



Analysis of National Initiatives for Digitising Industry.

Portugal: Portugal Indústria 4.0



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Disclaimer: The views expressed in this document are those expressed by the experts conducting the analysis of the National Initiatives on digitising industry and do not necessarily represent the view of the European Commission and the National Initiative on the subject.

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Executive Summary

Fiche of Portugal

1. Introduction

1.1. Overall economic situation of the country

Portugal economic landscape. Portugal with a Gross Domestic Product (GDP) of \$1.232.088 M is the 16th European economy and the 51st worldwide with the US leading the ranking. In terms of Industrial Aggregated Value, the ranking of Portuguese economy is very similar but in this case China leads the overall ranking closely followed by US.

Industry ecosystem structure. According to the "Country Report Portugal 2017" the Portuguese economy has continued to recover for the fourth consecutive year. However, it remains vulnerable to shocks. Growth in domestic demand is still fueled by strong private consumption. The conditions for investment remain challenging and continue to drag on growth. However, investment is expected to recover in the medium-term with the support from EU funds. This will help rebalance the economy by increasing the share of the tradable sectors.

Portugal's economic recovery continues, supported by a rebound in net exports but held back by weak investment. Annual real GDP growth accelerated significantly to 1.6 % in the third quarter of 2016. This was due to a strong resurgence in exports of goods and services, which outweighed imports and increased the external contribution to economic growth to 0.7 percentage points.

The Portuguese industry accounts for about one fourth of the country's gross domestic product (GDP) and jobs.

1.2. Overall strategy / situation concerning the digitization of manufacturing / production

Context. The national initiative Portugal i4.0 presented in January 2017, is part of the National Strategy for the Digitalization of the Economy. The overall objective of the National Strategy for the Digitization of the Economy includes an initial set of measures of valorisation, promotion and investment in the digitization of the Portuguese economy. The Ministry of the Economy, intending to generate the conditions for the development of the national industry and services in the new paradigm of Digital Economy, decided to launch an initiative to identify the needs of the Portuguese industrial fabric in the scope of its digital transformation and guide measures (public and private) of awareness, adoption and massification of new technologies in the business models of Portuguese companies.

According to the European Commission's Digital Economy & Society Index 2017, Portugal stands above the EU average at the level of digital competitiveness. The Portuguese score has grown at a faster pace than the US average in recent years, currently occupying 16th place. According to this study, Portugal should focus on improving the digital skills of the population (half of the population does not have basic digital skills and 28% have never used the internet). Measures to be developed

under the Industry 4.0 initiative should be in line with these conclusions, with the preponderance of measures at the human resources level.

Another study, from UBS, indicates Portugal above average and as the 23rd most prepared economy to adopt Industry 4.0 from a set of 45 countries analyzed, with emphasis on its infrastructures, general skills and capacity for innovation. These ratings refer to a reasonable degree of preparation that contrasts with current competitiveness. According to Deloitte's 2016 Manufacturing Global Competitiveness Index, the Portuguese industry is only 35th out of 40 economies analyzed. That is, Portugal will not yet be capitalizing on this industrial revolution. As an example, Portugal has only about one third of robots per 10,000 employees compared to Spain. This data needs to be considered taking into account the industrial specialization of these countries. In Portugal, the so-called traditional sectors (e.g., textiles and footwear) are of great importance in the economy, and these are sectors where great penetration of robotics is unlikely and undesirable (because several manual operations are necessary for the production of luxury products). In general, we can conclude that Portugal has a better degree of preparation than current competitiveness, revealing that the 4th Industrial Revolution is a clear opportunity to blur the typical barriers to the country's competitiveness, such as the lack of internal market scale and the peripheral location

Timing. The i4.0 strategy was built using a bottom-up strategy, listening through interviews, workshops and auditions, 88 companies – coming from 4 fields of business relevant to the Portuguese economy for their number and importance and their level of preparation for the technological adoption – as well as 25 other entities – of various kinds such as academic institutions', institutes or associations – from April to June 2016, who proposed a set of measures to accelerate the adoption of industry 4.0 by national companies. This set of measures was then validated by a Strategic Committee, made up of several multinationals with i4.0 experience in their countries of origin, as well as other national entities and companies. This iterative process of sounding and validation resulted in the Industry 4.0 Program consisting of 64 public and private initiative measures, many of which are already being implemented. The i4.0 Program was presented in January 2017. Therefore, since April 2016 the Portuguese Government sustained a dialogue between businesses, officials, associations, science and policy and allowed all economic operators to have a uniform understanding of the potential of the industry 4.0 as well as to set the measures needed to accelerate the adoption of industry 4.0 by national companies.. As a result, and in order to create conditions for the development of industry in the digital age, the Portuguese Ministry of Economy decided to launch a national Portugal i4.0" Programme in January 2017, dealing with the National Strategy for the Digitization of the Portuguese Economy, which is composed by 64 initial measures (public and private) identified from April 2016 at the bottom-up strategic dialogue.

Goals. The national initiative has the following core goals:

1. Accelerate Industry 4.0 concepts and technology adoption by Portuguese businesses
 - Provide the business community with knowledge and information
 - Promote a set of tools for business transformation
 - Empower and readjust the national workforce
2. Promote Portuguese companies as international Industry 4.0 players
 - Capitalize the scientific and technological ecosystem

- Create a favourable context for the development of i4.0 startups
- Promote national technological solutions abroad
- 3. Make Portugal an attractive location to invest in Industry 4.0
 - Communicate the country as a HUB of experiences and know-how sharing in order to attract resources
 - Create favorable conditions (legal and fiscal) for investment related to i4.0

The Strategy for Industry 4.0 is a set of 64 public and private initiative measures that are expected to impact more than 50,000 companies operating in Portugal and, at an early stage, will enable the retraining and training of more than 20,000 workers in digital skills.

Strategic Lines. This initiative was setup to be developed “bottom up”, focusing on specific sectors. For the first time, multinational companies such as Altice-PT, Bosch, Deloitte, Google, Huawei, Microsoft, Siemens or Volkswagen have joined the Government to outline a national strategy for the industry. These companies were part of the **Strategic Committee of the Industry 4.0 initiative**, together with the National Innovation Agency, Compete, CIP, COTEC, GS1, IAPMEI, IPQ and Turismo de Portugal, in a total of more than 25 entities. After the launch of the Portugal i4.0 Program another Strategic Committee was established, namely this one: <https://www.industria4-0.cotec.pt/en/industry-4-0-program/strategic-committee/>

The consultation and cooperation process in the field of industry 4.0, identifying key challenges and potential policy and digital enablers led to the definition of **64 measures for the national strategy organised in 6 strategic vectors**:

1. **Human capital qualification (22 measures).** The main aim is to adapt the formative contents of the national education system to new technologies and promote retraining and training of professionals.
2. **Technological cooperation ecosystems (24 measures).** To promote cooperation for the development and subsequent implementation of innovative solutions and technologies in the framework of the 4th industrial revolution.
3. **Startupi4.0 (4 measures).** Recognize the role of startups in technological innovation and develop a set of measures aimed at Industry 4.0 in line with the National Strategy for Entrepreneurship of Startup Portugal.
4. **Financing and investment incentive (4 measures).** Develop a set of financing mechanisms for projects with Industry scope 4.0 in order to accelerate investments and encourage the adoption by the Portuguese business community.
5. **Internationalization (7 measures).** Promote Portuguese technology for the foreign market, thus encouraging the internationalization of companies and attracting investment in the country.
6. **Standards and Regulation (3 measures).** Ensure legal adaptation and technical standardization in the face of the challenges of the new industrial revolution, creating an environment conducive to technological development and investment.



The setting of the Portugal i4.0 Program prioritized the listening/auscultation/sounding of **4 fields of business** relevant to the Portuguese economy for their number and importance and their level of preparation for the technological adoption, namely:

- Fashion& Retail
- Automotive
- Tourism
- Agri-food

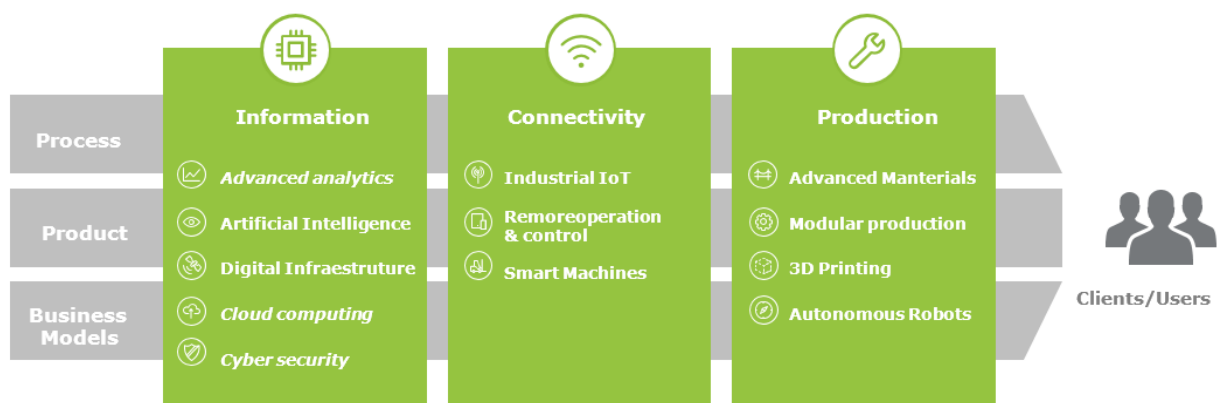
The result of “Portugal i4.0) derives from the cooperation of more than 100 entities and companies (in fact were 88 companies and 25 other entities, i.e. 113) in working groups for different sectors, such as agri-food industry (production, processing, transport and storage), retail (distribution, e-commerce, textiles, footwear, etc.), tourism and automobile (molds, plastics, machinery, robotics, electronics, etc.). These groups, made up of the largest companies in their sectors, by SMEs and also by startups who dominate and are developing solutions based on technologies characteristic of the fourth industrial revolution, have facilitated dialogue between companies, employees, associations, science and politics and allowed all economic operators have a uniform understanding of the potential of Industry 4.0.

The total investment is €414 million (100% supported by EU funds) and up to 2.26 billion euros in incentives, via Portugal 2020, for the development of awareness and adoption of technologies associated with the Industry 4.0 concept, in the next four years.

Digital Industrial Transformation Enablers. As a result of the digitization of society and industry, the end customer is now more informed and connected with access to a global offer. This phenomenon creates a more competitive environment but with opportunities for better prepared companies. At the disposal of companies are innovative technologies in terms of trade, production and logistics that transform the relationship with the end customer, workers and between companies. The use of available technologies and a customer-focused approach dictate the success of the business fabric in adapting to the challenges of today's markets. The national initiative considers a set of digital

transformation enablers (information, connectivity and production) with a vertical impact of the horizontal dimensions of Industry 4.0 (i.e. process, product and business models)

- **Information.** This digital enabler pillar covers technical domains such as consider aspects such as advanced analytics, artificial intelligence, digital infrastructures, cloud computing & cybersecurity.
- **Connectivity.** This pillar considers digital enablers such as advanced sensors (including embedded technologies), remote access and system operation and smart machines.
- **Production.** This pillar considers digital enablers such as advanced materials, modular manufacturing systems, 3D printing and autonomous robotics.



National Initiative Coordinates. The strategy will be followed up on an ongoing basis and the action plan will be continuously updated on the basis of the Working Groups that are currently (September 2017) being organized and set up.

Facts on the Portuguese National Strategy 'Portugal I4.0'	
Ministry in Charge	Ministry of Economy ¹ [Website]
Contact Person	<p>José Sequeira Special Adviser to Secretary of State Industry Ministry of Economy jose.sequeira@mecon.gov.pt</p> <p>Helena Duarte Advisor to the Board of Directors Portuguese Agency for Competitiveness and Innovation helena.duarte@iapmei.pt</p>
Main Strategy Documents	Portugal Industria 4.0 – Action Plan (Portuguese) ²

¹ <https://www.industria4-0.cotec.pt/en/about/>

² https://www.industria4-0.cotec.pt/wp-content/uploads/2017/07/industria4_0medidas-pt.pdf

I.3. Digitization level of the country

Qualitative analysis. Portugal ranks 15th in DESI 2017. Portugal improved its score compared to 2016 in all DESI dimensions with the exception of Digital Public Services. Greatest progress took place in fixed and mobile broadband take-up (Connectivity) as well as in the corporate use of digital technologies. Portugal's greatest challenge lies in raising the digital skills levels of its population.

Quantitative analysis. In DESI 2017, Portugal has an overall score of 0.53 and ranks 15th out of the 28 EU Member States (0.52). Concerning connectivity, Portugal has a medium rank in fixed broadband take up (19), while it scores very high (6) in 4G coverage and rank 26 in mobile broadband take-up. During the past year, Portugal has improved in fast broadband subscriptions (68%). Over half of Portugal (68%) are online and 48% of the population has basic digital skills. ICT professionals remain a decreasing share of employment (2,3%; rank 22), and the number of STEM graduates is significantly decreasing with difficulties for companies to recruit the ICT specialists they need (rank 22). Portugal ranks low in the use of internet by citizens (24). Despite an uptake in the share of internet users making video calls online and using social networks, there is still reluctance to engage in online transactions through online shopping and eBanking. they do so less than other European citizens with 41% and rank 24 in this category.

Portugal's businesses feature high rates of information sharing and RFID technology use (8%, rank 2). Use of social media and eInvoicing increased significantly in 2016 (19%, rank 8), but the share of SMEs selling online and of eCommerce in SME turnover both flattened (18%, rank 11).

Portugal is among Europe's best performers (0,65, rank 10) but its score worsened compared to 2016, mainly due to weaknesses in the amount of data being pre-filled in online forms and in Open Data (41%, rank 25).

2. National Strategy towards “Digitizing European Industries”

A key element in the implementation of the national strategy has been the establishment of the national platform for Industry 4.0. With the establishment of the national platform, all these companies and entities will continue to be involved in the implementation of this strategy, since several of the measures presented are either private initiative or cooperation between the various entities gathered in the Industry 4.0 platform. In order to ensure the effective implementation of these measures, a protocol was signed between the Ministry of Economy and COTEC Portugal, which provides that COTEC is responsible for monitoring the measures and updating them, as the needs for action in digital contexts change rapidly.

The vast majority of the measures that make up the Strategy for Industry 4.0 aim at the training of human resources with a strong focus on training from an early age and throughout life, with priority being given to the retraining of workers and the creation of new jobs. Out of the 64 measures proposed, 10 flagship measures have been identified as the most emblematic measures of this strategy (public and private)

1. **Financing.** Mobilization of European Structural and Investment Funds up to € 2.26 billion of incentives, through Portugal 2020, for the awareness, adoption and massification of technologies associated with the Industry 4.0 concept, over the next 4 years. The intention is to invest in resources relevant to the digital transformation of the economy through financing based on specific eligibility criteria.

An instrument called Industria Vale 4.0, aimed at supporting digital transformation through the adoption of technologies that allow disruptive changes in SME business models (such as the hiring of e-commerce sites or factory management software to certified providers) is worth mentioning. These vouchers have the unit value of 7500 euros, should support more than 1500 companies and represent a public investment of 12 M€.

Also worth noting is the launch of a credit line to support SME exports through PME Investimentos. This line allows the anticipation of sales proceeds at a subsidized interest rate, thus mitigating the risk of exporting companies of innovative technology of equipment that integrate technologies 4.0

2. **Digital Skills Program.** Promote the launch of the initiative that will enable, by 2020, an additional 20 thousand people in information and communication technologies in relation to current levels of training. In collaboration with the private sector, this measure is aimed at addressing the shortage of specialized technicians in this area and allows the support of professional retraining, creating new opportunities for professional insertion through the acquisition of new competences.
3. **Technical Courses Industry 4.0.** Review of the portfolio of professional technical courses in line with the demand of new competences by the companies in the scope of the digitalization of the economy. In this context, interfaces between schools and industry will be created and the use of qualified workers will be promoted, as well as the use of business equipment to support school activities.
4. **Learning Factories.** Promotion and support in the creation of physical infrastructures with technological equipment that recreate business environments Industry 4.0, with a view to the qualification of human capital, promoting and giving continuity to ongoing initiatives

such as Fabtec, Laboratory of Processes and Technologies for Advanced Systems of Production, which consists of a learning factory to demonstrate innovative solutions to the business fabric, and Introsys Training Academy, which integrates a simulated factory floor (SGF), and Academy 360 Room with interactive panels that control equipment on the factory floor.

5. **International missions.** Promotion of missions with national commissions, led by representatives of the Government, with a view to sharing products and services of Industry scope 4.0 developed in Portugal. These committees should be present at events / fairs (eg Hannover Messe), cities / regions and industrial centers (eg missions to Lombardy and Basque Country) that could provide opportunities for Portuguese companies.
6. **Adira Industry 4.0.** ADIRA, a national SME company, has several projects aiming the development of i4.0 solutions. The ADIRA I4.0 project, developed with the support of Portugal 2020, aims to develop i4.0 solutions applied to ADIRA products and processes, addressing topics such as sensorization, telemetry, predictive maintenance, production process scanning, quality and online production monitoring. In addition to this project, ADIRA has other ongoing actions under i4.0: i) A precursor partnership of the "collaborative laboratory" mechanism between ADIRA and CEiiA is underway. ii) In parallel, ADIRA is developing the P2020 SLM-XL project, which aims to develop a large additive manufacturing equipment for industry. iii) ADIRA also participates in an H2020 project, in consortium with big European names, aimed at the development of an additive manufacturing equipment integrated in an automatic production cell. iv) ADIRA has recently started a R&D unit, also with the support of Portugal 2020, called 4additive, in which it intends to study further aspects of additive manufacturing, such as metallurgical aspects of materials, among others. v) In "incubation" the company has the Add.additive mobilizing project, which Adira will lead, and which intends to extend the additive technology to various sectors and the various stages of the value chain.
7. **Footure 2020.** Measure of the Portuguese Association of Footwear, Components, Fur Products and Substitutes Industry, is a strategic plan of the Portuguese footwear cluster that aims to implement the footwear cluster for the digital economy based on multiple initiatives. By the end of 2020, it is intended to achieve a qualitative leap in the process of international affirmation of Portuguese footwear, establishing it as a reference of the industry worldwide.
8. **Bosch Digital.** In Portugal Bosch has 3 main factories with investments regarding i4.0. At the factory 'Bosch Car Multimedia', with a planned investment of € 54.7m until 2018, 30 projects are currently underway at the plant, with 8-10 of which are specifically linked to i4.0. One of those, the DONE Lab Bosch (€ 3M investment) has been in operation since 2017 at the University of Minho, and is a unique laboratory in Portugal for the advanced additive manufacturing of prototypes and tools. At 'Bosch Thermo-technology' plant, the Smart Green Homes project in partnership with the University of Aveiro for the development of solutions for smart homes and the digitization of Bosch equipment worth an investment of € 19 million, with the creation of around 150 jobs. The 'Bosch Ovar plant', which was inaugurated in September 2017, with an investment of 2.9 million euros, is preparing a large i4.0 project in partnership with the University of Porto, worth about € 20m and it is focused on safe cities and the development of the factory itself.

9. **4AC Industria 4.0 - Accelerator, Incubator, Prototyping.** Multiple multinationals such as Mitsubishi (Daimler), Siemens and Volkswagen Autoeuropa are part of the new accelerator, incubator and production and prototyping space for Industry 4.0. Bee Creative, Follow Inspiration, Mobi.Me and Prodsmart are also already part of the project, with the aim of accelerating product development and business development. The 4AC-Industria 4.0 results from a partnership between CEiiA and Startup Portugal, which aims to support technology startups to provide the industry, both hardware and software, in transforming ideas into products, product development and also in the scale-up phase. It will act as a focal point between industry, universities, technological centers and entrepreneurs, but also investors and other stakeholders of the entrepreneurship ecosystem.
10. **Consortium PSA Mangualde.** This initiative, with an estimated investment of 12 million euros, will be developed by PSA of Mangualde in consortium with 3 universities and 5 technology partners, based on the following axes: intelligent robotic systems (collaborative robots), advanced inspection and traceability systems (artificial vision), autonomous drive systems, digital factory and future factory (low cadence and high diversity).

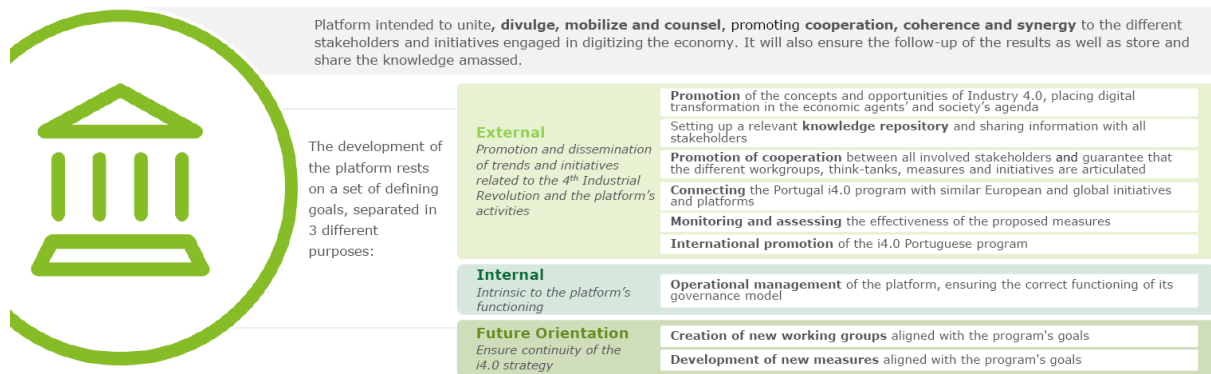
Like European best practices, the development of the initiatives is supported by a platform that will serve as a "HUB" of continuous development and of encouraging cooperation between the different entities involved, thus ensuring the continuity of the efforts made and the achievement of the proposed objectives. The creation of "Plataforma Portugal i4.0" operated by COTEC represents the first step to enhance industry 4.0 and it will be the main support tool to develop and deploy the measures.



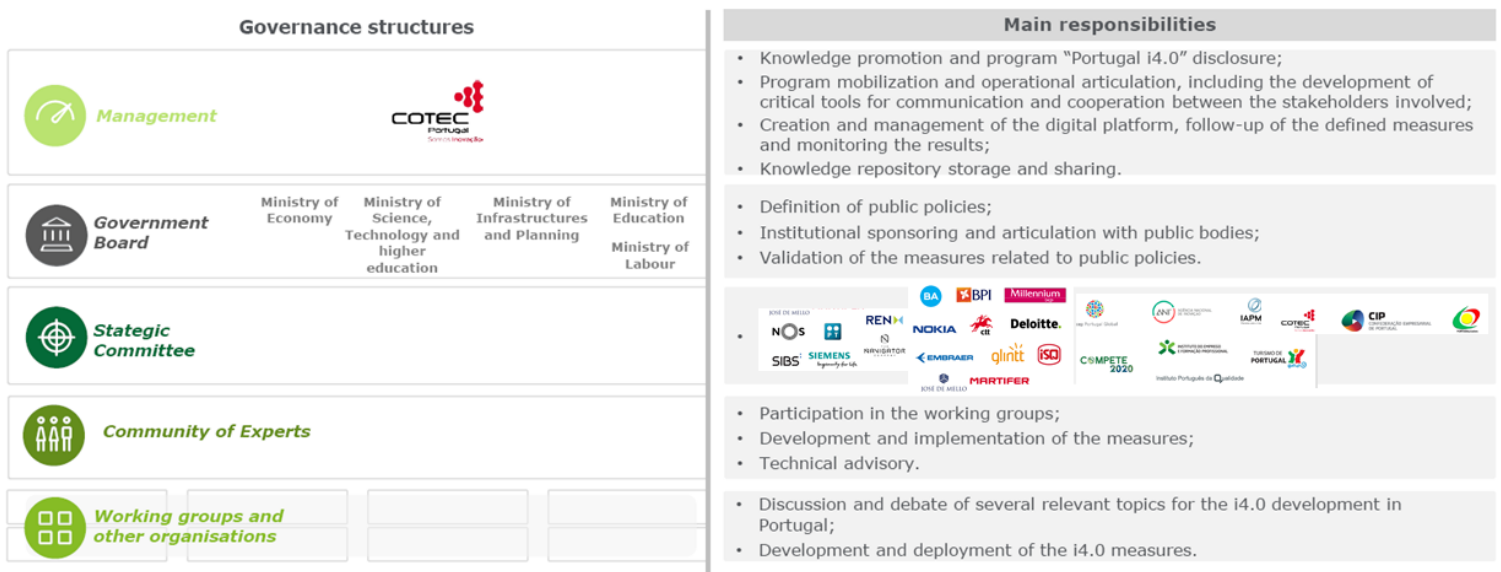
The scope of the platform is based on three types of objectives, which sustain the platform's role as a privileged discussion and further measure planning forum for the new challenges of digitizing the Portuguese economy.

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The platform creation includes the definition of a set of structures that will compose the governance model. These structures will be formed by the main organisations of the fourth industrial revolution ecosystem. It is worth noting that the Plataforma Portugal i4.0 monitoring, dynamisation, updating and coordination of the National Strategy for the Digitalization of the Economy were mandated to a private entity (for a term of 4 years) and therefore signed through a public-private partnership. In addition, it is important to highlight the Platform's distinct governance model and its financing model, where part of the investment to manage the platform and implementation of the activities / initiatives that will be stimulated comes from 17 business groups established in Portugal, some and with relevant experience of i4.0, which together with public and private organizations constitute the Strategic Committee of the Platform itself.



The national platform since its foundation has now established the Media, Fintech, Connected Health, Standardization, Skills, and Cyber Security workgroups. It has also developed the i4.0 Scoreboard and its baseline, a tool that will allow the monitoring and evaluation of the degree of digital maturity or preparation of the national economy for intelligent digitization (comparing it with other European and world economies), and measure their impact on innovation capacity and the resulting business competitiveness and performance of economic agents. It should therefore allow the public authorities to have a tool to assist in the management of the allocation of resources to the

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digitization in light of their impact on the competitiveness and development of the national economy.

3. Digitising European Industry (DEI) Pilar 1 - Digital Industrial Platforms & Research, Development and Innovation actions.

The national initiative as one of the key strategic vector consider that the cooperation between companies, universities, technology centers, business associations, public bodies and other stakeholders was essential for the creation of the transformation in Portugal. In this sense, it was identified as a framework for the development of cooperation and development of solutions and innovative technologies in the industrial revolution.

The technology cooperation vector contributes to DEI pillar 1 but also to DEI Pillar 3. The strategic vector considers 24 measures for technical cooperation and implementation of the national strategy. The objectives of this strategic vector are as follows:

- Promote cooperation between stakeholders of the national economy to prepare for the new industrial paradigm
- Promote sharing of experience, knowledge and partnership development

The measures considered are as follows:

1. **Bosch Digital.** In Portugal Bosch has 3 main factories with investments regarding i4.0. At the factory 'Bosch Car Multimedia', with a planned investment of € 54.7m until 2018, the DONE Lab Bosch (€ 3m investment) has been in operation since 2017 at the University of Minho, is an unique laboratory in Portugal for the advanced additive manufacturing of prototypes and tools, inaugurated at the Engineering School of the University of Minho working continuously for innovation projects using technologies (such as additive production) and human resources. In addition to this laboratory, some 30 projects are currently underway at the Bosch Car Multimedia plant, with 8-10 of which are specifically linked to i4.0. At 'Bosch Thermo-technology' plant, the Smart Green Homes project in partnership with the University of Aveiro for the development of solutions for smart homes and the digitization of Bosch equipment worth an investment of € 19 million, with the creation of around 150 jobs. The 'Bosch Ovar plant', which was inaugurated in September 2017, with an investment of 2.9 million euros, is preparing a large i4.0 project in partnership with the University of Porto, worth about € 20m focused on safe cities and the development of the factory itself.
2. **ADIRA Industry 4.0.** ADIRA, a national SME company, has several projects aiming the development of i4.0 solutions. The ADIRA I4.0 project, developed with the support of Portugal 2020, aims to develop i4.0 solutions applied to ADIRA products and processes, addressing topics such as sensorization, telemetry, predictive maintenance, production process scanning, quality and online production monitoring. In addition to this project, ADIRA has other ongoing actions under i4.0: i) A precursor partnership of the "collaborative laboratory" mechanism between ADIRA and CEiiA is underway. A platform for process development is already in place at CEiiA and a first joint development roadmap has already been defined. ii) In parallel, ADIRA is developing the P2020 SLM-XL project, which aims to develop a large additive manufacturing equipment for industry. iii) ADIRA also participates in an H2020 project, in consortium with big European names, aimed at the development of an additive manufacturing equipment integrated in an automatic production

cell. iv) ADIRA has recently started a R&D unit, also with the support of Portugal 2020, called 4additive, in which it intends to study further aspects of additive manufacturing, such as metallurgical aspects of materials, among others. It is not so focused on equipment development but on acquiring knowledge and competence in the process. v) In "incubation" the company has the Add.additive mobilizing project, which ADIRA will lead, and which intends to extend the additive technology to various sectors and the various stages of the value chain.

3. **Footure 4.0 Project.** Implementation of the Shoe Industry Cluster for the Digital Economy based on multiple initiatives that aim to serve four strategic pillars: (1) Innovation of the customer experience, (2) Intelligent manufacturing, (3) Qualification and (4) Sector leadership and dissemination. By the end of 2020, it is intended to achieve a qualitative leap in the process of international affirmation of Portuguese footwear, establishing it as a fundamental reference of the industry worldwide.
4. **Creation of an Open Days i4.0 program.** Creation of an open days program in factories in Portugal with i4.0 technology that aims to share and disseminate the "modus operandi" of technologically advanced factories that operate in several relevant segments in Portugal. The program foresees a factory tour in an interactive format (whenever possible) with the presentation of its most innovative technologies (preferably in operation), exhibition of end products with possibility of interaction, educational and hands-on activities with the row and also forums of discussion between participants and collaborators. It may involve companies such as AutoEuropa VW, PSA Mangualde, Grupo Soceme and Petrutex.
5. **Reissue of the event Hey! Hackathon.** Valorisation and dissemination of private initiatives to encourage innovation and an industrial approach, such as the Hey! Hackathon, based on a collaborative event at the Mitsubishi Fuso Truck Europe facility, where creative people from diverse areas meet to develop software and applications of innovative and usable ideas in a specific theme.
6. **Creation of maturity evaluation matrix i4.0.** Creation and dissemination of a self-diagnostic tool for technological maturity assessment of i4.0 at the corporate level, based on the definition of a set of evaluation criteria and good practices. The tool addresses an overview of i4.0 ecosystems, an illustration of an i4.0 reference architecture incorporating technology, business and operating models, platforms and services.
7. **Open Science and Open Innovation.** Encouraging joint activities on Open Science and Open Innovation, focusing first and foremost on actors in the industrial ranks i4.0 mapped in the national Industry 4.0 program, involving companies, researchers, students, decision makers, funding agencies and other relevant entities.
8. **5G Innovation Program.** Huawei intends, through partnerships with local operators, initiate training activities and provide access to 5G Labs in order to guide the implementation of 5G in Portugal in the coming years.
9. **Knowledge desk.** Promote the set-up of Knowledge Branches with the purpose of bringing people, companies and institutions together in the creation and sharing of knowledge, creating bridges between the identification and analysis of social, economic and cultural needs and challenges and knowledge production institutions that can contribute to respond to them.

10. **Born from Knowledge.** Program dedicated to stimulating innovation and the capacity to undertake on the basis of training, scientific research and knowledge. Integrates actions and follow-up initiatives to people who are the basis of ideas, projects and achievements in the field of innovation, in particular, companies and startups of scientific and technological base, associating certification and accreditation mechanisms and valuation and recognition of the activity carried out in a context of collaboration between academia and the business sector.
11. **Promoting and enhancing the role of local authorities in initiatives i4.0.** The intention is to promote with the local authorities the implementation of initiatives with an impact on the local business fabric aimed at building and accelerating business ideas that fall within Industry 4.0 or processes of digital transformation of existing business models. It is intended that these initiatives be practical, broad and comprehensive in the national territory, assuming a dynamic of its own.
12. **Promotion of the sharing of experiences and knowledge in the scope of i4.0.** Promotion and dissemination of events of public or private initiative for the sharing of experiences and knowledge, training of human resources, development of partnerships and attraction of experience, on the topics of technological innovation, digitization and automation, within the scope of i4.0.
13. **Creation of National Digital Network.** Creation of a network of volunteers in the business, academic and scientific ecosystem, to raise awareness, monitor and promote the digital transformation of Portuguese companies and their public measures to support this transformation, with a view to accelerating in proximity the digitalization of the economy; taking into account the Digital Portugal Agenda.
14. **CTT E-commerce in box.** Project mobilized by CTT to create a Marketplace of national companies to boost the process of digitization and sale online of Portuguese companies. It is intended to create a solution with the support of national reference partners that confers trust, traction and complementarity in terms of e-commerce skills. Especially aimed at SMEs, it is intended to implement a model that allows the company to expose its products in a reference marketplace.
15. **Road show "Robotics".** Launching of a roadshow with the theme of integration of robotics, sensing and automation in Portuguese companies. It will be aimed at industrial SMEs interested in innovating their production process with the latest technology, demonstrating new business models, approach to Man-Robot Collaboration (MRC) and integration with IT systems.
16. **Exhibition 560.** Sustained development of Exhibition 560 - itinerant exhibition, within the Ministry of Economy, of the most sophisticated and technological products of Portuguese industry.
17. **Development of a study on cybersecurity in context i4.0.** Information security is a key issue to ensure the competitive advantage in an environment whose evolution is increasingly dependent on technological innovation. In the context of industry i4.0, cybersecurity is particularly critical, as innovative technological tools are at the heart of this new industrial paradigm. In this context, Deloitte-COTEC intend to elaborate a study on the theme of cybersecurity in context i4.0, exploring its relationship with emerging technologies, the challenges of companies in the various industry sectors, as well as main international trends.

18. **ACEPI Navegantes XXI Awards.** Valorization and promotion of ACEPI prizes focused on e-commerce, as prizes of excellence in Digitization in Portugal, promoting the introduction of additional categories on other technologies of Industry 4.0 such as automation and robotics, Big Data, Internet of Things, among others.
19. **PSA Mangualde Consortium.** Development of technologies and solutions that will configure the beginning of the intelligent transformation of the factory to the industry 4.0, increasing the flexibility and competitiveness of the PSA car production unit of Mangualde, to receive the new vehicle in conditions of an even higher industrial performance. This initiative, with an estimated investment of 12 million Euros, will be developed by PSA of Mangualde in consortium with 3 Universities and 5 technological partners, based on the following axes:
 - Intelligent robotic systems (collaborative robots);
 - Advanced inspection and traceability systems (Artificial vision);
 - Autonomous systems of movement (AGV);
 - Digital factory (IoT);
 - Factory of the future -FoF (Low cadence and High diversity).
20. **Digital Single Balcony -Tourism.** Creation of a Single Digital Counter to manage the interaction between the various entities in the Tourism and the State sector, allowing to reduce the dispersion of information by concentrating on a single channel of information services, licensing and finance (tax matters).
21. **Tourism data integration platform.** Development of the existing information management platform (TravelBI), guaranteeing (1) new data sources, (2) new functionalities and (3) new business models. In parallel, develop the platform as a repository of public APIs.
22. **Digital Tourism Forum.** Creation of a forum for debate and sharing of experiences on the digitization of the tourism sector, which will ensure the continuity of the "Industry 4.0 | The future of Portuguese industry "in the sector through periodic sessions of presentation and discussion of solutions, analysis of success stories and best practices of technological scope, nationally and internationally, transversal and specific to the different segments.
23. **Huawei Portugal Innovation & Experience Center.** Creation of a network of centers for innovation and experimentation aimed at providing greater proximity to innovation and new technologies. This initiative aims, to provide greater proximity to innovative technology through the use of this center, to bring the latest advances in R & D to the national market and, on the other hand, to offer a place of practical teaching for the formation of to deepen their professional knowledge and skills, enabling a practical experimentation approach for local talent.
24. **IoT Smart Agriculture.** Creation of a program that, through partnerships between Huawei and Portugal Telecom with SMEs and Universities, will support the development of solutions for improving efficiency in agriculture through crop quality management and soil quality testing.

The previous actions can be mapped to the DEI pillars in the following, in many cases with a particular measure having an impact and contribution to a number of such pillars.

Analysis of National Initiatives for Digitising Industry: Portugal

Portugal indústria 4.0

Technology Cooperation - Strategic Vector Measures	DEI Pillar 1 - Digital Platforms	DEI Pillar 2 - Standardisation	DEI Pillar 3 - Digital Innovation Hubs	DEI Pillar 4 - Digital Skills
1. Bosch Digital	•		•	
2. ADIRA Industry 4.0	•		•	
3. Footure 4.0 Project	•		•	•
4. Creation of an Open Days i4.0 program			•	•
5. Reissue of the event Hey! Hackathon			•	
6. Creation of maturity evaluation matrix i4.0			•	
7. Open Science and Open Innovation			•	
8. 5G Innovation Program	•			
9. Knowledge desk				•
10. Born from Knowledge	•			•
11. Promoting and enhancing the role of local authorities in initiatives i4.0			•	
12. Promotion of the sharing of experiences and knowledge in the scope of i4.0	•			•
13. Creation of National Digital Digital Network	•			
14. E-commerce in box	•			
15. Road show Robótica			•	
16. Exhibition 560			•	
17. Development of a study on cybersecurity in context i4.0			•	
18. ACEPI Navegantes XXI Awards			•	
19. PSA Mangualde Consortium	•		•	
20. Digital Single Balcony -Tourism	•			
21. Tourism data integration platform	•			
22. Digital Tourism Forum			•	
23. Huawei Portugal Innovation & Experience Center			•	•
24. IoT Smart Agriculture	•			

4. Digitising European Industry (DEI) Pilar 2 - Standardization actions, regulation and testbeds

This pillar of the European strategy can be aligned with two strategic vectors of the national strategy. In particular, internationalization, standards and regulation.

The measures included in the internationalisation strategic line of action are designed to promote the international position and recognition of Portuguese industry and to support SMEs in the internationalization process, in the sense of adapting to the reality of the global economy. Additionally, and in order to pull the internationalization of small and medium-sized enterprises, the national initiative proposes to focus on exploring free zones. The main objective of this vector includes:

- Attract capital, people and financing to the economy, enhancing the attractiveness of the domestic industry.
- Support for the international dissemination of Portuguese industry and investment in the theme of Industry 4.0.

To achieve these objectives the national initiative proposes 7 lines of action

1. **Creation of international showcases - "Portugal 4.0 Day"**. Creation of international demonstrator events, with the designation "Portugal 4.0 Day", in strategic spaces / locations (eg European Commission headquarters) with the aim of promoting the work done by Portuguese technology companies.
2. **Participation in the main technological fairs**. Promotion of national committees, led by Executive representatives, with a view to sharing products and services of scope i4.0 developed in Portugal. Some of these include: FABTECH Canada, Hannover Messe, FABTECH Mexico, IoT Solutions World Congress, UXLxUser Experience, Web Summit2017
3. **Business missions**. Ensure and support the presence of the best Portuguese technological companies in official meetings, State visits abroad and State receptions to foreign entities, with the following objectives: (1) Guarantee the credibility of national companies in international missions oriented to the scope of i4.0; (2) Capitalize on the incentives for internationalization created for the purpose of this program; (3) Facilitate agreements to provide services and / or commercialization of products with other countries. Conversely, calls should be made to international companies that will be received by our companies, in order to promote the appreciation of the digitalization of the economy as an attractive factor of foreign investment.
4. **Reinforcement of Digitization in the Government's Economic Diplomacy Strategy**. Valorization of the digitization of the national economy in the strategy of economic diplomacy of the Government, as an attractive factor of foreign investment, including the promotion of predicted investments, success stories and the advantages of the national socioeconomic climate in terms of digitalization. The actions in matters related to the intervention in the Internationalization of the sector and the ICT companies will be developed in articulation with the Digital Portugal Agenda.

5. **Uniform communication of the destination Portugal on public digital platforms.**
Development of a collaborative digital structure that results in synergistic gains for the Portugal brand, both in content and technology. This development should be based on a standardization of the communication of the destination Portugal, at national, regional and local level, through the graphic standardization, navigability and contents of the different public platforms of destination promotion, guaranteeing the centralization of digital communication and governance.
6. **Organization of the Digital Champions Meeting.** The Digital Champion will represent Portugal at the Digital Forum Champions Europe, where the Digital Champions of each Member State are based and where the main role is the pivotal link between the Portuguese Digital Agenda (Public and Private) and Civil Society (including Citizens and the companies). Officially they meet at least twice a year.
7. **International promotion of Portuguese best practices and initiatives in the Digital Champions Forum.** It is expected that in future Digital Champions meetings, Portuguese best practices and initiatives will be promoted, inviting corporate representatives in a timely manner, presenting initiatives and results in order to publicize the good examples, entrepreneurs and Portuguese companies and thus give some European notoriety. This initiative should be developed with local operators.

These internationalization actions are complemented by legal and regulatory aspects. The development and implementation of technological enablers requires certain legal guarantees in order to provide legal certainty and a regulatory framework that encourages both supply and adoption of technology. This requires ensuring that there is legal and normative adaptability to address the challenges of the new industrial revolution. To this end, a set of measures was selected to be included in the i4.0 framework. The objectives to be addressed include:

- Encourage stakeholder participation in standardization activities.
- To develop the legal framework and national normative collection in order to cover the needs of the fourth industrial revolution.

To this end, 3 measures will be adopted and implemented as part of the national strategy:

1. **Portuguese participation in industry standardization 4.0.** Event (s) involving international speakers from countries with extensive industry experience 4.0, which will convey the importance of standardization both as a basis and as support for interoperability. The aim of this initiative is to ensure Portuguese participation in international standardization initiatives related to the digitization of industry and associated technologies, drawing up proposals and creating reference architectures at European and international level.
2. **Development and implementation of data standards and data exchange.** To support companies, public entities and Portuguese economic agents in general, in the implementation of data standards and data exchange. Through the use of these standards, digital technologies optimize production processes, facilitate the relationship between the various actors in the value chain, and contribute to improving end-user benefits in quality, safety, efficiency, traceability and cost reduction.

3. **Standardization diagnosis.** Design of a tool for dissemination to companies in order to have a starting point to know the degree of use and application of standards of products, services and processes, as well as to identify the needs of standardization and training in this scope.

As shown below all these measures fit into the DEI pillar 2 related to standardization and regulation activities.

Financing & investment Incentives - Strategic Vector Measures	DEI Pillar 1 - Digital Platforms	DEI Pillar 2 - Standardisation	DEI Pillar 3 - Digital Innovation Hubs	DEI Pillar 4 - Digital Skills
1. Creation of international showcases - "Portugal 4.0 Day"		•		
2. Participation in the main technological fairs		•		
3. Business missions		•		
4. Reinforcement of Digitization in the Government's Economic Diplomacy Strategy		•		
5. Uniform communication of the destination Portugal on public digital platforms		•		
6. Organization of the Digital Champions Meeting		•		
7. International promotion of Portuguese best practices and initiatives in the Digital Champions Forum		•		
Standards & regulation - Strategic Vector Measures				
1. Portuguese participation in industry standardization 4.0		•		
2. Development and implementation of data standards and data exchange		•		
3. Standardization diagnosis		•		

5. Digitising European Industry (DEI) Pillar 3 - Digital Innovation Hubs actions

As illustrated by the measures to be implemented under the “Technology Cooperation” vector of the national initiative, the national initiative does not have a vector particularly devoted to the implementation of digital innovation hubs. However, significant investments are being put in place to leverage both the innovation ecosystems, digital transformation services, business development activities, access to infrastructures and the launch of new enterprises in the realm of industry 4.0. This Section complements the previous analysis with specific actions for business development integrated in the national initiative.

The digital Innovation Hubs pillar is also connected to the Startupi4.0 initiative. In line with StartUP Portugal - National Strategy for Entrepreneurship, the Portugal i4.0 measures are implemented in the short-medium term, aimed at strengthening the role of Startups in the national business environment as agents for the promotion of innovation and updating of business models. The objectives of this strategic vector is as follows:

- Promote Portugal as an attractive HUB for Startupse investors, creating the necessary conditions for this purpose.
- Create conditions for sharing skills and solutions between the business world and the innovation ecosystem.

The strategic vector considers the following set of measures:

1. **Accelerator, Incubator and Industry Prototyping Center 4.0 - "4AC-Industry 4.0"**. Multinational companies such as Mitsubishi (Daimler), Siemens and Volkswagen Autoeuropa are part of Matosinhos, the new accelerator, incubator and production and prototyping space for Industry 4.0. BeeVeryCreative, FollowInspiration, Mobi.Mee Prodsmart startups are also already part of the project, aiming to accelerate product development as well as business development. 4AC-Industria 4.0 results from a partnership between CEiiA and StartupPortugal. It aims to support technology startups to provide the industry, both hardware and software, in transforming ideas into products, product development and also in the scale-up phase. It will act as a focal point between industry, universities, technological centers and entrepreneurs, but also investors and other stakeholders of the entrepreneurship ecosystem.
2. **Promotion of innovation strategies in the national business fabric.** Promotion of innovation strategies in the national business fabric to approach agents focused on disruptive technologies and business models, namely startups, materialized through the creation of internal structures, independent or shared between companies. An example is the "Next47", a Siemens independent business unit that aims to stimulate disruptive ideas and accelerate new technologies, working with partners ranging from Siemens employees / entrepreneurs to start-ups and companies already established.
3. **Digital Tourism Hackathon. Creation of a Digital Tourism.** Hackathon that accelerates the alignment of solutions and innovative / technological companies with the market needs, through a recurrent presentation model by startups of its projects to players in the sector to reward successful cases and empower their access to the market.

4. **Center for innovation and tourism development.** Creation of a Center for Innovation in Tourism, based on a partnership between Turismo de Portugal, associative structures, companies and technological partners, universities and entities of the entrepreneurial ecosystem and creative industries, promoting the generation, development and application of innovative ideas for tourism and to promote the approximation between traditional "industry" and new business models in tourism.

As shown in the picture below all the measures in this vector directly map to the DIH pillar in the DEI strategy

StartUp u4.0 - Strategic Vector Measures	DEI Pillar 1 - Digital Platforms	DEI Pillar 2 - Standardisation	DEI Pillar 3 - Digital Innovation Hubs	DEI Pillar 4 - Digital Skills
1. Accelerator, Incubator and Industry Prototyping Center 4.0 - "4AC-Industry 4.0"			•	
2. Promotion of innovation strategies in the national business fabric			•	
3. Digital Tourism Hackathon			•	
4. Center for innovation and tourism development			•	

It is also worth noting that Portugal has already a strong innovation network that can and will be exploited to dynamise SME digital transformation. In particular:

- Production Technologies Cluster (PRODUTECH) is an articulated network of manufacturing technology providers capable of responding to both competitiveness and sustainability challenges and to the manufacturing industry’s requirements with innovative, flexible, integrated and competitive solutions. PRODUTECH’s mission is to promote the sustainable development and internationalization of the Portuguese industry of manufacturing technologies – such as providers of capital goods, machine-tools, industrial equipment and systems, system integrators, software houses and developers of industry-oriented computer applications, engineering and consultancy companies – in close collaboration with key sectors of the manufacturing industry, the Portuguese Science and Technology System (SCT) and other stakeholders. Currently this cluster counts with more than 90 members, most of them industrial companies. As a key partner in several projects, PRODUTECH promotes initiatives and actions, within three main areas -Cooperation, Innovation and Internationalization-, fostering the international competitiveness of the Portuguese economy, and boosts the cooperation between companies and other relevant stakeholders in a structured way.
- COTEC Portugal is a private business association for innovation which will coordinate and boost the implementation of the measures of Program i4.0 - National Strategy for the Digitalization of the Economy, as well as to guarantee the updating of these measures and initiatives..
- There are several innovation parks in Portugal, which can have a key role as digital innovation hubs: **UPTEC - Science and Technology Park of University of Porto** is a fundamental structure of support knowledge transfer between the university and the market, created to sustain the University of Porto’s third mission - the social and economic leverage of its generated knowledge. **SPINPARK technology incubation centre** is a private non profitable entity created in 2006 by initiative of the University of Minho, of Avepark and the Science and Technology Association Park from Porto (APCTP) that promotes and supports

activities of advanced technology, intensive in knowledge and serving simultaneously as a launching platform and diffusion of the innovation in the context of the economy of knowledge.

6. Digitising European Industry (DEI) Pilar 4 - Skills development.

Skills development is one of the most, if not the most, significant vector of the national strategy. The National initiative is structured across 4 main lines: that cover the full education system in Portugal with the following objectives:

1. **Basic, Secondary and Professional Education.** Encouragement and captivation of the new generations for ICT, digitization and automation, sensitizing them to the current factors in the global economy.
2. **Higher Education (university and polytechnic).** Adaptation of higher education (university and polytechnic), reinforcing the weight of topics related to ICT and innovation in content and activities, preparing students for the current challenges of the labour market.
3. **Reskilling of workforce.** Promotion of cross-generation initiatives for democratization and retraining of ICT skills for the whole working population
4. **Industry Attractiveness.** Increased attractiveness of the national industrial sector for the new generations, focusing on the awareness of entrepreneurs and decision makers of the national business fabric for innovation within the industry 4.0.

The national programme considers 22 specific measures at this level. The measures cross-cut each of the 4 educational targets to meet the human capital qualification objectives in the following way:

Human capital qualification - Strategic Vector Measure	Educational Targets			
	Basic, Secondary and Professional Education	Higher Education (university and polytechnic)	Reskilling of workforce.	Industry Attractiveness.
1. Valorization and expansion of the project "Science in the School"	•			
2. Guarantee of Digital Competencies	•			
3. Digital literacy and digital skills	•	•	•	
4. Portugal Code Movement	•	•	•	
5. Reissue of the project "Think Industry - New Generation"	•			•
6. Technical courses i4.0	•		•	•
7. Creation of training offer in i4.0 in the institutes of Higher Education (university and polytechnic)		•		
8. "Demonstrator Robots" Programs Institutes of Higher Education (polytechnic)	•	•		•
9. Creation of training offer in i4.0 in higher education (university)		•		•
10. Creation of a Consortium of Schools of Portuguese Language Engineering (CEELP)		•		
11. Visa policy addressed to the most qualified workers		•	•	
12. Creation of a Chair i4.0	•	•		
13. Research in i4.0				•
14. Siemens Academy 4.0		•		•
15. Conversion of engineers to the areas of Software and Information System Engineering		•		
16. Professional re-qualification and integration			•	
17. Promotion of Learning Factories		•	•	
18. Training actions for professionals			•	
19. Atelier Digital		•	•	
20. Digital Competence Program	•		•	
21. Action-Industry Programs	•			•
22. Tourism Digital Academy			•	•

The specific measures are detailed below:

1 Valorisation and expansion of the project "Science in the School". The measures aim at the valorisation and expansion of the "Science in the School" program, with the objective of motivating the students of the different education and training routes for the learning of sciences and for the choice of technological areas. Through an agreement between the Ilídio Pinho Foundation, the

Ministry of Education and the Ministry of Economy, an annual prize is awarded - the "Science in the School" Prize. The Prize has, and will continue to have, a decisive influence on the preparation of the young people who will have to face the enormous challenges posed to the modern societies of knowledge that Portugal has as a reference for its development. It is also expected to pass the winning projects to potential startups or innovative activities of companies already existing in the Portuguese business fabric.

2 Guarantee of Digital Competencies. Adaptation of the provision of basic and secondary education in order to guarantee basic competences with regard to Information and Communication Technologies and Digitization. This measure is promoted from the Ministry of Education.

3. Digital literacy and digital skills. Program of training in digital literacy and digital competence, developed by Higher Education Institutions, with differentiated levels (teachers, youth, seniors, administration, people in social exclusion contexts, people with special needs, vocational education) and with the purpose of mobilizing and to make the country aware of the importance of digital literacy and computing, through which it is hoped to encourage all those responsible, people, institutions and companies for democratization and generalization of the offer of training and learning environments, open and inclusive, in skills. This measure is promoted from the Ministry of Science, Technology and Higher Education, Ministry of Education, Ministry of Economy, Ministry of Labour, Solidarity and Social Security.

4. Portugal Code Movement. Program to stimulate the participation of teams of young students, researchers and companies in code development, through collaboration between schools and higher education institutions, based on exercises and territorial challenges. It has the collaboration and collaboration of several companies such as Google, Microsoft, Cisco, IBM, Altran, APDC, Critical Software, PNMF, PT, IST and ANPRI. This measure is promoted from the Ministry of Science, Technology and Higher Education, Ministry of Education, Ministry of Economy, Ministry of Labour, Solidarity and Social Security.

5. Reissue of the project "Think Industry - New Generation". Reissue of the "Think Industry - New Generation" project, which aims to convey to the youngsters of basic and secondary education a new image of the industry, associating it with positive values and an attractive professional future through a creative approach that deals with themes related to industry and the professions linked to it in an innovative way. Thus, "Think New Generation Industry" should evolve into a chain of projects, geared to the mobilization of young people, their educators and business organizations, and supported by the valorisation of scientific, technical and technological knowledge, providing new tools - processes and training means - for the development of the Training and Technological Qualification, essential for the improvement of the quality of the assets for the Portuguese Industry. In the last edition of the project it was possible to reach 37,200 students, through 2,500 sessions. This measure is promoted from Rede de Centros Tecnológicos de Portugal (RECET) and Academia PME do IAPMEI and technology centres CITEVE, CENTIMFE, CATIM, CTIC, CTVC, CTCP e CEVALOR.

6. Technical courses i4.0. Review of the portfolio of professional technical courses in line with the demand of new competences by the companies in the scope of the digitalization of the economy. In this context, interfaces will be created between schools and industry, and the use of qualified workers will be promoted, as well as the use of business equipment to support school activities. This measure is promoted from the Ministry of Education, Ministry of Economy, Ministry of Labour, Solidarity and Social Security and ANQEP.

7. Creation of training offer in i4.0 in the institutes of Higher Education (university and polytechnic). To contribute to the development of the program of modernization and valorization of polytechnic education in the field of industry, involving the students in systematic actions with the companies and, at the same time, promoting the knowledge of the concept and technologies of the Industry 4.0. To this end, technological development projects will be promoted in institutes and polytechnic schools, aimed at solving problems at the regional level. The work carried out by MCTES in order to create 6 pilot Technical Levels (Level 5) in 5 national polytechnical institutes (Bragança, Cávado and Ave, Leiria, Beja and Setúbal) stands out. This measure is promoted from the Ministry of Science, Technology and Higher Education, Ministry of Economy, Coordinating Council of Polytechnic Institutes.

8. Demonstrator Robots" Programs Institutes of Higher Education (polytechnic). Contribute to the provision of demonstration robots to institutions of higher education, integrating in training and mentoring contexts, through partnerships with manufacturers (e.g KUKA, ABB). With these partnerships, it is intended to stimulate students for experimentation and learning in real context, promoting a closer approximation to the technologies that characterize this area. This measure is promoted from the Ministry of Science, Technology and Higher Education, KUKA, ABB and other companies in the sector.

9. Creation of training offer in i4.0 in higher education (university). Promote master's and postgraduate training in digital competencies applied to industry (ie, global connectivity of supply and distribution chains, including "IoT-Internet of Things", increasing digitalization of the means of conception and production, banalization of additive technologies of manufacturing and generalization of robotization of operations, or "industry 4.0"), from new programs or curricular changes to existing courses, in close collaboration with the Ministry of Economy, companies and business associations.

The following initiatives stand out:

- Promotion of partnerships with foreign higher education institutions in the field of Industry 4.0 challenges (software for robotics, 3D printing, Big Data, cloud computing, among others);
- Creation of a joint and articulated training program with companies in the field of Industry 4.0 (Information Technologies, Engineering and Industrial Management, Scanning and 3D Printing);
- Creation of a postgraduate course in advanced production by Fabtec with the support of Produtech.
- Promotion of the DM4 Manufacturing project aims to develop a set of integrated decision support tools, aligned with the efficient use of advanced technologies for production systems. In addition to INESC TEC, the institutions involved in the project are IST-ID, the Associação Superior Instituto Técnico

10. Creation of a Consortium of Schools of Portuguese Language Engineering (CEELP). Contribute to the creation of a consortium, composed of the Faculty of Sciences and Technology of the New University of Lisbon, Faculty of Engineering of the University of Porto, University of Lisbon, Faculty of Sciences and Technology of the University of Coimbra, School of Engineering the University of Minho and the University of Aveiro (engineering departments). This measure is intended to:

- Ensure implementation of all activities jointly developed by Consortium Members to promote teaching, research and innovation;

- Promote the implementation of training actions in developing countries and projects for the reception of students, professionals and engineering researchers;
- Design the quality of Portuguese engineering and Portuguese engineering schools internationally and support and complement the training of engineering professionals;
- Promote joint lobbying and promotion activities of the consortium, at the level of metropolitan areas, regional coordination commissions, national government and international entities, for the promotion of engineering and higher education projects and advanced engineering research .

This measure is promoted from the Ministry of Science, Technology and Higher Education and Engineering Faculties.

11. Visa policy addressed to the most qualified workers. Measure to strengthen the European visa policy for the recruitment of technical staff, in particular in the fields of engineering and / or training and / or experience in new technologies. A network of Portuguese recruiters and a policy support platform should be established, bringing together companies and candidates. The users of the policy will be able to enjoy working conditions equal to the national citizens, favourable conditions for family reunification and perspective of permanent residence.

12. Creation of a Chair i4.0. Contribute to the creation of a University Chair in i4.0, with the aim of integrating in the training plans a set of content and skills oriented to the industry 4.0, adapting the current educational offer of higher education, in order to:

- Integrate content directly related to the industry concept 4.0 in curricular units (eg integrate a chapter focused on sensors in a robotics discipline);
- Develop a new set of curricular units focused on specific segments of the concept (eg 3D Printing, bigdata, cybersecurity, Internet of Things, e-commerce);

This measure is promoted from the Ministry of Science, Technology and Higher Education and Ministry of Economy

13. Research in i4.0. Support the development of research programs and partnerships within industry 4.0, in particular by encouraging the creation of collaborative laboratories involving scientific institutions and enterprises. This measure also contributes to DEI pillar number 1 on digital platforms and R&D&I action promotion. This measure is promoted from the Ministry of Science, Technology and Higher Education

14. Siemens Academy 4.0. Through partnerships with Universities / Polytechnics and with Startups / Spin-Offs / Coaching / financial funding it is intended to prepare the students / young people for the fourth industrial revolution. This measure also contributes to DEI pillar number 3 on DIH. This measure is promoted from Siemens Portugal, Cadflow, Bee Very Creative.

15. Conversion of engineers to the areas of Software and Information System Engineering. In order to increase the human capital of specialized resources in new technologies, which are increasingly insufficient in the current business context, Deloitte, in partnership with Instituto Superior Técnico and INESC, have launched a training program that allows people with training in various engineering disciplines to acquire the necessary skills in the areas of Software and Information Systems Engineering. This intensive 6-month program is based on the core competencies of Computer Engineering and gives graduates a postgraduate degree in Software and Information Systems Engineering. The protocol establishes a total financing of the course, the costs being shared between Deloitte and the trainee who, if he or she obtains a good use, will be able to integrate the Deloitte staff. This program has the possibility to convert up to 40 engineers per edition. In addition to

seeking to meet the growing need of companies with skills in new technologies, this program is a relevant opportunity for those seeking a second professional opportunity, since it allows the development of skills increasingly valued by the labour market. This measure is promoted by Deloitte and INESC.

16. Professional re-qualification and integration. Promotion of initiatives for democratization and retraining of skills in the area of Information and Communication Technologies (ICT). These initiatives aim to provide the active population with skills adequate to the needs of companies in the area of software development, namely with training in the main technologies and programming languages, related to the industry concept 4.0.

17. Promotion of Learning Factories. Promotion and support in the creation of physical infrastructures with technological equipment that simulates business environments i4.0 dedicated to training, allowing the apprehension of the i4.0 concepts and their practical application. This initiative should complement the courses developed for the professionals of the ranks, in coordination with the program of valorization of polytechnics and possible improvements of technological centers. The learning factories should be integrated into the initiative already underway in the context of FabLabs. The Laboratory of Processes and Technologies for Advanced Production Systems, Fabtec, is a good example, which leads the Portuguese participation in a pan-European application to the EIT (European Institute of Innovation & Technology) in the area of Smart Manufacturing. This action clearly contributes also to DEI pillar 1 on Digital platforms.

18. Training actions for professionals. It is estimated that Industry 4.0 will have a direct impact on 54% of existing jobs. Faced with this trend, companies will be prepared to meet this challenge by developing technical and behavioural skills of their employees (technical and managerial staff). It is also intended to foster a specific offer for leaders taught in management schools throughout the country.

19. Atelier Digital. Program developed by Google, in partnership with Higher Education Institutions, in particular the Polytechnic Institutes, with the objective of training and training citizens with the skills and tools necessary for success in the digital economy, through the creation of a platform with training and tools free. The trainings will have the formats of online and offline training. This measure is promoted by Google, Ministry of Science, Technology and Higher Education, Coordinating Council of Polytechnic Institutes, Institutions of Higher Education (Universities)

20. Digital Competence Program. This initiative in digital skills will enable an additional 20 thousand people in ICT to be trained by the current levels of training and, in collaboration with the private sector, will be able to face the shortage of specialized technicians in this field. This initiative will also enable support for retraining, creating new opportunities for professional insertion through the acquisition of new skills. This measure is promoted from the Ministry of Science, Technology and Higher Education, Ministry of Education.

21. Industry Action Programs. Tailor training offerings with double certification, regardless of qualification level, looking for the industry and the needs of each region. Information on the applications for the "Compete" program may support the definition of Human Resources qualification needs. This measure is promoted from the Ministry of Science, Technology and Higher Education, Ministry of Education, Ministry of Economy, Ministry of Labour, Solidarity and Social Security, Academia PME do IAPMEI.

22. Tourism Digital Academy. Creation of a digital academy that transfers theoretical and practical knowledge, with professional-oriented training, supported by itinerant centers and complemented by certified online training to instruct and disseminate the new digital tools for the sector, ensuring the integration of decentralized locations. This measure is promoted from Tourism Portugal and the network of education and training for tourism.

7. Specific National Measures.

Beyond the specific measures addressed by the previous pillars, the national initiative Portugal i4.0 is also putting together specific measures that deal with the development and application of specific investment and financing instruments. These are of particular interest to the development and the increase the pace of industrial modernization and transition from traditional industry towards industry 4.0 ones.

Public finance policies for corporates are focused on developing a set of financing mechanisms for i4.0 projects in order to accelerate investment and national business engagement. In this sense, a set of measures has been defined that aims at concretizing financing and investment support. The objectives are very clear:

- Implementation of the financing instruments to support digitization plans and modernization of the national economy.
- Development of the conditions for encouraging investment in technological solutions and business in the field of Industry 4.0.

To address these objectives the national initiative considers 4 measures, which are supported by structural funds from the COMPETE 2020 programme:

1. **Specific alerts i4.0.** Specific announcements for Industry 4.0, with a mobilization of up to € 2.26 billion of incentives, through Portugal 2020, for the following instruments:
 - Voucher i4.0 for Micro and Small and Medium-Sized Enterprises: Creation of a specific mechanism to encourage investment in projects i4.0, whose format is similar to the existing Vouchers under Portugal 2020. In the case of "Vale i4.0" will be a support to promote the investment of micro enterprises and SMEs in projects in the field of e-commerce and digital marketing development. The voucher will have an overall allocation of € 12 million and will cover 1500 companies, each voucher having a unit value of € 7,500;
 - Qualification of SMEs: to create conditions for the implementation of measures of adhesion to i4.0 (studies, computerization), in particular in the area of digital management and marketing and e-commerce;
 - Productive Innovation: to implement innovative production solutions using digital processes of digital control;
 - "Research and Technological Development" Mobilization Programs: Promotion and creation of incentives for the development of technologies and models i4.0 transversal and lasting applicability, with a critical impact on the competitiveness of the Portuguese business fabric.
2. **Export Support Facility i4.0.** Launch of a credit line to support SME exports through The Ministry of Economy. This line allows the anticipation of sales at subsidized interest rates, thus mitigating the risk of exporting companies of innovative technology of equipment that integrate technologies 4.0
3. **Reinforcement of the role of Technology Centers.** Within the scope of the Interface Program, it is intended to guarantee conditions to the Technological Interface Centers (CIT) to work more and better with companies, having as counterpart the requirement of their action reflected in the evaluation of their business plans, and the definition of goals medium-long term. This program also aims to increase R & D and innovation capacity in SMEs by enhancing their link to the innovation system through ITC. The Program in question will be directed to the pursuit of three key areas of action: (1) The financial reinforcement of CIT activities and structures; (2) Strengthening highly qualified human resources for CITs by attracting highly qualified human resources; (3) Promoting the development of new areas of expertise, including energy efficiency, the promotion of the circular economy and the digitization of the economy.

4. **Accelerator for incentives to digitize tourism.** Develop an accelerator for competitive incentives for digitization. Create an application guide, systematizing and disseminating in a simple and aggregated way (1) the different possible frameworks within the incentive programs and (2) the necessary requirements and procedures. In addition, a roadmap (tender plan) should be created for applications for incentives to digitize, focusing on transparency, simplification and acceleration of procedures

8. Investments for Digitising European Industry.

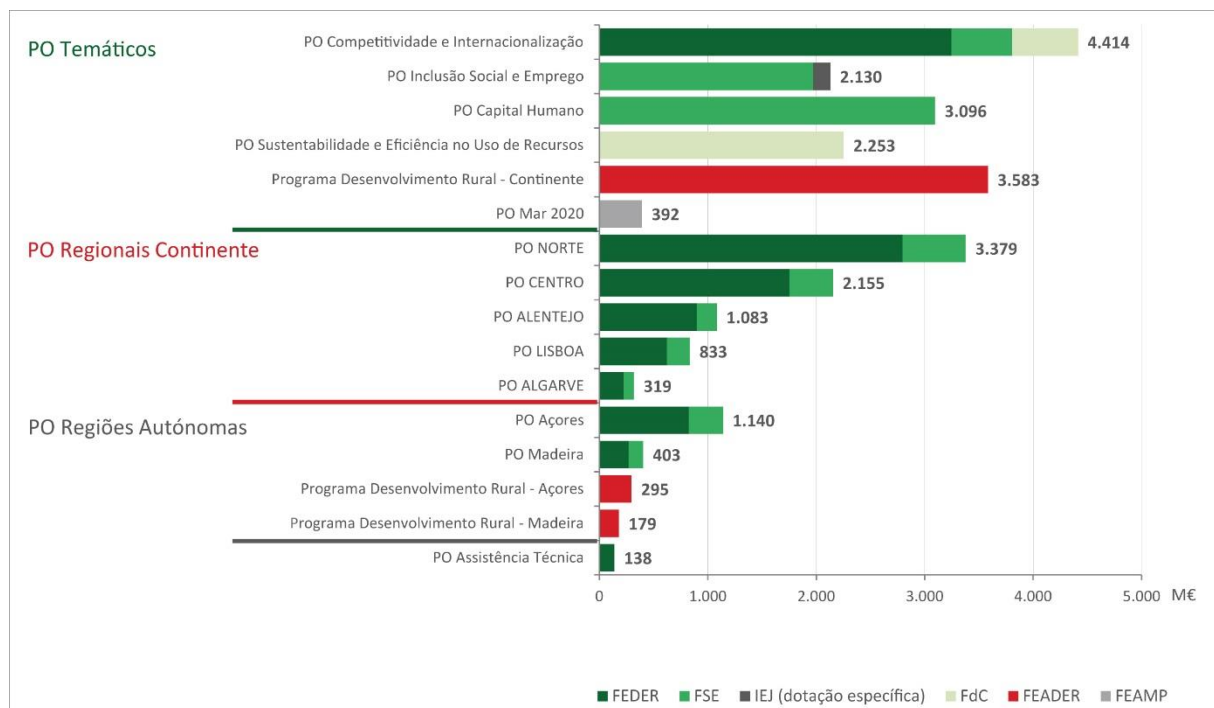
Portugal 2020 is a partnership agreement signed by Portugal and the European Commission that gathers the action of 5 European Structural and Investment Funds - ERDF, Cohesion Fund, ESF, EAFRD and EMFF - in which the programming principles are set out to mark the economic, social and territorial development policy to be promoted in Portugal between 2014 and 2020. These programming principles are aligned with the Smart, Sustainable and Inclusive Growth pursued by EUROPA 2020 strategy.

The main goals of Portugal 2020 policies are: to promote the production of tradable goods and services; to increase exports; to transfer outputs from the scientific system to the productive fabric; the observance of compulsory education currently up to 18 years of age; to decrease early school leaving levels; to integrate people at risk of poverty and to combat social exclusion; to promote sustainable development in terms of resource use efficiency; to strengthen territorial cohesion, particularly in low-density cities and areas and to rationalise, modernise and empower Public Administration.

Through 16 national and regional programmes, Portugal has been allocated EUR 25.79 billion from ESI Funds over the period 2014-2020. With a national contribution of EUR 6.89 billion, Portugal has a total budget of EUR 32.69 billion to be invested in various areas, from employment to energy efficiency as well as entrepreneurship and research and innovation. Portugal 2020 shall be operationalized through 16 Operational Programmes plus the Territorial Cooperation Programmes in which Portugal shall participate together with the other Member-States:

- 4 Thematic Operational Programmes in the Mainland
 - Competitiveness and internationalisation
 - Social inclusion and employment
 - Human capital
 - Sustainability and the efficient use of resources
- 4 Regional Operational Programmes in the Mainland
 - North
 - Center
 - Lisbon
 - Alentejo
 - Algarve
- 2 Regional Programmes in the Autonomous Regions
 - Azores
 - Madeira
- Operational Programme for European Territorial Cooperation
 - Spain-Portugal
 - Madeira-azores-canary islands
 - Atlantic area
 - Southwest Europe
 - Mediterranean
 - Espon, Urbact, Interact and Interreg C

- 3 Rural Development Programmes
 - 1 RURAL DEVELOPMENT PROGRAMME IN THE MAINLAND - PDR 2020
 - 2 in the Autonomous Regions (AZORES and MADEIRA)
 - 1 Programme for the European Maritime and Fisheries Fund (FEAMP)
- OPERATIONAL PROGRAMME MAR 2020
 - 1 Operational Programme for Technical Assistance
- OPERATIONAL PROGRAMME FOR TECHNICAL ASSISTANCE



The ESI funds will:

- Improve entrepreneurship and business innovation, partly by developing the e-economy and fostering small and medium-sized enterprises' access to finance.
- Increase economic competitiveness by boosting the production of tradable goods and services.
- Boost research and development by promoting knowledge transfer between academia and businesses and strengthening innovation systems in enterprises.
- Tackle unemployment by improving the quality of education and training and matching skills and labour-market demand.
- Reduce poverty by improving access to services and supporting the social economy, social innovation and social entrepreneurship.
- Assist in the shift to low-carbon and resource-efficient economy, promote sustainable fishing practices and develop knowledge transfer and innovation in resource efficient agriculture and rural development.
- Support the maritime economy and labour markets in coastal areas.
- Contribute to the modernisation of public administration through capacity building and investment in human resources development and e-governance.

Analysis of National Initiatives for Digitising Industry: Portugal
Portugal indústria 4.0

Under the Portugal Industry 4.0 measures, it is expected that up to 4.5 B€ of investment will be injected into the economy in the next 4 years (2017-2020).