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VOCATIONAL EDUCATION AND TRAINING FOR THE FUTURE OF WORK

PORTUGAL

CEDEFOP REFERNET THEMATIC PERSPECTIVES

Vocational education and training for the future of work: Portugal

Policy strategies and initiatives to prepare vocational education and training (VET) systems for digitalisation and future of work technologies

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CHAPTER 1.
Introduction

In the last decade, the Portuguese government has launched several strategies, initiatives and measures seeking to enhance innovation and competitiveness in the enterprises and hence the economy as a whole.

Some governmental initiatives were keystones in the past, for instance, the Technological plan [Plano Tecnológico] ([1]) launched in 2005 brought a broad awareness to what needed to be prioritised at the national level and linked those priorities to the need to increase the qualifications of the population.

In 2007, the Technological plan for education (PTE) ([2]), was a significant programme to modernise the schools for the future and in the development of ICT skills. The PTE set down an integrated and coherent effort into the update of the technological infrastructure of schools, the provision of online content and services and the strengthening of ICT skills of students and teachers.

In 2009 and connected with PTE a system for training and certification in ICT skills for teachers in primary, lower and upper secondary education ([3]) was created. Training in ICT skills included three levels of courses:

(a) digital competences;
(b) pedagogical and professional ICT competences; and
(c) advanced ICT competences in education.

From 2007 to 2015 the programme e.school [*e.escola*] was developed. It comprised the initiatives *e.escola*, *e.professor*, *e.oportunidades*, *e.juventude*, and *e.escolinha* ([4]). This programme financed actions that facilitated access to the information society and promoted info-inclusion.

The Directorate-General for Education and Science Statistics - DGEEC, has been responsible for several initiatives related to systems and technologies ([5]) as

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([1]) Plano Tecnológico https://dre.pt/application/file/a/466327

([2]) Plano Tecnológico da Educação https://dre.pt/application/conteudo/642198

([3]) Portaria (Ordinance) No 731/2009, de 07 de julho. http://www.dgeec.mec.pt/np4/%7B$clientServletPath%7D/?newsId=244&fileName=Portaria_731_2009.pdf

([4]) Resoluções do Conselho de Ministros [Resolutions of the Council of Ministries] No 51/2008, de 19 de março, https://dre.pt/application/file/a/246469; 12/2011, de 8 de fevereiro https://dre.pt/application/file/a/280386 and revoked by 42-B/2015, de 19 de junho https://dre.pt/application/file/a/67552596

([5]) Direção-Geral de Estatísticas da Educação e Ciência. http://www.dgeec.mec.pt/np4/sistemas_tecnologias/

the Agenda Portugal Digital ([6]); ICT in public administration; technological equipment projects in schools [*Projetos de Apetrechamento Tecnológico nas Escolas*]; schools' digital security, among others.

In 2014, the Research and innovation strategy for smart specialisation ([7]) was approved. It aimed at developing a national research and innovation system within a sustainable framework, with the goal to reduce the weaknesses identified in the report coordinated by the Foundation for Science and Technology (FCT) ([8]) in 2013.

In 2017, it was launched the Strategy ICT 2020 ([9]), which will guide the digital transformation of the Portuguese Public Administration until 2020. It comprises three main strands (i) promotion and integration and interoperability; (ii) innovation and competitiveness; and (iii) resource sharing and investment in digital competences. The last line of action includes the better usage of ICT through training actions and the organisation of ICT skills centres. The government fully reviewed this strategy in 2018 ([10]) to reflect and show the progress made on the implementation of the cross-sectoral and sectoral measures and the related data on investments, savings and economic and social benefits. https://www.incode2030.gov.pt/sites/default/files/2019_digital_government_factsheets_portugal.pdf

The Industry 4.0 - i4.0, is the National Strategy for the digitalisation of the economy ([11]) implemented by the government to develop industry in the digital area, seeking the respond to digitisation, automation and the need for new skills.

Launched in January 2017, 120 enterprises contributed to its design and identification of the current national industry needs and gave particular attention to the SMEs as drivers of change. Through a bottom-up methodology, close to the relevant stakeholders, the government has been reinforcing the urgency to raise awareness about digital transformation and the necessity to have (re)qualified human capital. In 2019, from the 64 measures initial foreseen, 95% were implemented, covering more than 24,000 enterprises and 550 000 people. The second phase of i4.0 started in April 2019.

([6]) Agenda Portugal Digital. http://www.portugaldigital.pt/index/

([7]) Estratégia de Investigação e Inovação para uma Especialização Inteligente.

([8]) FCT. https://www.fct.pt/index.phtml.en

([9]) Estratégia TIC 2020. https://dre.pt/application/file/a/107757079

([10]) https://tic.gov.pt/documents/37177/109352/CTIC_TIC2020_PS-MCTES.pdf/69e27357-1409-ae34-ccee-d533257801cb

([11]) Indústria 4.0 - Estratégia Nacional para a Digitalização da Economia. https://dre.pt/application/file/a/107757079

The Portugal INCoDe.2030 is the National digital competences initiative for 2030 ([12]), aligned with i4.0 it is an integrated public policy to enhance and foster digital competences. After an experimental period of study, it was set in 2018; it is an inter-ministerial initiative that congregates the governmental areas of administrative modernisation; science, technology and higher education; education; labour; planning and Infrastructures; and economy. The purpose is to strengthen the ICT basic skills of the Portuguese population, preparing them for emerging and digital based employment opportunities.

The Strategy for technological innovation and entrepreneurship 2018-30 ([13]) has the objective of ensuring the Portuguese convergence with Europe until 2030, increasing the competitiveness of the economy based on research, development and innovation. Besides, it establishes the settings for qualified employment in Portugal on the international context, together with the increase in investment public and private in R&D.

This strategy values the technology transfer by promoting the enterprise's development capacity, technology transfer offices, interface centres and other institutions, providing training to improve knowledge about these processes or developing a centralised capacity to support these institutions, among others.

Regarding the impact of digitisation on labour relations, collective bargaining shows a very 'timid' approach to these issues. The 2019 Digital economy and collective bargaining ([14]) study, published on 31 January, concluded that there is a broad scope of intervention in monitoring the technological processes. The study collected information on the impact of digital technologies on the practices adopted by the enterprises and the extent to which collective bargaining integrates these or other practices. The respondents identified possible areas of intervention as the incentive of teleworking, the decrease of the working hours in the enterprises, the reconciliation of work and family life, or prevention of work accidents (CRL, 2019).

This issue cannot be apart from the grand discussion about the future of work and the work of the future. The Global Commission on the Future of Work has presented a report to the ILO, in January, offering responses to the fundamental and disruptive changes in working life-taking place around the world due with digitalisation era. The report looks after a human-centred agenda for the future of work to create a development model to regulate the use of technological advances

([12]) Resolução do Conselho de Ministros [Council of Ministers Resolution] No 26/2018, de 8 de março. https://dre.pt/application/file/a/114835001

([13]) Estratégia de Inovação Tecnológica e Empresarial. https://dre.pt/application/file/a/114835000

([14] A Economia Digital e a Negociação Colectiva published by the Centre for Labour Relations [Centro de Relações do Trabalho]. https://en.crlaborais.pt/home

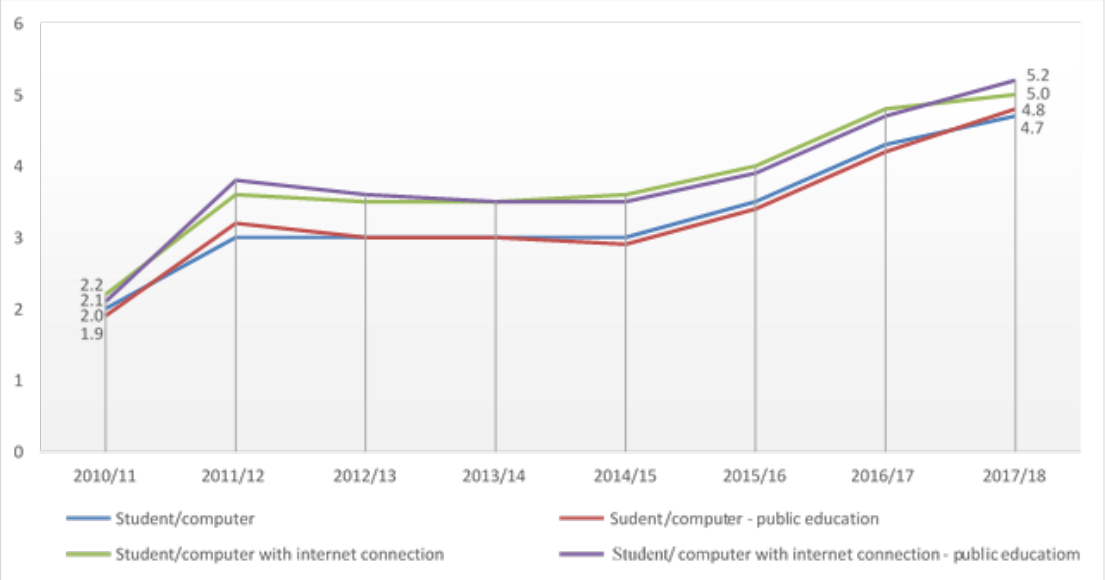
as artificial intelligence and robotics. Therefore the report recommends the establishment of an effective lifelong learning (LLL) ecosystem with the active engagement of the Governments, the employers, workers and educational institutions, to size the new possibilities that digital technologies open up for broad participation in training, as well as the possibility to overcome time and resource constraints through flexible and shorter learning pathways (ILO, 2019).

Security and protection, an increasingly important theme in this context, was revised in 2019 with a new version of the *Estratégia Nacional de Segurança do Ciberespaço* for 2019-2023 (National Strategy Cyberspace Security) ([15]). It also covered the promotion of free, secure and efficient use of the cyberspace by citizens, enterprises and public and private organisation.

Statistic information

Data on technological modernisation of schools (DGEEC, 2019) show an increase in the number of students that use computers with internet connection (Figure 1).

Figure 1. Evolution of the average number of students per computer with an Internet connection



Source: DGEEC, Recursos Tecnológicos das Escolas 2017/2018.

From the data presented in Table 1, there is it is clear the positive evolution in the public schools after the economic crisis. In 2017/18, the results indicated an

([15]) Resolução do Concelho de Ministros [Resolution of the Council of Ministers] n.º 92/2019, de 5 de junho. https://dre.pt/application/file/a/122498847

increase of students with a computer that attended public school (+0,4%), which contrasts with the results of private schools that revealed a decrease (-0,3%).

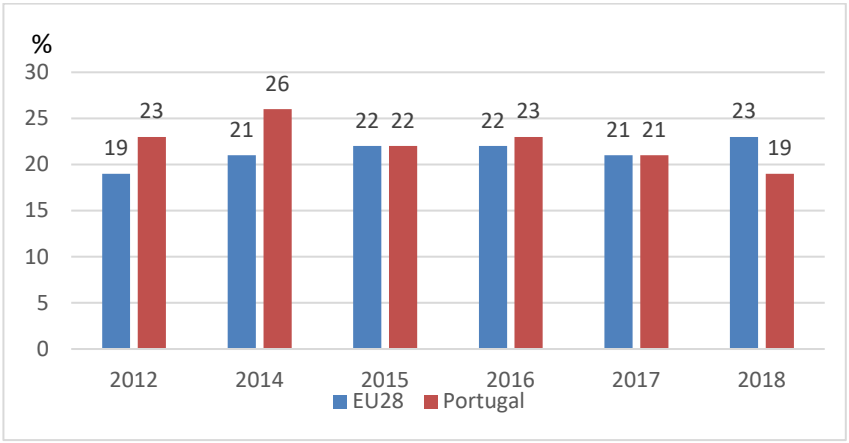
Table 1. Evolution of the average number of students per computer, by public and private educational establishment, 2010/11 to 2017/18

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Total	**2,0**	**3,0**	**3,0**	**3,0**	**3,0**	**3,5**	**4,3**	**4,7**
Public	**1,9**	**3,2**	**3,0**	**3,0**	**2,9**	**3,4**	**4,2**	**4,8**
1st cycle	1,0	3,1	5,8	5,2	5,0	5,4	6,5	6,6
2nd cycle	3,4	3,2	2,5	2,5	2,5	2,9	3,7	4,4
3rd cycle	3,3	3,1	2,5	2,4	2,4	2,8	3,6	4,3
Secondary education	3,4	3,2	2,4	2,4	2,5	2,8	3,6	4,1
Private	**2,3**	**2,5**	**2,7**	**3,2**	**3,8**	**4,1**	**4,5**	**4,2**
1st cycle	1,0	1,2	1,4	2,2	4,2	4,6	5,2	5,3
2nd cycle	6,6	6,5	6,0	5,9	5,6	6,1	6,3	5,9
3rd cycle	5,5	5,3	5,2	5,1	4,6	5,0	5,6	4,8
Secondary education	3,2	3,2	2,9	2,9	2,9	3,1	3,4	3,2

Source: DGEEC, Recursos Tecnológicos das Escolas 2017/2018.

In what concerns the investment of ICT skills, Eurostat data shows that the enterprise's provision on continuing training in the area of ICT area is quite similar to EU-28 average, however with a slight decrease trend when compared with the 2014 national percentage (Figure 2).

Figure 2. Data on enterprises that provided training to develop/upgrade ICT skills of their personnel, 2012-18

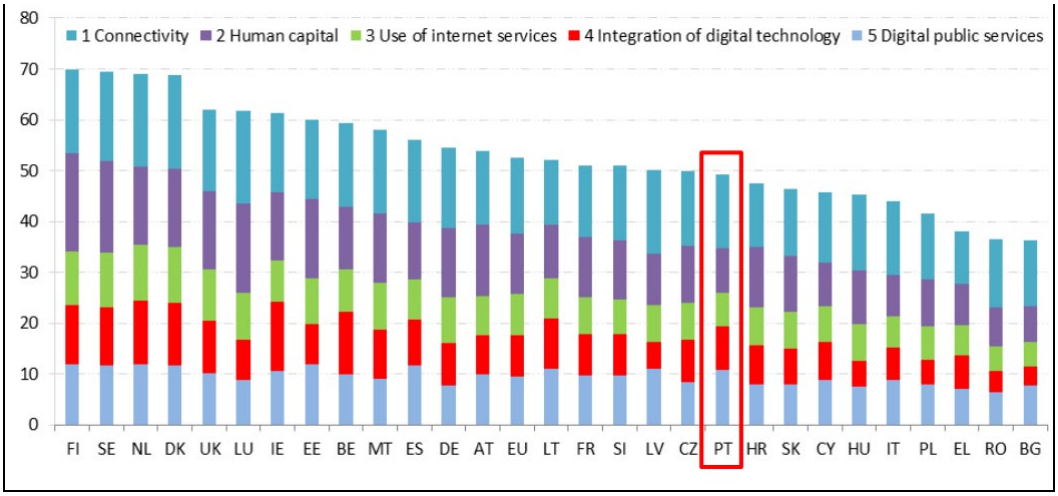


Source: Eurostat, isoc_ske_ittn2 [15.05.2019].

The Digital Economy and Society Index (DESI) (European Commission, 2017) established the following areas:

(a) connectivity (fixed broadband, mobile broadband, broadband speed and prices);
(b) human capital (Internet use, basic and advanced digital skills);
(c) use of Internet (citizens' use of content, communication and online transactions);
(d) integration of digital technology (business digitisation and eCommerce); and
(e) digital public services (eGovernment).

Figure 3. Digital Economy and Society Index 2019 ranking



Source: European Commission. https://ec.europa.eu/digital-single-market/en/desi [accessed in 13.12.2019]

The European Commission stated that over the past year, all EU countries improved their digital performance. However, Portugal ranks 19th out of the 28 EU Member States ([16]). It scored slightly better in four of five dimensions, but this did not improve the ranking. The largest improvement is in the Digital public services dimension due to the increase in the share of e-government users. There was progress in the Connectivity dimension, linked to the improvement in take-up rates for both fixed and mobile ultrafast broadband services. The country performs weakly in both the Human capital and Use of internet services, partly explained by the relatively large number of people who do not use the internet regularly.

([16]) European Commission's Digital Economy and Society Index (DESI) 2019. https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=59908

CHAPTER 2.
VET policy strategies to adapt to digitalisation

The Industry 4.0 has one strategic priority dedicated to Human resources training [*Capacitação de Recursos Humanos*]. This strategic priority aims to adapt the training contents of the national education system to the new technologies and promote measures for training and professional requalification. It has objectives according to the target groups:

(a) compulsory education, including upper secondary VET – to encourage and attract the new generations for ICT, digitisation and automation, preparing them to the current key aspects of the global economy;
(b) higher education – to adapt the universities and polytechnics teaching reinforcing the weight of themes associated with ICT and innovation in contents and activities, preparing the students to the challenges of the labour market;
(c) active population – to promote requalification through transversal initiatives to all generations, ICT retraining for the whole working population.
(d) industry attractiveness – to increase the appeal of the national industrial sector to the new generations, focusing on the awareness of entrepreneurs and decision makers of the national business network for innovation within i4.0.

Moreover, the measures presented are in line with the gaps identified in the DESI regarding the training offers in ICT.

INCoDe.2030 initiative is an integrated programme for Portugal, bringing together and encouraging collaboration between people with different experience and knowledge as well as multiple public and private organisations. It aims to ensure digital literacy and inclusion for the exercise of citizenship; to encourage specialisation in digital technologies and applications for job qualification and a higher value-added economy; and to produce new knowledge in international cooperation.

This initiative has five major priorities:

(1) inclusion – to reach the entire population and promote the digital skills;
(2) education – to provide training to the young people and reinforce the digital skills at all levels of education and lifelong learning;
(3) qualification – to promote the professional training to the working population by provide them with the knowledge needed to integrate a labour market increasingly dependent on digital skills;

(4) specialisation – to promote job qualification and create add-value to the economy by reinforcing offers such as higher professional technical programmes ([17]) and other postgraduate courses;
(5) research – to ensure the development of new knowledge and the active participation in international R&D networks and programmes.

Each of these priorities is associated with a set of public policies objectives and measures whose pursuit is carried out by several institutions and entities.

The coordination of INCoDe.2030 encompasses three permanent structures:

(a) national forum for digital competences – responsible for gathering and coordinating a broad range of private and public enterprises, and institutions, to ensure widespread mobilisation for the initiative, as well as of organising annual events to present and analyse national and international successful experiences and good practices;
(b) coordination structure – supervises the action lines and the initiative as a whole. It promotes and coordinates the activities of each action line to guarantee a common focus and purpose, updates the general and specific goals and objectives;
(c) technical secretariat – monitors, records and reports on the progress of the planned activities, develops the platforms needed for its implementation and communication, in close link with the two above mentioned structures.

An Observatory for digital competences has been set up by DGEEC, in collaboration with the National Institute for Statistics [*Instituto Nacional de Estatística*, INE]. Its mission is to monitor and report on the programme's development, considering the indicators of access; human capital; use; and investment.

The programme *Capacitar* i4.0 ([18]) integrates the national initiatives i4.0 and INCoDe.2030 and aims at qualifying people and organisations to the challenges of the fourth industrial revolution. It has the following objectives:

(d) promote a network of i4.0 academies in enterprises that develop plans to qualify their assets in response to the challenges of the fourth industrial revolution in the fields of 'knowing, knowing how to do and knowing how to be'. Therefore, reducing the time needed to start a new function and increasing the efficiency of the workers and the enterprise, and the quality of the product or service;

([17]) Cursos técnicos superiores profissionais – CTeSP.

([18]) Programa Capacitar i4.0. https://www.iapmei.pt/Paginas/Capacitar-i4-0.aspx

(e) encourage and enable the development of learning factories in i4.0 academies, as demonstrators of innovative technologies, processes, operations and methodologies;
(f) boost the recruitment of researchers in critical areas of i4.0 to ensure technical and scientific excellence in the academies i4.0;
(g) rouse intercompany actions promoted by enterprises and centres for qualification with proven experience in delivering individual and collective training, which contribute to the development of digital skills;
(h) create and test evaluation tools to measure the level of an enterprise's maturity when considering the challenges posed by the industry 4.0;
(i) embolden the creation of action plans and reference contents available in a universal and freeway, via e-learning, to boost self-training and qualify the demand for services, aligned with evaluation and diagnostic tools;
(j) heighten the creation of a network of qualified trainers in the field of i4.0, ensuring that the i4.0 academies training meet the challenges of the market with technical excellence;
(k) propose the alignment of i4.0 themes in R&TD partnerships.

CHAPTER 3.

VET 4.0 initiatives and programmes

The priorities for the education policies established in 2018 legislation ([19]) reinforce the promotion of ICT in the curricula and are according to the principles set in the Exit profile of students leaving compulsory education in 2017, starting from primary to upper secondary education.

It is worth to mention the project for autonomy and curriculum flexibility of schools ([20]) launched in 2017 and aimed at defining the guiding principles and rules for the design, implementation and evaluation of the curriculum for primary, lower and upper secondary education. It is guided by the principles and goals delineated in the Exit profile of students leaving compulsory education where it is present the reference to the digital. The project started its implementation in a pedagogical experience basis and allowed the authorities to monitor and evaluate it, which is critical to its redevelopment. This project links to other programmes and initiatives as the National skills strategy and the INCoDe.2030.

The National network of programming and robotics clubs [*Clubes de programação e robótica*] (CPR) ([21]) is an initiative of the education ministry, launched in the school year 2014/2015 that reached a significant projection with 269 clubs registered in 2019. The CPR are open to all students up to a limit established by each school subject to the teachers' availability. There are regional and national events where each club can participate with a maximum of four students. The various types of programming languages are gaining increasing importance in today's world, and are fundamental not only in the area of the STEM (sciences, technology, engineering and mathematics), but also in other areas, as they help in the development of transversal competences such as analytical thinking, problem-solving, collaborative work, and creativity.

In 2018 the European framework for the digital competence of educators [*Quadro Europeu de Competência Digital para Educadores*] (DigCompEdu) ([22]) was published to support teachers and trainers at all levels of education including adult learning.

([19]) Decreto-Lei (Decree-Law) No 55/2018, de 6 de julho https://dre.pt/application/file/a/115648908 and Despacho (Order) No 6478/2017, de 26 de julho) https://dre.pt/application/file/a/107756793

([20]) Despacho (Order) No 5908/2017, de 5 de julho. https://dre.pt/application/file/a/107635109

([21]) CPR. http://erte.dge.mec.pt/clubes-de-programacao-e-robotica

([22]) DigCompEdu. http://area.dge.mec.pt/download/DigCompEdu_2018.pdf

The Institute for Employment and Vocational Training (IEFP) is the public employment service responsible for the co-coordination of the third priority of INCoDe.2030 - Qualifications.

Since 2016, and to guarantee the fulfilment of the INCoDe.2030 objectives, IEFP has defined a minimum percentage of training courses in information technology, communications and electronics, for each activity plan of its network of employment and vocational training centres.

In the 2019 IEFP activity plan, the strategic guidelines pointed to the promotion of digital competences with a particular focus on the:

- definition of a minimum percentage of ICT and Electronic – TICE ([23]) in the training courses provided by each of IEFP's vocational training centres;
- investment in the professional qualification of graduates in the TICE area, in strategic partnerships with sector organisations and higher education institutions;
- creation of training paths in digital citizenship competences;
- implementation of Technology academies, geared towards training in digital competences, in the IEFP's vocational training centres, in close collaboration with enterprises and clusters.

In the scope of INCoDe.2030, IEFP is responsible for the strategy 'Digital competences plus' ([24]) which is designed to qualify unemployed people with a higher education degree, and through the training in competences for digital citizenship, in implementation on the second half of 2019. It foresees a pilot project involving about 5 000 people.

In 2018, IEFP financed the following initiatives:

- Training for digital citizenship – are modular training courses certified under INCoDe.2030 and aligned with the Dynamic reference framework of digital competences. IEFP developed them to raise the digital literacy levels of the population. These courses target people over 18 years old, employed or unemployed, but with a particular focus on those with the lowest levels of digital literacy. IEFP developed them in partnership with the Vocational Training Centre for Electronics, Energy, Telecommunications and Information Technology Industry [Centro de Formação Profissional da Indústria Electrónica, Energia, Telecomunicações e Tecnologias da Informação] (CINEL) ([25]) and the Agency for Administrative Modernisation [Agência para a Modernização Administrativa]

([23]) *Tecnologias de Informação, Comunicação e Eletrónica* – TICE.

([24]) *Competências Digitais Mais.*

([25]) CINEL. https://www.cinel.pt/appv2

(AMA) ([26]). The courses are going to be tested in a pilot project and soon implemented.

- Huawei laboratories – under the Memorandum of Understanding signed in 2017 between the Portugal and China, IEFP has been developing contacts with Huawei to install Huawei laboratories in the IEFP's network of employment and vocational training centres.

The consultation phase for the acquisition of training equipment is underway, as well as the validation and comparison of Huawei's training programmes with the training standards of the National Qualifications Catalogue [Catálogo Nacional de Qualificações] (CNQ), to map them and facilitate the process of attributing Huawei certifications. This process is being developed in collaboration with CINEL and includes the promotion of specific training courses.

- Cisco networking academies – under the Memorandum of Understanding signed in July 2015, between IEFP and Cisco Systems Inc., these academies allowed the possibility of implementing the Cisco programme in IEFP's network of employment and vocational training centres.

Currently, IEFP is implementing Cisco academies based on training programmes for the development of competencies in ICT, recognised worldwide, and that enable the trainees to obtain a specific Cisco certification (CompTIA A +, Cisco CCENT, Cisco CCNA Routing and Switching, Cisco CCNA Security, among others). In 2019, 472 students participated in Cisco academies.

These academies, however, do not have the monopoly of training when it comes to computer network management, but only serve as support units to the preparation for Cisco exams and certification at a national level. Any of the IEFP's vocational training centres can promote professional training in the area of computer network management.

The courses defined by Cisco focus on setting up, maintenance, management and security of computer networks themes, e.g. networking essentials; CCNA R&S: introduction to networks, routing and switching, security; introduction to internet of things; introduction to cybersecurity (out site the CNQ); NDG Linux essentials; NDG introduction to Linux I; entrepreneurship; get connected.

- Samsung tech labs – a cooperation agreement between IEFP, Samsung Eletrónica Portuguesa S.A. and CINEL, signed in 2013, had the objective of promoting a whole set of initiatives to contribute to the qualification of professionals in the area of electronics and automation, especially young people, thus enhancing their employability.

([26]) AMA. https://www.ama.gov.pt/

This cooperation allowed the promotion of initiatives such as vocational training or training of trainers in particular areas of electronics and laboratories equipped with the most recent tools. In the following years, the agreement was reinforced and extended to four IEFP's employment and vocational training centres. It contributed to promoting quality and innovation in vocational training, as well as the acquisition of innovative technical skills that can contribute to modernisation and competitiveness of enterprises.

- Microsoft IT Academies – a cooperation agreement between IEFP and Microsoft Portugal was signed in 2014. This agreement includes:

(a) Microsoft Office Pro Plus licenses providing, by Microsoft, free of charge, to all of IEFP's registered unemployed in vocational training centres;

(b) 30 Microsoft IT Academies set at the IEFP's network of Professional Training Services and aiming at:

- providing professional training in the field of Information Technology, using Microsoft Platforms; and
- promoting exams for Microsoft Certification under a broad range of certifications.

In 2019, 1 450 students got a Microsoft certification, promoted by these academies

The National Agency for Qualification and Vocational Education and Training (ANQEP) participates in the first priority of INCoDe.2030 - Inclusion. Within the first priority ANQEP took part in the Working Group responsible for the development of the National Digital Competence Dynamic Reference Framework (QDRCD) ([27]) designed in line with the European Digital Competence Framework for Citizens, DigComp 2.1.

The QDRCD has three main objectives (a) to support the definition of policies and strategies; (b) to design education programmes, and; (c) to evaluate and certificate skills, either by self-diagnosis or by certifying entities.

ANQEP integrated training units regarding Digital Literacy in the National Catalogue of Qualifications with the intention of promoting the acquisition of competences for the qualification of an effective digital citizenship. It also reviewed the key-competences standard for adults – basic education, namely the areas of competences such as digital competences; citizenship and professionalism; and personal, social and learning competences.

([27]) Quadro Dinâmico de Referência de Competência Digital, *Despacho (Order) n.º 1088/2019 de 31 de janeiro*. https://www.incode2030.gov.pt/en/featured/incode2030-releases-digital-competence-dynamic-reference-framework

Concerning the third priority of INCoDe.2030 - Qualification, ANQEP is responsible for:

(a) identification of digital skills needs for employability, in close linkage with the System of anticipation of qualification needs (SANQ) and the labour market;
(b) ICT offers in the CNQ that grant qualifications at level 4 and 5 of the QNQ ([28]), including the access to specialised certifications;
(c) update and qualification of active adults, employed and unemployed, namely long-term unemployed registered in the *Qualifica* centres.

Finally and regarding the financial support, the Operational Programme Human Capital [*Programa Operacional Capital Humano*] (POCH) reprogramming, approved by the EC in November 2018, reinforced the allocation of funds to the strategic priority related to the adults' qualification. It took into account the increased focus on the development of transversal and specialised digital skills, under the *Qualifica* Programme, aligned with INCoDe.2030 objectives as the long-term courses that integrate ICT training modules.

POCH prepared a call to support ANQEP's mission ([29]) of updating the CNQ and its training standards with the essential qualifications for the competitiveness and modernisation of the economy.

Within the resources available, POCH supports other initiatives that aim at strengthening mechanisms for adjusting qualifications' supply and demand is open. It allows an increased alignment with the New Skills Agenda considering that POCH promotes LLL, namely the *Qualifica* centres, adult education and training programmes/courses (cursos EFA) and the apprenticeship programmes.

POCH funds two projects in the scope of the *Estrutura de missão Portugal Inovação Social* (EMPIS): 'Make code' and 'Learning and teaching math'.

The Make Code - *Programa o teu futuro* is an initiative of the *Fundação da Juventude*, with the support of Microsoft, in the area of education, which aims at contributing to the improvement digital skills of young people, teachers and schools in the north of Portugal. It offers them a programme increase digital literacy by introducing them to coding and computer science. It uses two tools to support creation and design using. By making physical or virtual objects, students can create an environment to learn coding concepts. Both tools offer an immersive experience that translates code into a visual representation. On the other hand, it also aims at nurturing the innovative, inventive and enterprising side of

([28]) The Quadro Nacional de Qualificações is in line with EQF, Portaria (Ordinance) No 782/2009 de 23 de Julho. The *Quadro Nacional de Qualificações* is in line with EQF, *Portaria* (Ordinance) *No 782/2009 de 23 de Julho*.

([29]) Article 3 of the Decreto-Lei (Decree-Law) No 36/2012, de 15 de fevereiro. https://dre.pt/application/file/a/542957

adolescents. It covered 7 800 students; 580 teachers and 49 school-grouping with almost 280 thousand euros

The Learning and teaching math [*Aprender e ensinar Matemática com a Khan Academy*] is a project that promotes the improvement of quality in teaching and learning mathematics by using digital resources available in the Khan Academy platform. It targets teachers and students at primary and lower secondary education, and covers the centre and north regions of Portugal, with 280 and 250 thousand euros respectively. It contributes to the universal access to innovative educational resources and strategies, boosting the motivation and autonomous learning of students and driving increased rates of school success.

In addition to the above-mentioned projects, POCH funding is available for VET programmes (ISCED 3), where the volume of investment is higher. Among them, there are some areas where ICT is predominant, although indirectly, and contributing to promoting the development of digital skills. They are, among others: the computer sciences; electronics and automation; audio-visual and media production.

CHAPTER 4.

Using 4.0 intelligence for VET

INCoDe.2030 strategic priority five - research, has a particular link with intelligence, generally called 'Big Data', the computational biology and bioinformatics, photonics, advanced and cognitive computing and automatic learning, cybersecurity and cybernetic systems.

From the 15 research projects in artificial intelligence and data science in Public Administration, funded by FCT, two focused on education. These projects seek to find innovative ways of relating data, finding patterns, anticipating failures and optimising processes in the Public Administration.

The first, entitled 'Modeling the flow of students in the Portuguese education system' [Modelação do fluxo de estudantes no sistema de ensino Português] aims at defining organisational policies of the education system that help in taking specific corrective measures.

The second, called 'Understanding the determinants of academic performance: evidence from the Portuguese upper secondary system' [Compreender os determinantes do desempenho académico: evidências do sistema de ensino secundário português], has as primary objective the creation of an early warning system that signals the students that are most likely will not complete compulsory education.

Private initiatives related with needs of enterprises started to be publicly presented. For instance, the platform for descriptive and predictive analysis of the labour market in Portugal, developed by Randstad, called XPT (eXperience PorTugal) allows supporting the enterprise recruitment operations and help clients in strategic decision to acquire and retain talent. This information is supported by public data, such as macroeconomic information, unemployment, migration flows, and education, among others.

In 2019, was launched the AI Portugal 2030, an innovation and growth strategy to foster Artificial Intelligence ([30]).

The strategy states that in terms of human resources, data from 2017 show that Portugal has a shortage of qualified people in 'advanced technological areas, mostly in higher education (67% of EU average in 2017), but also in lifelong learning (88.8%) and new PhDs (94%)'. However, it states only broad objectives for education, qualification and specialisation.

([30]) https://www.portugal.gov.pt/download-ficheiros/ficheiro.aspx?v=236848b1-fcb6-4c65-9773-292d1c5b9ad1.

CHAPTER 5.

VET 4.0 learning practices

The social partners have been implementing regular learning practices focusing on using digital and i4.0 technologies.

The Portuguese Commerce and Services Confederation [*Confederação do Comercio e Serviços de Portugal*] (CCP) and the Institute for Social and Economic Studies [*Instituto de Estudos Sociais e Económicos*] (IESE) are currently developing a study on qualifications and ICT to be published by the end of January. This study called 'Qualifications based on learning outcomes for commerce and services sector, including ICT' will update the existing training standards for qualifications in the trade and services sector and intends to show the impact of the ICT in the professions of the sector. Following the diagnosis resulting from the study, it may lead to the design of new qualifications.

In June 2018, CCP launched the 'Digital Commerce Programme' [*Programa Comércio Digital*] ([31]) in cooperation with the Portuguese Association of Electronic Commerce and Interactive Advertising [*Associação Economia Digital*] (ACEPI) ([32]). It aims at inspiring entrepreneurs to introduce digitalisation in their business through the adoption of a digital presence, to incorporate technology into their business models and to simplifying the processes with customers and suppliers using ICT.

Since 2005, the CCP develops the 'Dinamizar' project. This project, based on a training-action methodology, targets SMEs up to 100 trade and service workers and offers on-the-job training and consultancy services. It intends to increase the qualifications' level of entrepreneurs and workers; and to improve their management models. The fifth edition of the 'Dinamizar' project, financed by Compete 2020, will start in 2019 and include a theme dedicated to digital economy directed to enterprises that want to implement digital strategies in their business models and increase their skills in this area. This theme is going to support enterprises to enter into the digital economy; to facilitate the digital transformation and a business' online presence; to improve the work processes by increasing the speed, accuracy and effectiveness of ICT-related tasks; and increase digital literacy in SMEs in the sector.

The LIDIA project ([33]) promoted by the Institute of Education [*Instituto de Educação da Universidade de Lisboa*] aimed at assisting the digital integration of

([31]) Programa Comercio Digital. https://www.comerciodigital.pt/

([32]) ACEPI. https://www.acepi.pt/

([33]) LIDIA project. http://lidia.ie.ulisboa.pt/

adults. It set proposals of activities with digital technologies for professionals working specifically with adults. In a LLL perspective, this project tackled education problems, adults' training and qualification, regarding ICT, and aligns its action to encourage literacy, digital inclusion and qualification.

This project targeted primarily trainers, social animators, social and educational staff, working in potential learning contexts, both formal and non-formal. Especially professional involved in the facilitation and implementation of actions that deal with those typically more excluded from the information society, namely, professionals responsible for cultural, educational and social fields in local administration offices; private social institutions; cultural and recreational associations; museums; universities; senior day centres; teachers; etc.

The above-mentioned QDRCD ([34]) (see point 4) presents a frame with four broader scopes:

(a) support the definition of policies and strategies, allowing a mapping of digital competencies articulated with other standards;
(b) design education programmes, in particular curricular revision;
(c) promote and support the development of training programmes, citizenship, and employability skills;
(d) assess and certify skills, either by self-diagnosis or by certificating institutions.

The QDRCD adapted the European Digital Competence Framework for Citizens to the national context. There was a revision of designations and of some competences; the 'Programming' competence was excluded because it is mirrored either in some of the competences of Area 5 - Solution development or at the Highly specialised level, transversal to all competences. It reduced the number of proficiency levels to four, unlike the eight levels in DigComp 2.1. The base for this decision is the attainable difficulty in operating eight levels, specifically the differentiation factors used for levels 5 and above.

([34]) Despacho (Order) n.º 1087/2019, de 31 de janeiro. https://dre.pt/application/file/a/118890407

CHAPTER 6.

Adapting to AI and automation

Portugal adopted a National strategy for AI (see point 5) in middle 2019. The INCoDe.2030 (technical coordination of the programme) promotes the strategy called 'AI Portugal 2030' in cooperation with the *Fundação para a Ciência e Tecnologia* (FCT); Agência Nacional de Inovação (ANI), *Ciência Viva* and *Agência para a Modernização Administrativa* (AMA).

It aims at promoting research and innovation in the AI area, to develop and apply it in fields such as public administration, education, training and business. Portugal is thus in line with the EC directives that aim to encourage Member States to promote the development and use of AI in Europe.

At this stage is too early to speak about national training programmes with specific focus on enabling adults to understand the implications of AI or to learn AI methods. There are no national training programmes to assist adults who may have been displaced by their jobs due to automation.

CHAPTER 7.
Conclusions – main challenges and outlook

The Portuguese economy been performing considerably well in the last few years. The GDP is the highest since 2007 and in 2019, in spite of a slower GDP growth the economic outlook remains favourable. On the other hand, the stable situation of the labour market is expected to contribute to a positive scenario.

In what concerns digitalisation, the country remains among the EU leaders in the area of digital public services in terms of both demand and supply according to the EC digital scoreboard. Portugal has the infrastructures and the innovation capacity needed to take a lead in the fourth industrial revolution (European Commission, 2017). However, qualifying the population with digital competences is a huge challenge, with several political, economic, cultural and social dimensions.

A recent report (OECD, 2019) on the priorities for adult learning (PAL) states that Portugal is among the countries that are not ready to tackle their urgent skill challenges. According the study, the urgency and financing are the dimensions of the PAL dashboard more crucial, followed by the flexibility.

To respond to these needs the government, elected in October 2019, included in their programme for the next four years important measures concerning the digital competences (science, education and training). Among them, there is political will to intervene in several different areas, as such:

- Wider the higher education, considering that it is the answer to many challenges hold by the digital society;
- Lead the digital competences at all educational levels, through the reinforcement of the INCoDe.2030 and the qualification of human resources in a transverse and long term perspective;
- Foster computer education. More than ICT skills, it contributes to the development of so-called computing thinking; techniques and methods for solving problems; creating the ability to design systems and to understand the power and limits of human and artificial intelligence.
- Promote the digitalisation of schools through the generalisation of digital competences among students, teachers and schools communities;
- Strengthening the link between VET and the labour market namely through the generalisation of digital competences to all levels of training;
- Promote the digital citizenship as a priority to guarantee that the whole population have access to digital technologies;
- Develop programmes modernise schools and increase the internet connectivity and to promote the transversal integration of technologies in the

different curricula. It will increase the use of digital resources and the teaching of code and robotic.

Abbreviations and acronyms

ACEPI	Portuguese Association of Electronic Commerce and Interactive Advertising [Associação Economia Digital]
ANQEP	National Agency for Qualification and VET [Agência Nacional para a Qualificação e o Ensino Profissional]
AMA	Agency for Administrative Modernisation [Agência para a Modernização Administrativa]
CCP	Commerce and Services Confederation [Confederação do Comercio e Serviços de Portugal]
CINEL	Vocational Training Centre for Electronics, Energy, Telecommunications and Information Technology Industry [Centro de Formação Profissional da Indústria Electrónica, Energia, Telecomunicações e Tecnologias da Informação]
CNQ	National Qualifications Catalogue [Catálogo Nacional de Qualificações]
CPR	National network of programming and robotics clubs [Clubes de programação e robótica]
DESI	Digital Economy and Society Index
DGEEC	Directorate-General for Education and Science Statistics [Direção-Geral de Estatísticas da Educação e Ciência]
FCT	Foundation for Science and Technology [Fundação para a Ciência e a Tecnologia]
ICT	Information communication and technology
IEFP	Institute for Employment and Vocational Training [Instituto de Emprego e Formação Profissional]
IESE	Institute for Social and Economic Studies [Instituto de Estudos Sociais e Económicos]
INE	National Institute for Statistics [Instituto Nacional de Estatística]
LLL	Lifelong learning
POCH	Operational Programme Human Capital [Programa Operacional Capital Humano]
PTE	Technological plan for education
QDRCD	Dynamic reference framework for digital competence [Quadro Dinâmico de Referência de Competência Digital]
QNQ	Quadro Nacional de Qualificações
SANQ	System of the anticipation of qualifications needs [Sistema de Antecipação de Necessidades de Qualificações]
VET	Vocational education and training

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