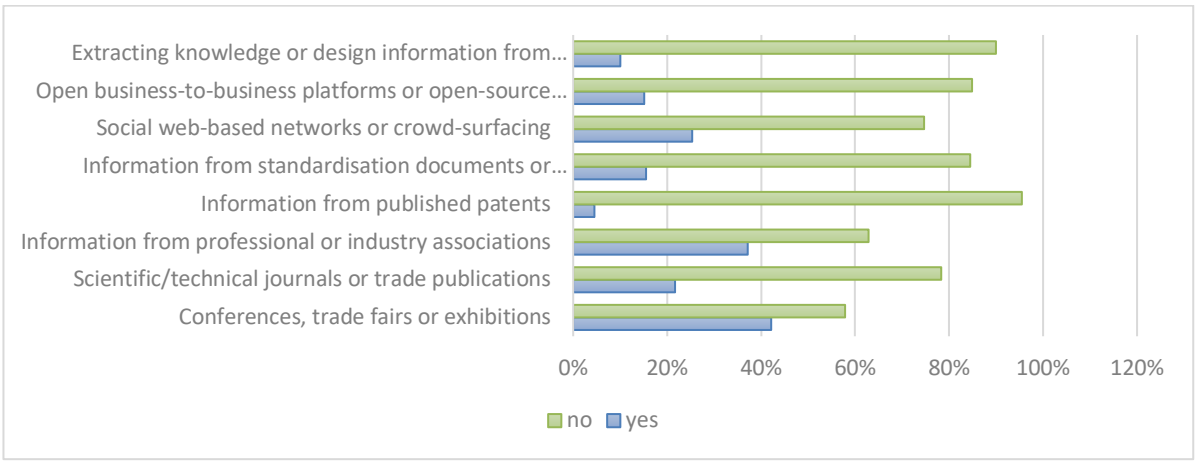

Figure 19. Enterprises acquiring knowledge through different channels - Source: Elaboration from NSO (2018)

Finally, Figure 19 shows the different channels from which enterprises acquire knowledge. From the sample analyzed by the NSO, it is possible to see that the favorite ones are conferences (42%) and industry associations (37%). Other channels that are more in line with Open Innovation practices, like open business-

to-business platforms (15%) or social web-based networks (25%), are less adopted. This is in line with the obstacle related to high innovation costs. Maltese firms need to be conducted to new strategies and practices related to the Open Innovation paradigm.

3. Italy and Sicily: evidence from a lagging region

Over the years, literature explored innovation from a geographical perspective, giving evidence on how the proximity to the industrial hub and economic centres located in specific European regions may increase the performance (Balland et al., 2014). Location and market weaknesses in human and physical capital are the most relevant constraints for regions (Boschma, 2005). As lagging region, Sicily is an interesting case study with this regard. Overall, the island shows governance and market weaknesses as the main barriers to strengthening a competitive innovation ecosystem.

The Italian national authority (ISTAT) statistics reveal that the situation appears fragmented if we observe the difference between North and South using six indicators from Regional Innovation Scoreboards[2] in 2019 as recommended in the literature (Antonioli et al., 2013). Namely, these are (1) patent applications; (2) SME innovating in-house; (3) product or process innovators; (4) R&D expenditure public sector; (5) scientific publications; (6) population with tertiary education.

[2] Detailed information can be found at https://ec.europa.eu/docsroom/documents/37783

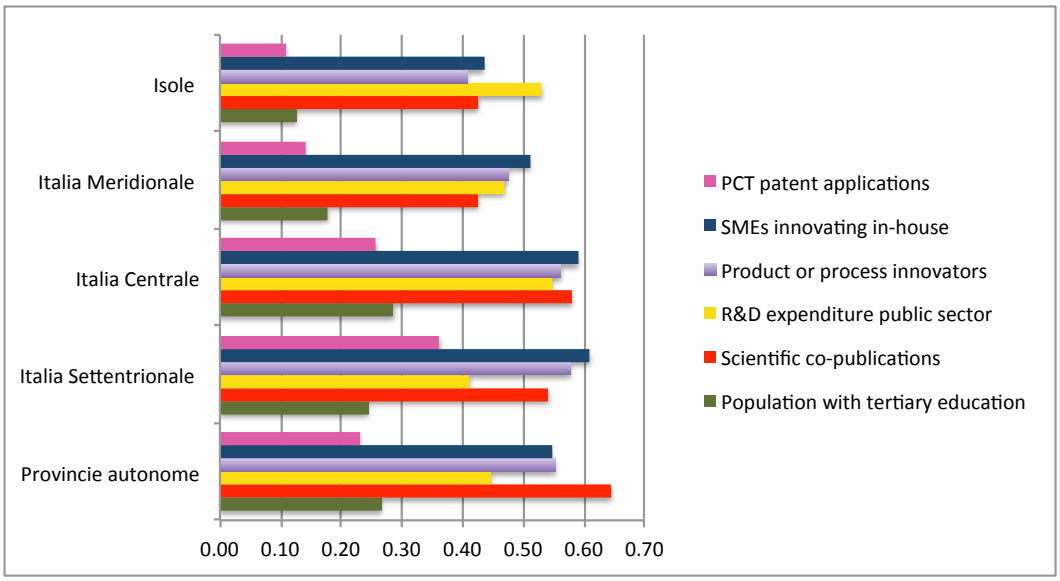

Figure 20. Italian Innovation performances (share) in 2019 - Source: Elaboration from Regional Innovation Scoreboards (2021)

Overall, the findings reported in Figure 20 show what follows.

- Northern regions (Italia Settentrionale) show the well-known leading position within the industrial patterns of the Country, especially in terms of patent application, in-house innovation of SMEs, product or process innovation, with autonomous provinces of Bolzano and Trento (Province Autonome) leading in scientific co-publications. Interestingly, the indicator for the R&D expenditure of the public sector is lower than other parts of Italy.
- Regions from central Italy (Italia Centrale) report the highest share of R&D expenditure of the public sector and population with tertiary education.
- Sicily and Sardinia (Isole) have similar performance as the rest of the South of Italy (Italia Meridionale) in ranking low in all indicators, except for R&D

expenditure of the public sector where these areas follow the regions in the Centre of Italy.

- The gap between North Italy (Italia Settentrionale) and lagging regions (Isole) can be due to the higher number of industries located in the North and the migration phenomenon of young talents moving from the South to North to find a job.

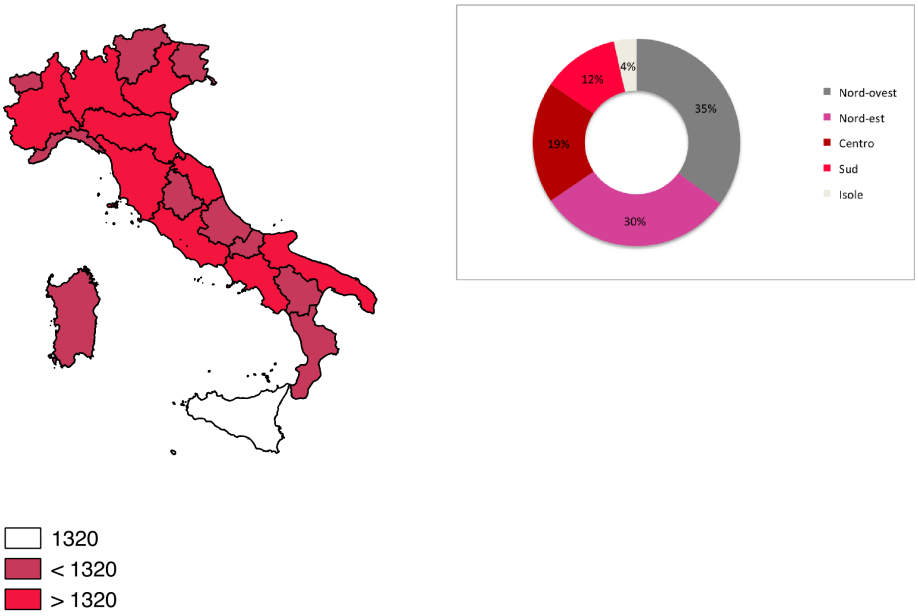

Figure 21. Number of enterprises that introduced product innovation in 2019 - Source: Elaboration from Istat (2021)

Another key point is related to the specific characteristics of the enterprises. From official statistics, we can observe that 1,320 enterprises introduced product innovation in Sicily. Conversely, the number of activities is 2,447 if we consider the

process innovation. Using these two benchmarks, we can compare Sicily and the rest of the country in the innovation field as shown in the following maps (Figure2 21 and 22).

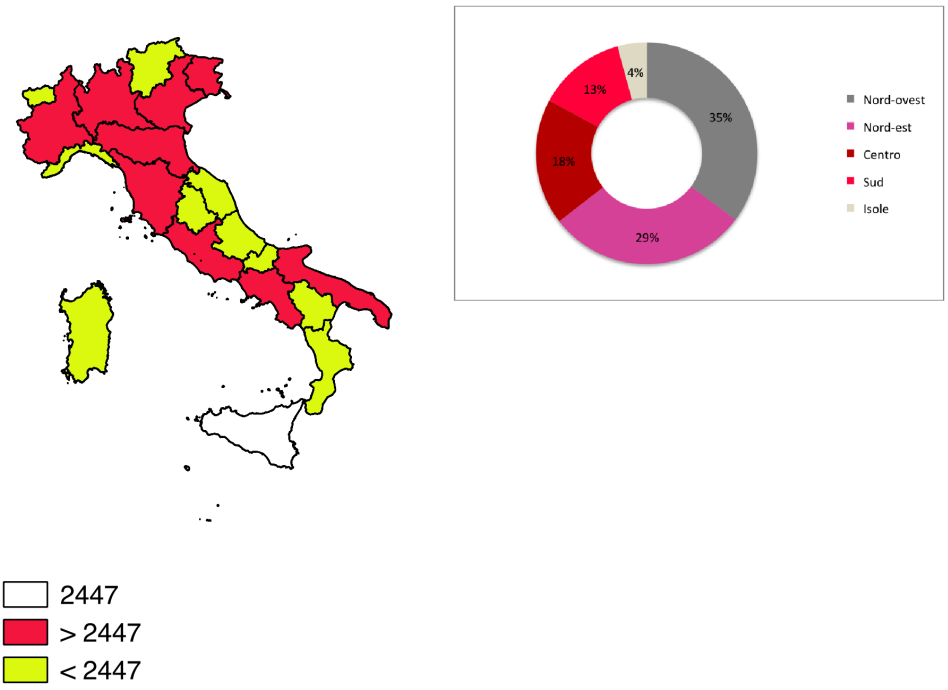

Figure 22. Number of enterprises that introduced process innovation in 2019 - Source: Elaboration from Istat (2021)

In absolute terms, Sicily performs better than some regions (e.g., Trentino-Alto Adige and Liguria) located close to leading areas like Lombardia and Piemonte. In parallel, the Sicilian region shows a higher number of enterprises introduced innovation process than Region located close to powerful Region like Lazio (e.g.,

Abbruzzo). In parallel, the number is higher than other Southern regions (e.g., Calabria and Sardinia).

Table 2. Innovation expenditure, GDP, and their ratio, across Italian regions in 2019 - Source: Elaboration from Istat and Eurostat (2021)

Region	GDP (million euro)	Region	Innovation expenditure (million euro)	Region	Innovation expenditure - GDP ratio
LOM	398779	LOM	11319,683	LIG	0,061
LAZ	200840	LAZ	7307,464	LAZ	0,036
VEN	164860	EMR	5676,836	EMR	0,035
EMR	163751	VEN	4931,708	PIE	0,032
PIE	137782	PIE	4365,761	VEN	0,030
TOS	118727	LIG	3022,312	PAB	0,029
CAM	109631	TOS	2069,283	LOM	0,028
SIC	89365	CAM	1312,236	FVG	0,025
PUG	77475	FVG	962,816	UMB	0,018
LIG	49741	PAB	731,412	TOS	0,017
MAR	42392	MAR	692,138	PAT	0,017
FVG	38772	SIC	682,982	MAR	0,016
SAR	35256	PUG	662,895	ABR	0,012
CAL	33619	UMB	429,155	CAM	0,012
ABR	33131	ABR	406,321	MOL	0,009
PAB	25516	PAT	362,471	PUG	0,009
UMB	23267	SAR	279,112	SAR	0,008
PAT	20967	CAL	114,996	SIC	0,008
BAS	13090	BAS	83,907	VAO	0,007
MOL	6490	MOL	61,109	BAS	0,006
VAO	4868	VAO	35,701	CAL	0,003

Legenda: ABR (Abruzzo), BAS (Basilicata), CAL (Calabria), CAM (Campania), EMR (Emilia-Romagna), FVG (Friuli-Venezia Giulia), LAZ (Lazio), LIG (Liguria), LOM (Lombardia), MAR (Marche), MOL (Molise), PAB (Provincia Autonoma di Bolzano), PAT (Provincia Autonoma di Trento), PIE (Piemonte), PUG (Puglia), SAR (Sardegna), SIC (Sicilia), TOS (Toscana), UMB (Umbria), VAO (Valle d'Aosta), VEN (Veneto)

If we look at the details of some innovation detail Despite these findings, the innovation field in Italy still appears fragmented, and Sicily shown fragilities together with other regions (Table 2).

- Lombardia, Lazio, and Emilia Romagna spend more on innovation than others.
- In terms of Innovation expenditure / GDP ratio, Liguria, Lazio, Emilia Romagna, and Piemonte are the regions in the first positions of the ranking.
- Sicily ranks 8th in terms of GDP. Despite this, the expenditure for innovation put the region as 12th in the ranking, and in terms of expenditure/GDP ratio the region is one of the last four.

Additional regional data from ISTAT can help to understand the cooperative behaviour of enterprises in terms of industrial relations. Figure 23 reports the number of cooperation agreements among the enterprises to develop innovation. Taking Sicily as benchmark we find similar patterns as those found in the previous Figures. This may suggest the fact that the dynamics of cooperation occurs despite being located in fragile settings (Tödtling et al., 2011).

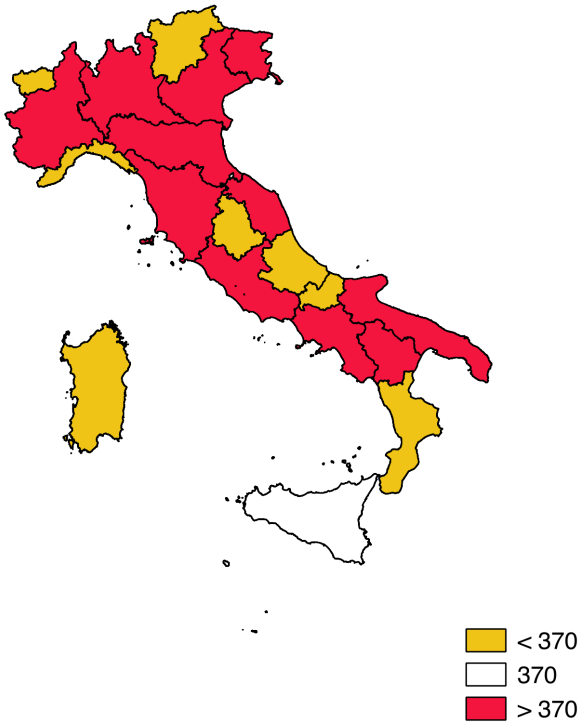

Figure 23. Number of cooperation agreements for innovation in 2019 Source: Elaboration from Istat (2021)

In synthesis, the evidence points out that:

- Innovation patterns confirm the well-known gap between North and South Italy. The geography of innovation in Italy is boosted by sp,e Northern regions, which are leaders in innovative enterprises, patent applications, and human capital.
- Sicily shows relatively better statistics than other regions as to the number of enterprises that introduced product and process innovation, showing higher innovative behaviour than those (e.g., Liguria and Trentino) located

near the main industrial hubs of Italy. Although absolute numbers are influenced by the size of the region, this can be an encouraging evidence.

- Public expenditure to support innovation is relatively higher especially in those areas where innovation statistics of enterprises have lower performance. This recalls the importance of the public sector to reduce market failure, providing public goods, incentives, and financial support. This dependence on the public hand is lesser evident in the regions led by more dynamic ecosystems, like Lombardia.
- Sicily is not in a favourable position to compete with the most advanced regions. Despite this, encouraging patterns come from the development of cooperation agreements between firms.

All these statistics stress the urgency to fill the gap between North and South Italy. Economic and industrial policy should have a key role in improving the conditions of the lagging areas. There is a strong relationship between industrial development and innovation. The highest innovation gap is recorded in the regions where the industrial sector is less dynamic and developed. It is of primary importance to rethink the industrial relations climate, improving the capacity of dialogue among management, experts, and policymakers, as stressed in Antonioli et al. (201)

Moreover, public finance can have a primary role, and should have the same importance as governance in filling the territorial gap. Improving governance is a priority to create favourable conditions to make Southern regions more dynamic and resilient through innovation.

4. Policy implications and conclusions

The present work aimed to comment selected indicators about the status of innovation in Europe with a focus on Italy, Malta, and Sicily. In particular, we focused on those data that could help to understand the development of Open Innovation practices. We can summarize the main messages that emerged from our analysis in the followed points.

- The heterogeneity across Europe is evident. Urbanization in countries is correlated with more frequent processes of innovation.
- The comparison between Italy and Malta reveals a similar situation between. Indicators related to Open Innovation practices reveal large margins of improvement for both countries.
- Malta has shown low performance in indicators related to the Open Innovation practices. Maltese firms have significant differences in the innovation level depending on the industry: the manufacturing firms have lower innovation levels than the non-manufacturing ones. Firms register the high costs of innovations as the main obstacle to innovation, and it appears they need to improve Open Innovation practices.
- Italy shows persisting gaps between the regions. Lagging areas like Sicily have lower performance in innovation indicators. As to Sicily, there are some positive signals that need more in-depth investigation with appropriate microdata, though innovation expenditure per unit of GDP is one of the lowest in Italy. Southern regions and Islands have more support from the public sector than other regions for what concerns R&D.

Partner
Università degli Studi di Enna "Kore"
Cittadella Universitaria - 94100 Enna (EN)
www.i-knowproject.eu

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Appendix

Table A 1. Economic Industries codes – Source: NSO (2018)

CODE	ECONOMIC INDUSTRY
10	Manufacture of food products
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
33	Repair and installation of machinery and equipment
OTHER MANUFACTURING.	Other manufacturing
43	Specialised construction activities
46	Wholesale trade, except of motor vehicles and motorcycles
47	Retail trade, except of motor vehicles and motorcycles
52	Warehousing and support activities for transportation
55	Accommodation
56	Food and beverage service activities
58	Publishing activities
59	Motion picture, video and television programme production, sound recording
61	Telecommunications
62	Computer programming
63	Information service activities
64	Financial service activities, except insurance and pension funding
65	Insurance
66	Activities auxiliary to financial services and insurance activities
68	Real estate activities
69	Legal and accounting activities
70	Activities of head offices; management consultancy activities
71	Architectural and engineering activities; technical testing and analysis
73	Advertising and market research
74	Other professional, scientific and technical activities

78	Employment activities
80	Security and investigation activities
82	Office administrative, office support and other business support activities
OTHER	Other non-manufacturing