



**DELIVERABLE D3.2:**  
**"IDENTIFICATION OF THE GROWTH OPPORTUNITIES FOR THE  
SME ECOSYSTEM UNDER THE MAJOR ECONOMIC &  
SOCIETAL CHANGE OF THE 4TH INDUSTRIAL REVOLUTION  
– IDENTIFICATION OF SECTORS & OPPORTUNITIES -  
PROPOSAL OF THE APPROPRIATE STRATEGIES, POLICIES  
& METHODS"**

PROJECT TITLE:	Enabling SMEs for the 4th Industrial Revolution
PROJECT ACRONYM:	4th Industrial Revolution
MIS CODE:	5070969
PROJECT WEBSITE	<a href="http://www.4thindustrialrevolution.eu">www.4thindustrialrevolution.eu</a>
WORK PACKAGE:	WP5: 4th Industrial Revolution Forum
RESPONSIBLE PARTNER:	Association of Information Technology Companies of Northern Greece (SEPVE)
CONTRIBUTING PARTNERS:	Centre for Research and Technology Hellas (CERTH) Regional Chamber of Skilled Crafts Association, Haskovo
SUBCONTRACTOR	EUROCONSULTANTS S.A.

The 4th Industrial Revolution project is co-funded by the ERDF and by national funds of the countries participating in the INTERREG Greece-Bulgaria 2014-2020 Cooperation Programme

The contents of this publication are sole responsibility of the Association of Information Technology Companies of Northern Greece (SEPVE) and can in no way be taken to reflect the views of the European Union, the participating countries, the Managing Authority and the Joint Secretariat.

The 4<sup>th</sup> *INDUSTRIAL REVOLUTION* project Partnership is the following:

No	Beneficiary Name	Short Name	Country
LB (PB1)	Association of Information Technology Companies of Northern Greece	SEPVE	GREECE
PB2	Centre for Research and Technology Hellas	CERTH	GREECE
PB3	Regional Chamber of Skilled Crafts Association, Haskovo		BULGARIA



## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION</b> .....	<b>8</b>
1.1	PURPOSE AND SCOPE.....	8
1.2	DELIVERABLE STRUCTURE.....	8
<b>2</b>	<b>GROWTH OPPORTUNITIES FOR THE SME ECOSYSTEM</b> .....	<b>9</b>
<b>3</b>	<b>IDENTIFICATION OF ECONOMIC SECTORS IN THE CBC AREA</b> .....	<b>19</b>
3.1	GREECE.....	19
3.1.1	<i>Dominant economic sectors in the Greek side of the CBC area</i> .....	23
3.2	BULGARIA .....	26
3.2.1	<i>Dominant economic sectors in the Bulgarian side of the CBC area</i> .....	29
3.2.2	<i>Blagoevgrad district</i> .....	34
3.2.3	<i>Smolyan district</i> .....	36
<b>4</b>	<b>OPPORTUNITIES</b> .....	<b>44</b>
4.1	EU PROGRAMMES THAT CAN BE EXPLOITED BY GREEK SMES.....	44
4.1.1	<i>EU programmes to be exploited exclusively by Greek SMEs</i> .....	45
4.1.2	<i>EU programmes to be exploited by SMEs across Europe</i> .....	50
4.1.3	<i>Other EU Initiatives [33]</i> .....	57
4.2	EU PROGRAMMES THAT CAN BE EXPLOITED BY BULGARIAN SMES.....	59
4.2.1	<i>Opportunities to encourage the development of small and medium-sized enterprises (EU funded instruments)</i> .....	59
4.2.2	<i>Financing from the European Structural and Investment Funds in Bulgaria</i> .....	59
4.2.2.1	<i>Programme "Competitiveness and Innovation in Enterprises" 2021 – 2027</i> .....	59
4.2.2.2	<i>Programme "Research, Innovation and Digitization for Smart Transformation" 2021 – 2027</i> ....	60
4.2.2.3	<i>Programme "Human Resources Development" 2021 – 2027</i> .....	61
4.2.3	<i>Financing by the Recovery and Resilience Plan</i> .....	61
4.2.4	<i>Financing from seed, venture and mezzanine funds</i> .....	63
4.2.5	<i>Financing from the Cooperation Programme Interreg VI-A "Greece-Bulgaria 2021 – 2027"</i> .....	64
<b>5</b>	<b>POLICIES AND MEASURES</b> .....	<b>65</b>
5.1	DIGITAL TRANSFORMATION IN EUROPE .....	65
5.2	OVERVIEW OF EU LEVEL POLICIES FOR SMES .....	67
1.1.1	<i>The Small Business Act (SBA)</i> .....	68
1.1.2	<i>The e-government action plan (2011-2015)</i> .....	72
1.1.3	<i>An action plan to improve access to finance for SMEs – COM (2011) 870</i> .....	72
1.1.4	<i>EU Regional Policies</i> .....	72
1.1.5	<i>EU Competition Policy</i> .....	73
1.1.6	<i>EU Strategic Policy</i> .....	73
1.1.7	<i>EU Policy for SMEs post-2020</i> .....	74
5.3	NATIONAL POLICES AND MEASURES IN GREECE .....	75
1.1.8	<i>Research and Innovation Strategy for Smart Specialization (2021-2027)</i> .....	76
1.1.9	<i>Greece 2.0 National Recovery and Resilience Plan</i> .....	78
5.4	NATIONAL POLICES AND MEASURES IN BULGARIA .....	82
5.4.1	<i>Policy for smart specialization in the new programming period (2021 – 2027)</i> .....	83
5.4.2	<i>National strategy for small and medium-sized enterprises 2021 – 2027</i> .....	86
<b>6</b>	<b>CONCLUSIONS</b> .....	<b>89</b>
<b>7</b>	<b>REFERENCES</b> .....	<b>90</b>

## TABLE OF FIGURES

FIGURE 1: STELLBA HYDRO GMBH LOGO .....	13
FIGURE 2: STAM LOGO .....	13
FIGURE 3: DIAGNOSTIQA LOGO .....	14
FIGURE 4: SCHÄLLIBAUM AG LOGO .....	15
FIGURE 5: NOVOCAPTIS COGNITIVE SYSTEMS & ROBOTICS LOGO .....	15
FIGURE 6: 01TM MECHATRONICS LOGO .....	16
FIGURE 7: OZZIE ROBOTICS LOGO .....	16
FIGURE 8: BAZIGOS S.A. LOGO.....	17
FIGURE 9: PERNOD GROUP LOGO .....	18
FIGURE 10: PRAGMA IOT LOGO .....	18
FIGURE 11: ECONOMIC SECTORS' CONTRIBUTION TO GREECE'S OVERALL GVA [9].....	20
FIGURE 12: GREECE'S ECONOMIC SECTORS SHARE DISTRIBUTION [9] .....	21
FIGURE 13: INCOME SHARE OF EACH MAJOR SECTOR IN THE ENTIRE GREEK CBC SECTOR AND EACH SEPARATE REGION [11] .....	22
FIGURE 14: GREEK CBC'S SHARE DISTRIBUTION [11].....	22
FIGURE 15: GREEK CBC'S SERVICE SECTOR SHARE DISTRIBUTION [11].....	23
FIGURE 16: GREEK CBC'S INDUSTRY & CONSTRUCTION SECTOR SHARE DISTRIBUTION [11] .....	24
FIGURE 17: SHARES OF INDUSTRY SUBSECTORS IN THE GREEK CBC AREAS [11] .....	24
FIGURE 18: GREEK CBC'S INDUSTRY & CONSTRUCTION SECTOR SHARE DISTRIBUTION [11] .....	25
FIGURE 19: GREECE COMPARED TO EU COUNTRIES' DIGITAL MATURITY AND INDUSTRIAL SIZE .....	26
FIGURE 20: DISTRICTS IN THE CROSS-BORDER REGION BETWEEN BULGARIA AND GREECE (SOURCE: WWW.GREECE-BULGARIA.EU).....	26
FIGURE 21: NUMBER OF ENTERPRISES BY SECTORS IN THE CROSS-BORDER REGION OF BULGARIA WITH GREECE (SOURCE: NATIONAL STATISTICAL INSTITUTE).....	29
FIGURE 22: NUMBER OF EMPLOYED PERSONS IN THE ENTERPRISES BY SECTORS IN THE CROSS-BORDER REGION OF BULGARIA WITH GREECE (SOURCE: NATIONAL STATISTICAL INSTITUTE) .....	30
FIGURE 23: NET SALES REVENUES BY SECTORS IN THE CROSS-BORDER REGION OF BULGARIA WITH GREECE (SOURCE: NATIONAL STATISTICAL INSTITUTE).....	31
FIGURE 24: EXPORTS OF ENTERPRISES BY SECTORS IN THE CROSS-BORDER REGION OF BULGARIA WITH GREECE (SOURCE: NATIONAL STATISTICAL INSTITUTE).....	31
FIGURE 25: LOCATION OF BLAGOEVGRAD DISTRICT ON THE TERRITORY OF BULGARIA (SOURCE: NATIONAL STATISTICAL INSTITUTE) .....	34
FIGURE 26: NUMBER OF ENTERPRISES IN BLAGOEVGRAD DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE).....	35
FIGURE 27: NUMBER OF EMPLOYED PERSONS IN THE ENTERPRISES IN BLAGOEVGRAD DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE).....	35
FIGURE 28: NET INCOME FROM SALES OF THE ENTERPRISES IN BLAGOEVGRAD DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE) .....	36
FIGURE 29: EXPORTS OF THE ENTERPRISES FROM BLAGOEVGRAD DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE) ...	36
FIGURE 30: LOCATION OF SMOLYAN DISTRICT ON THE TERRITORY OF BULGARIA (SOURCE: NATIONAL STATISTICAL INSTITUTE).....	37
FIGURE 31: NUMBER OF ENTERPRISES IN SMOLYAN DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE).....	37
FIGURE 32: NUMBER OF EMPLOYED PERSONS IN THE ENTERPRISES IN SMOLYAN DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE).....	38
FIGURE 33: NET INCOME FROM SALES OF THE ENTERPRISES IN SMOLYAN DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE) .....	38
FIGURE 34: EXPORTS OF THE ENTERPRISES FROM SMOLYAN DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE) .....	39
FIGURE 35: LOCATION OF KARDJALI DISTRICT ON THE TERRITORY OF BULGARIA (SOURCE: NATIONAL STATISTICAL INSTITUTE) .....	39
FIGURE 36: NUMBER OF ENTERPRISES IN KARDJALI DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE).....	40
FIGURE 37: NUMBER OF EMPLOYED PERSONS IN THE ENTERPRISES IN KARDJALI DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE) .....	40
FIGURE 38: NET INCOME FROM SALES OF THE ENTERPRISES IN KARDJALI DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE) .....	41
FIGURE 39: EXPORTS OF THE ENTERPRISES FROM KARDJALI DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE) .....	41

FIGURE 40: LOCATION OF HASKOVO DISTRICT ON THE TERRITORY OF BULGARIA (SOURCE: NATIONAL STATISTICAL INSTITUTE)	42
FIGURE 41: NUMBER OF ENTERPRISES IN HASKOVO DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE)	42
FIGURE 42: NUMBER OF EMPLOYED PERSONS IN THE ENTERPRISES IN HASKOVO DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE)	43
FIGURE 43: NET INCOME FROM SALES OF THE ENTERPRISES IN HASKOVO DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE)	43
FIGURE 44: EXPORTS OF THE ENTERPRISES FROM HASKOVO DISTRICT (SOURCE: NATIONAL STATISTICAL INSTITUTE)	44
FIGURE 45: DIGITAL ECONOMY AND SOCIETY INDEX (DESI) 2022 RANKING: GREECE	45
FIGURE 46: DIGITAL TRANSFORMATION OPERATIONAL PROGRAM [36]	46
FIGURE 47: OVERVIEW OF THE HORIZON EUROPE FRAMEWORK [21]	50
FIGURE 48: UNION ANTI-FRAUD PROGRAMME BUDGET	56
FIGURE 49: I4.0 EU COMPETENCE CENTERS	58
FIGURE 50: THE 2030 DIGITAL COMPASS [34]	65
FIGURE 51: MANUFUTURE VISION AND STRATEGY FOR 2030 [35]	66
FIGURE 52: KEY OBSTACLES IMPACTING SME GROWTH (SOURCE [44])	68
FIGURE 53: THE DETAILED SBA ASSESSMENT FRAMEWORK AND ITS LINKS TO THE SMALL BUSINESS ACT PRINCIPLES [46]	70
FIGURE 54: SHARE OF ESIF ALLOCATION BY FUND 2014-2020 VERSUS 2021-2027 [61]	75
FIGURE 55: NATIONAL RECOVERY AND RESILIENCE PLAN AT A GLANCE [65]	79

## TABLE OF TABLES

TABLE 1: A BRIEF OVERVIEW OF KEY INDUSTRY 4.0 TECHNOLOGIES	9
TABLE 2: FOUR FOUNDATIONAL TYPES OF INDUSTRY 4.0 TECHNOLOGIES	11
TABLE 3: INDUSTRY 4.0 ADOPTION PATHWAYS	12
TABLE 4: MAIN ECONOMIC INDICATORS FOR GREECE 2018-2022 [7]	19
TABLE 5: POPULATION OF THE CROSS-BORDER REGION WITH GREECE ON THE BULGARIAN SIDE OF THE BORDER	27
TABLE 6: AVERAGE ANNUAL NUMBER OF EMPLOYEES UNDER LABOUR CONTRACT IN THE ENTERPRISES OF THE CROSS-BORDER REGION WITH GREECE ON THE BULGARIAN SIDE OF THE BORDER, NUMBER	27
TABLE 7: AVERAGE ANNUAL WAGES AND SALARIES OF THE EMPLOYEES UNDER LABOUR CONTRACT IN THE ENTERPRISES OF THE CROSS-BORDER REGION WITH GREECE ON THE BULGARIAN SIDE OF THE BORDER, BGN*	27
TABLE 8: NUMBER AND SHARE OF NON-FINANCIAL ENTERPRISES IN BULGARIA AND IN THE FOUR DISTRICTS OF THE CROSS-BORDER REGION WITH GREECE BY CATEGORY, 2021	28
TABLE 9: DYNAMICS OF MEDIUM-SIZED AND LARGE NON-FINANCIAL ENTERPRISES IN THE FOUR REGIONS OF THE CROSS-BORDER REGION WITH GREECE, 2021	28
TABLE 10: LEADING SECTORS BY THE NUMBER OF ENTERPRISES, EMPLOYMENT, NET INCOME FROM SALES AND EXPORTS IN EACH OF THE FOUR BULGARIAN DISTRICTS (BLAGOEVGRAD, SMOLYAN, KARDJALI AND HASKOVO) AND AGGREGATED DATA FOR THE WHOLE CROSS-BORDER REGION, 2018 – 2021	33
TABLE 11: NATIONAL INDUSTRY 4.0 PROGRAMS AND INITIATIVES [17]	46
TABLE 12: ASSESSMENT FRAMEWORK FOR THE LEVEL PLAYING FIELD PILAR	71
TABLE 13: COMPARISON OF ERDF THEMATIC FOCUS FOR THE 2014-2020 AND 2021-2027 FUNDING CYCLES [61]	74
TABLE 14: REGIONAL S <sub>3</sub> PRIORITIES FOR 2014-2020	76
TABLE 15: FOUR MAIN PILLARS OF THE GREECE 2.0 RRP	79
TABLE 16: TOTAL INVESTMENT RESOURCES MOBILIZED BY RRP [68]	80
TABLE 17: MATCHING INTERVENTIONS AND REFORMS OF THE GREEK RRP AND THE RIS <sub>3</sub> PRIORITIES	80
TABLE 18: REGIONAL PRIORITIZATION IN THE FOUR DISTRICTS OF THE CROSS-BORDER REGION WITH GREECE UNDER ISSS 2021 – 2027	84
TABLE 19: REGIONAL SPECIALIZATION IN THE FOUR DISTRICTS OF THE CROSS-BORDER REGION WITH GREECE	88

## LIST OF ABBREVIATIONS

AI Artificial Intelligence

ATI	Advanced Technology for Industry
AFIS	Anti-Fraud Information System
ASEAN	Association of Southeast Asian Nations
CBC	Cross Border Coordination
CFD	Computational Fluid Dynamics
CPS	Cyber Physical Systems
CEF	Connecting Europe Facility
COVID-19	Coronavirus Disease of 2019
DIHs	Digital Innovation Hubs
DTB	Digital Transformation Bible
EFSI	European Fund for Strategic Investments
EU	European Union
ERP	Enterprise Resource Planning
ERDF	European Regional Development Fund
ERTMS	European Rail Traffic Management System
ESIF	European Structural Investment Fund
EMFF	European Maritime and Fisheries Fund
EAFRD	European Agricultural Fund for Rural Development
EIB	European Investment Bank
DG-COMP	European Commission's Directorate-General for Competition
ERDF	European Regional Development Fund
ESF+	European Social Fund Plus
EAP	Eastern Partnership
EDP	Entrepreneurial Discovery Process
GAV	Gross Added Value
GDP	Gross Domestic Product
GNI	Gross National Income
HPC	High Performance Computing
IaaS	Infrastructure as a Service
IoT	Internet of Things
ICT	Information and Communication Technologies
IMS	Irregularity Management System
JRC	Joint Research Centre
MAVs	Micro Aerial Vehicles
MENA	Middle East, and North Africa
MES	Manufacturing Execution System
MDG	Ministry of Digital Governance
NAD	National Digital Strategy
NACE	Nomenclature of Economic Activities
NSRF	National Strategic Reference Framework
NRRP	National Recovery and Resilience Plan
NSRF	National Strategic Reference Framework
OITBs	Open Innovation Test Beds
OECD	Organisation for Economic Co-operation and Development
OP CEI	Operational Programme for Competitiveness, Entrepreneurship, and Innovation
PaaS	Platform as a Service
PO	Policy Objectives
RIS <sub>3</sub>	Research and Innovation Strategy for Smart Specialization
RFID	Radio-frequency identification
RLT	Real-time Locating System

R&I	Research and Innovation
RRF	Recovery and Resilience Facility
RRP	Recovery and Resilience Plan
SaaS	Software as a Service
SCADA	Supervisory Control and Data Acquisition
SMEs	Small and Medium Enterprises
STOA	State-of-the-Art
SWOT	Strengths, Weaknesses, Opportunities, Threats
SCM	Supply Chain Management
SMP	Single Market Programme
STEM	Science, Technology, Engineering, and Mathematics
S <sub>3</sub>	Smart Specialization Strategy
TRL	Technology Readiness Level
TUM	Technische Universitaet Muenchen

## 1 INTRODUCTION

This report **delves into the economic landscape of both Greece and Bulgaria**, highlighting key sectors, their contributions, and the challenges they face. In addition, it explores opportunities for SMEs in the context of Industry 4.0, **focusing on EU programs** that can support their digital transformation efforts. Finally, **policies and measures that local, regional, and national authorities can implement to facilitate the adoption of new technologies by SMEs**, promoting economic growth and competitiveness in the Greek-Bulgarian Cross-Border Cooperation (CBC) area are proposed.

### 1.1 Purpose and Scope

**The purpose of this deliverable is to support the SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis by providing essential preliminary insights.** Before commencing the SWOT analysis, comprehensive research into the economic landscape of the Cross-Border Cooperation (CBC) area is necessary. This research aims to understand the dominant sectors within the CBC area thoroughly.

The scope of this deliverable encompasses several key components. Firstly, it involves extensive data collection from diverse sources, including market analyses, surveys, articles, and other relevant materials. These sources will provide comprehensive insights into the CBC area's business environment. **Within this scope, the deliverable will analyze and document the sectors that are currently dominant within the CBC area, providing a baseline understanding of the economic structure. Ultimately, this deliverable serves as a critical foundation for the subsequent SWOT analysis, providing context and understanding of the CBC area's economic landscape to facilitate the development of effective strategies and policies for economic growth and digital transformation.**

### 1.2 Deliverable Structure

The structure of this report has been thoughtfully organized to facilitate a clear and effective delivery of insights. It consists of several key sections:

- **Section 1: Introduction:** This section serves as the foundation of the report, elucidating its purpose and scope and outlining the overall structure.
- **Section 2: Growth Opportunities for the SME Ecosystem:** In this section, success stories of SMEs, at EU level, that grew due to use of digital tools and an in-depth analysis of growth prospects within the SME ecosystem are presented.
- **Section 3: Identification of Economic Sectors in the CBC Area:** Section 3 focuses on identifying economic sectors in the Cross-Border Cooperation (CBC) area. It comprises subsections for Greece and Bulgaria, detailing the dominant economic sectors in each region.
- **Section 4: Opportunities:** This section provides insights into EU programs that Greek, Bulgarian, and European SMEs can leverage.
- **Section 5: Policies and Measures:** In this section, proposals for policies and measures at local, regional, and national levels are developed to enable SMEs to adopt new technologies.
- **Section 6: Conclusions:** In the concluding section, key findings and insights are synthesized to provide actionable takeaways for stakeholders aiming to drive economic growth and enhance regional cooperation.

## 2 GROWTH OPPORTUNITIES FOR THE SME ECOSYSTEM

Multiple initiatives have emerged across European countries with the common goal of digitalising local industries, which may vary from official European initiatives, national or even regional. Significant steps were taken very early on by countries such as Germany, the UK, France and Italy. The governments of these countries quickly understood the significance of the competitive advantage that they could gain from these technologies and thus quickly organized national funding programs to promote the adoption of Industry 4.0 technologies to their respective industries. Each country sets up its own programs, strategies and initiatives according to the current status of its industry, examining its weaknesses and the sectors that it needs to improve upon.

This is in line with EU's approach, that a centralized action plan for Industry 4.0 could be counter-productive, as it could not be applicable to the needs of each member states. It has thus been decided that different bottom-up solutions from each country are preferable [1].

Multiple companies across the continent have taken advantage of these initiatives and funding programs. They seized this opportunity in order to apply new technologies to their workplace and improve their efficiency, organization, and productivity. **The key technologies that are applied within the I4.0 framework are the following:**

Table 1: A brief overview of key Industry 4.0 technologies<sup>1</sup>

Key Industry 4.0 Technologies	Definition
Big Data Analytics	Big data analytics is the process of examining and uncovering insights, patterns, and trends from large, complex data sets. It uses advanced analytical techniques, such as machine learning and data mining, to process and analyse vast amounts of structured and unstructured data.
Industrial Internet of Things (IIoT)	The Industrial Internet of Things (IIoT) is the use of internet-connected devices and sensors in industrial settings to collect and transmit real-time data.
Cyber-physical Systems	Cyber-physical systems (CPS) are integrated systems that combine physical and digital components to enable real-time communication and control. CPS are designed to improve efficiency, safety, and reliability in a wide range of industries, including transportation, manufacturing, and healthcare.
Artificial Intelligence (AI)	Artificial Intelligence (AI) refers to the development of computer systems that can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language understanding. By analysing data and identifying patterns, machine learning algorithms enable AI systems to make predictions and decisions. Artificial intelligence is applied to a wide range of fields, including natural language processing, computer vision, robotics, and autonomous cars. AI systems can be classified into different categories, including supervised learning, unsupervised learning, reinforcement learning, active, and frugal learning.

<sup>1</sup> For further information on Key Industry 4.0 Technologies, please refer to Deliverable 3.3

Additive Manufacturing	A process called additive manufacturing (AM), also known as 3D printing, creates three-dimensional objects by layering materials until a final shape is obtained. Unlike traditional manufacturing processes, which involve subtracting or shaping material from a larger block, AM builds the object from the ground up, layer by layer.
Augmented Reality (AR)	The concept of augmented reality (AR) refers to adding digital elements to a real-world environment to enhance it or make it more interactive. In this type of environment, the physical world is combined with virtual objects or information using computer-generated graphics, sounds, and other sensory inputs. The use of AR is mainly centered on mobile devices or wearable technology, and it can be used for different purposes, such as gaming, education, marketing, and training.
Simulation	Using simulations is an effective way to test different scenarios or modify processes to provide evidence for decision-making.
Blockchain	Blockchain technology can facilitate secure and transparent transactions, data sharing, and supply chain management in various industries. With blockchain, companies can track the movement of goods and materials in real-time, improve inventory management, reduce costs, and enhance trust and transparency between business partners.
Cloud Computing	Cloud computing allows users to gain access to and use computer resources, such as servers, storage, databases, and software, through the Internet without having to install hardware or infrastructure locally. Third-party providers typically provide these resources as a service through various subscription models such as Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS)
High Performance Computing (HPC)	High-Performance Computing (HPC) involves utilizing supercomputers and parallel processing techniques for running advanced application programs efficiently, reliably, and quickly. These high-speed and high-capacity systems are capable of processing billions and even trillions of calculations per second, making them invaluable for complex computational tasks. HPC is used across various fields such as climate research, quantum mechanics, molecular modeling, and physical simulations (like simulations of the universe's formation). By leveraging HPC, researchers and scientists can solve large-scale problems, analyze vast data sets, and perform research that would be impossible with standard computers.
Industrial Robots	Industrial robots are automated, programmable, and capable of movement on three or more axes.
Machine-to-Machine (M2M)	M2M, or machine-to-machine, refers to direct communication between two or more devices without the need for human interaction. By using wireless or wired communication channels, these devices can exchange data and perform actions automatically. A variety of industrial and commercial applications are using M2M, including fleet management, home automation, and remote monitoring and control.
Manufacturing Execution Systems (MES)	The Manufacturing Execution System (MES) is an automated system designed to track, monitor, and control manufacturing operations. Through MES systems, manufacturers can see and control manufacturing processes in real time, improve quality, reduce waste, and increase efficiency. Integration between MES and Enterprise Resource Planning (ERP) and Supply Chain Management (SCM) provides a comprehensive

	view of manufacturing operations.
Supervisory Control and Data Acquisition Systems (SCADA)	SCADA (Supervisory Control and Data Acquisition) systems are computer-based control systems used to monitor and control industrial processes, such as power generation, manufacturing, and transportation. These systems are used to gather real-time data from sensors and other devices, and then transmit that data to a central control center where it can be analysed and used to make decisions about how to manage the process. SCADA systems typically include software applications, human-machine interfaces, and communication networks that allow operators to remotely control and monitor processes in real-time.
Radio-frequency identification (RFID)	Using radio frequency identification or RFID, it is possible to identify and track objects by using signals generated by radio waves. An RFID system consists of two components: a reader which is attached to the object to be tracked along with a tag (or label) which is attached to the tag.
Real-time Locating System (RTLS)	RTLS is a technology used to automatically identify and track the location of objects or people in real-time using sensors, RFID tags, or other types of wireless communication.
Cybersecurity	Cybersecurity refers to the suite of technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access. In today's interconnected world, cybersecurity is critical for ensuring the integrity, confidentiality, and availability of information as it encompasses everything from protecting sensitive information from cyber espionage to securing critical infrastructure from cyber-physical attacks. Effective cybersecurity measures are particularly important as the volume and sophistication of cyberattacks grow and evolve.
Virtualization Technologies	Virtualization technology enables the operation of several virtual machines on a single physical server, optimizing the use of hardware resources while minimizing expenses. It creates an intermediary layer between the physical hardware and the software, permitting various operating systems and applications to function concurrently on a single physical server. Moreover, virtualization is the cornerstone that allows cloud computing to offer scalable computing resources to users, adhering to a usage-based payment model.

Industry 4.0 technologies can also be sorted in **four foundational types of disruptive technologies** [2] as shown in Table 2.

**Table 2: Four foundational types of Industry 4.0 technologies**

Type	Technologies included
Connectivity, data and computational power	<ul style="list-style-type: none"> <li>• Cloud technology</li> <li>• IoT</li> <li>• Blockchain</li> <li>• Sensors</li> </ul>

Analytics and intelligence	<ul style="list-style-type: none"> <li>• Advanced analytics</li> <li>• Machine learning</li> <li>• AI</li> </ul>
Human-machine interaction	<ul style="list-style-type: none"> <li>• Virtual reality (VR)</li> <li>• Augmented reality (AR)</li> <li>• Robotics</li> <li>• Automation</li> <li>• Autonomous guided vehicles</li> </ul>
Advanced engineering	<ul style="list-style-type: none"> <li>• Additive manufacturing (e.g. 3D printing)</li> <li>• Renewable energy</li> <li>• Nanoparticles</li> </ul>

In theory, all industries have the chance to transform by using Industry 4.0 technologies to varying degrees. It is predicted, however, that sectors that are operationally intensive, such as manufacturing, transportation and retailing, will experience a more noticeable change, due to the multiple tasks in their production lines that are suited for automation and digitization. The existing skills and infrastructures of each industry, as well as the types of technologies that will be used shall also dictate the nature of the transition. Industry 4.0 transformations can be sorted into three distinct adoption pathways [2] as shown in Table 3.

**Table 3: Industry 4.0 adoption pathways**

Adoption pathway	Summary
Accelerated	Regardless of a company's existing tech infrastructure (whether advanced or nonexistent) certain inexpensive digital, augmented-reality, and automation solutions are rapidly adoptable without transition headaches.
Differential	The existing tech infrastructure will affect how quickly some technologies are adopted. Companies with less foundational information technology (IT), operations technology, and data infrastructure will need time to transition.
Slowed or deferred	Even at companies with an advanced tech infrastructure, the adoption of the most cutting-edge innovations (such as full end-to-end automation) will be slow because of the high level of required capital expenditure and the unclear long-term payback.

The EU sees the fourth Industrial Revolution as an opportunity to revitalize its industry and adequately compete with rising manufacturing powerhouses, most notably China. In the past four decades, Europe has been struggling with a declining industrial sector due to the rise of new competitors in the global market, the relocation of labour-intensive work to nations that offer low labour costs and global supply chains with suppliers outside the EU. The EU plans to bypass these obstacles by reinvigorating its industry and morph it into one that includes smart factories with

increased flexibility in production, the ability for mass customization, faster production speed, quality and overall productivity, as well as customer interaction [3].

The SMEs mentioned below have been funded and supported by European programs in order to successfully adopt I4.0 technologies and gain a unique competitive advantage in the digital era. They are sorted depending on the type of technology that was used in each case (**HPC/Simulation, Robotics, CPS/IoT**): [4]

- **HPC / Simulation**

**Stellba Hydro GmbH (Germany)**



**Figure 1: Stellba Hydro GmbH logo**

Stellba Hydro is a German SME that specializes in manufacturing hydraulic turbines and hydropower plants, maintenance, repair and overhaul. The company was having trouble performing accurate simulations in order to adequately test all characteristics of its turbine models.

With the help of new “cloudified” Computational Fluid Dynamics (CFD) simulation software, it became possible for Stellba to perform multiple calculations for all characteristics of any turbine model in 1/3 of the time. As a result, Stellba managed to reduce development time and costs, while simultaneously raising the quality of its final products and overall boosting its profits and competitiveness.

**STAM (Italy)**



**Figure 2: STAM logo**

STAM is an Italian manufacturing SME. It is a frequent collaborator of the EU, having participated in over 50 European Programs and also acts as a supplier of the European Space Agency with the Technology Transfer Program [5].

The company acquired new HPC software that allowed it to develop highly sophisticated solutions for manufacturing cutting-edge gearbox technologies. It should be noted that this software is hard to be managed or afforded by an SME. As a result of using the software, STAM managed to reduce its product costs and began to respond faster to market needs by 30% in each case. This allowed them to offer more powerful, cheaper products in the market, making cycloidal gearboxes the best solution for multiple applications.

- **Robotics**

- **DIAGNOSTIQA (Spain)**



Figure 3: DIAGNOSTIQA logo

DIAGNOSTIQA is a Spanish SME with 20 years of experience in Consulting, Technical Assistance, Supervision and Diagnosis for the energy and industrial sector [6]. Collaborating with ETH Zurich, the University of Zagreb and the University of Dubrovnik, DIAGNOSTIQA adopted the “Blade Hunters” solution.

The concept of “Blade Hunters” is to use remotely piloted micro aerial vehicles (MAVs) in order to conduct visual inspection on the blades of wind turbines, negating the need to shut them down beforehand. There are two clear benefits from the use of this method. Firstly, the turbines continue to provide electrical power uninterrupted, as there is no longer any need to temporarily shut them down, which subsequently lowers the cost of the inspection. Furthermore, this method also has an environmental impact, as it improves the operation of wind turbines through cheaper, accurate inspection, extending their expected lifetime and making them more competitive compared to fossil fuel technologies. “Blade Hunters” is unique in its respective market and made DIAGNOSTICA a leader in the wind turbine inspection market.

- **Schällibaum AG (Switzerland)**



**Figure 4: Schällibaum AG logo**

Schällibaum AG is a Swiss family-owned SME that provides Civil Engineering, Geomatics and Architectural Services. The company adopted the TUM Flyers project, which involves the use of MAVs in order to perform inspections at various facilities, which would otherwise be too dangerous to be performed by humans, as well as time consuming and costly.

The TUM Flyers project gives the user a considerable advantage compared to other MAV inspection methods, as it develops novel vision-based localization, 3D reconstruction and navigation technologies for increasing the level of autonomy of MAV inspection systems and the quality of systematic inspections. This has made Schällibaum AG a leader in MAV inspection services, while it has simultaneously expanded its range of offered services and strengthened its position in this market. MAV inspection can decrease the inspection time by half, increase repeatability and cut down costs up to 50%. Furthermore, the company could increase profits as an increasing number of potential objects will require such services.

#### **Novocaptis Cognitive Systems & Robotics (Greece)**



**Figure 5: Novocaptis Cognitive Systems & Robotics logo**

Established in 2010 in Thessaloniki, Greece, Novocaptis is a pioneering high-tech firm that maintains strong ties to the business world, academia, and research institutions. This network places the company at the cutting edge of industry innovation. Committed to innovation, Novocaptis specializes in a broad range of fields, offering advanced products and services in service and consumer robotics, ambient intelligence, assisted living technologies, environmental applications, and the realms of education and entertainment<sup>2</sup>.

They excel in micro-scale systems, target tracking, and computer vision among other areas. The firm also provides customized R&D services tailored to the needs of global businesses, offering everything from initial research to full-scale development and project

---

<sup>2</sup> <http://novocaptis.com/>

management, with notable clients like CERN. Currently, Novocaptis is creating a wireless platform for "smart" buildings aimed at optimizing energy use, promising significant cost savings and environmental advantages.

### **Zero One Mechatronics (Greece)**



**Figure 6: o1TM Mechatronics logo**

o1TM Mechatronics was established by a group of passionate engineers and robotics aficionados from Greece<sup>3</sup>. Leveraging their extensive expertise, they have innovated a product range that aims to equip the robotics engineers and hobbyists of tomorrow with essential tools and products. Their launch collection features a compact motor controller designed to be small enough to integrate within a standard RC-servo or attach to the back shaft of a DC brushed motor with specifications up to 24V/5Amps. The company is set to broaden its offerings with solutions poised to revolutionize mechatronics design. The company was supported by the EPAnEK2014-2020 Operational Programme (Competitiveness-Entrepreneurship-Innovation).

### **OZZIE Robotics (Greece)**



**Figure 7: OZZIE Robotics logo**

OZZIE Robotics, an ITI-CERTH spin-off, specializes in developing AI-driven robot software and hardware for a variety of service applications<sup>4</sup>. Their technology focuses on creating robots that can detect and interact with humans, make decisions based on their surroundings, and perform tasks like moving and manipulating objects across different environments such as homes, public spaces, and industrial settings. They also custom-build service robots, combining their construction with sophisticated software integration. OZZIE leverages over 20 years of its founders' research experience, including significant projects like the Horizon 2020 RAMCIP. Their inaugural product is a service robot designed to aid elderly individuals in their homes or care facilities.

<sup>3</sup> <https://www.o1mechatronics.com/>

<sup>4</sup> <https://ozzie-robotics.com/>

In its early stages, OZZIE distinguished itself as one of the winning startups of the EIT Digital Venture Program in 2020. Technically, the company has successfully developed and integrated essential components into the OZZIE assistive robot to support its intended applications. This includes advanced software for human-aware navigation, recognizing activities, detecting fallen individuals, identifying persons, and high-level task planning. All these functionalities have been incorporated into our innovatively designed service robot mobile hardware platform. OZZIE Robotics is presently focusing its funding requirements on scaling up the company and further developing its two primary products, the OZZIE and OZZIE XL Robots.

The OZZIE startup is bolstered by a consortium of support structures indicative of a strong institutional and innovative backing. It is officially endorsed by Elevate Greece, the nation's flagship initiative aimed at fostering a vibrant startup ecosystem. Governmental endorsement is provided by the Hellenic Republic Ministry of Development and Investments, alongside the General Secretariat for Research and Technology, which collectively represent the public sector's commitment to advancing research and entrepreneurial ventures within the country. The enterprise is further energized by Mantis, a prominent entity specializing in business innovation, signifying a partnership that likely offers cutting-edge technological and strategic business solutions. This multifaceted network of support underscores the startup's robust position for growth and development within the technological sector.

- **CPS / IoT**

**Bazigos S.A. (Greece)**



**Figure 8: Bazigos S.A. logo**

Bazigos S.A. is a Greek mould manufacturing firm that specializes in high-precision components for multiple applications (household, medicine, personal healthcare, packaging). The company had been struggling to expand and cope with increasing demand due to sub-optimal scheduling of work, insufficient shop floor operators support and limited monitoring capacity.

In an effort to overcome these setbacks, Bazigos cooperated with the company CASP to develop a software solution. The result was the MStoCPPS, software that uses CPS components to enable autonomy, local intelligence and decentralized decision making. Bazigos saw improvements to its operations thanks to this initiative, such as increase of resource utilization, reduction of extra working hours, documenting production monitoring information, human related errors and failure to meet deadlines. The software was initially applied on high-precision parts, but it is expected that it will be extended to all business areas of the company.

### Pernoud Group (France)



Figure 9: Pernoud Group logo

The Pernoud Group is a French SME that specializes in mould manufacturing. The company collaborated with a number of companies including SMEs BILLION and HPS, in order to acquire cutting edge CPS systems to integrate real-time monitoring in its manufacturing process. More specifically, the CPS uses real-time data in order to take corrective action whenever anomalous parts are located on a product. The result is an increase in the quality of the final product and a significant decrease of scrap. Furthermore, the software allows for preventive maintenance of the moulding machines, drastically reducing the machine's down time.

### Pragma IoT (Greece)



Figure 10: Pragma IoT logo

Established in 2017 as a CERTH-ITI spin-off, Pragma operates at the forefront of Low Power Computing and the Internet of Things (IoT) sectors<sup>5</sup>. The company's foundation is rooted in the extensive, verified experience and scientific expertise of its founding directors. Pragma is committed to providing end-to-end software solutions tailored to the contemporary demands of the IoT landscape within the industrial sphere. It also extends its expertise to deliver specialized consulting services within the IoT sector, catering to a diverse portfolio of clients that includes both private enterprises and government agencies. With a steadfast dedication to responsible business practices and leveraging over two decades of industry

---

<sup>5</sup> <https://www1.pragma-iot.com/>

experience, Pragma has successfully positioned itself as a trusted service provider to prominent business conglomerates and multinational companies across Greece.

The company's main strategy is to use the latest technologies in the Internet of Things (IoT), Augmented Reality/Virtual Reality (AR/VR), Artificial Intelligence (AI), and data analysis to help its customers grow their business and keep them engaged. The company's solid setup, the skills of its team, and its deep technical know-how are key to making sure every project they take on is a success.

### 3 IDENTIFICATION OF ECONOMIC SECTORS IN THE CBC AREA

#### 3.1 Greece

It is no secret that Greece is a country that has gone through multiple financial challenges in recent years, with the 2008 financial crisis and most recently, the COVID-19 pandemic dealing a heavy blow to its economy. Nevertheless, the country remains an integral part for the EU, with its economic sectors contributing both in its domestic stability and its role in the global economy. In this chapter, an analysis of the main economic sectors in Greece is laid out, along with a more specific analysis of the country's most important economic sectors in the Greek-Bulgarian CBC area.

In 2022, the **Greek economy, under this challenging global economic environment, continued its dynamic recovery and achieved a growth rate of 5.9%**. Along with the increase in GDP, there was a **significant increase in exports** from €40 billion in 2021 to €54.7 billion in 2022, **as well as in investments** from 12.0% to 13.3% (% GDP) [7]. Gross public **debt slightly decreased, as well as unemployment rates**. Furthermore, **foreign direct investments reached high levels** in comparison to previous years. In addition, **tourism reached pro-pandemic levels**. The good tourist season, in combination with economic policies of the government as well as the National Recovery and Resilience Plan are factors that protected the Greek economy and improved its economic outlook. However, high inflation restrained economic growth. The rapid increase of prices burdened households and businesses and generated feelings of economic uncertainty in the national market. The **government introduced fiscal policies** to support the citizens without undermining the target of deficit reduction. However, a continuity of global economic uncertainty may pose a threat to the resilience of the national economy [8].

Table 4: Main Economic Indicators for Greece 2018-2022 [7]

	2018	2019	2020	2021	2022
GDP at current prices (% change)	1.5%	2.1%	-9.8%	9.8%	14.5%
GDP at current prices (€ billions)	179.6	183.4	165.4	181.7	208.0
Inflation (annual average)	0.6%	0.3%	-1.2%	1.2%	9.6%
Labor productivity	-3.6%	-0.1%	-7.0%	6.5%	10.9%
Unemployment rate (annual average)	19.3%	17.3%	16.3%	14.7%	12.4%
Investments (% GDP)	11.1	10.7	12.0	13.3	n/a
Private sector (% GDP)	7.9	8.2	8.8	9.7	n/a

General Government (% GDP)	3.2	2.5	3.1	3.6	n/a
Exports of goods at current prices (€ billions)	33.5	33.9	30.8	40.0	54.7
Imports of goods at current prices (€ billions)	54.1	55.7	48.9	65.5	93.0

The contribution of individual economic sectors to Greece's overall gross added value varies (Figure 11).

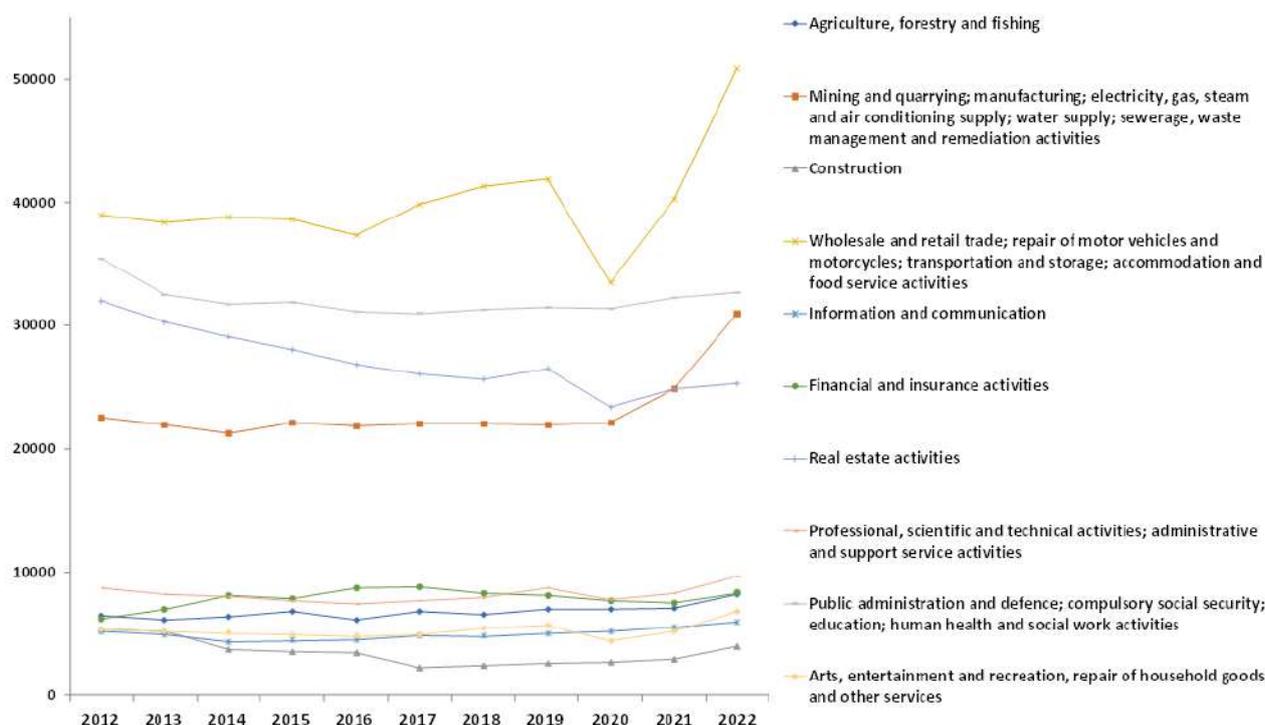


Figure 11: Economic sectors' contribution to Greece's overall GVA [9]

As shown in Graph on the Figure 11, the share of the service sector was 76.3% in 2022, industry and construction at 19.2%, while agriculture, forestry and fishing at 4.5%. The trade, transportation and storage, accommodation and food services industry had the highest share at 27.9% of the total of gross value added followed by: public sector (17.9%), industry and manufacturing (17.0%), real estate activities (13.9%), professional, scientific and technical activities, administrative and support service activities (5.3%), agriculture, forestry and fisheries (4.5%), financial and insurance activities (4.5%), arts, entertainment and recreation, repair of household and other services (3.7%), information and communication (3.2%) and construction (2.2%) [9].

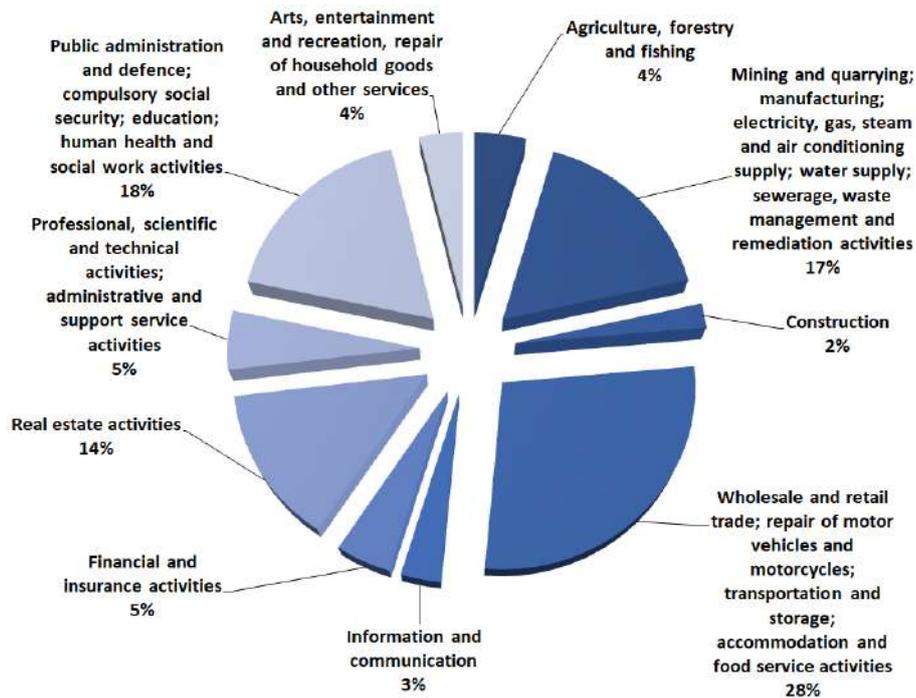


Figure 12: Greece's economic sectors share distribution [9]

In terms of the Greek-Bulgarian CBC area, there must be a more specific analysis of the economic sectors within the following prefectures that belong to it [10].

- Evros
- Rodopi
- Drama
- Xanthi
- Kavala, Thasos
- Serres
- Thessaloniki.

For each separate region in the CBC and for the entire CBC as a whole, the share of income for each of those sectors would be the following [11]:

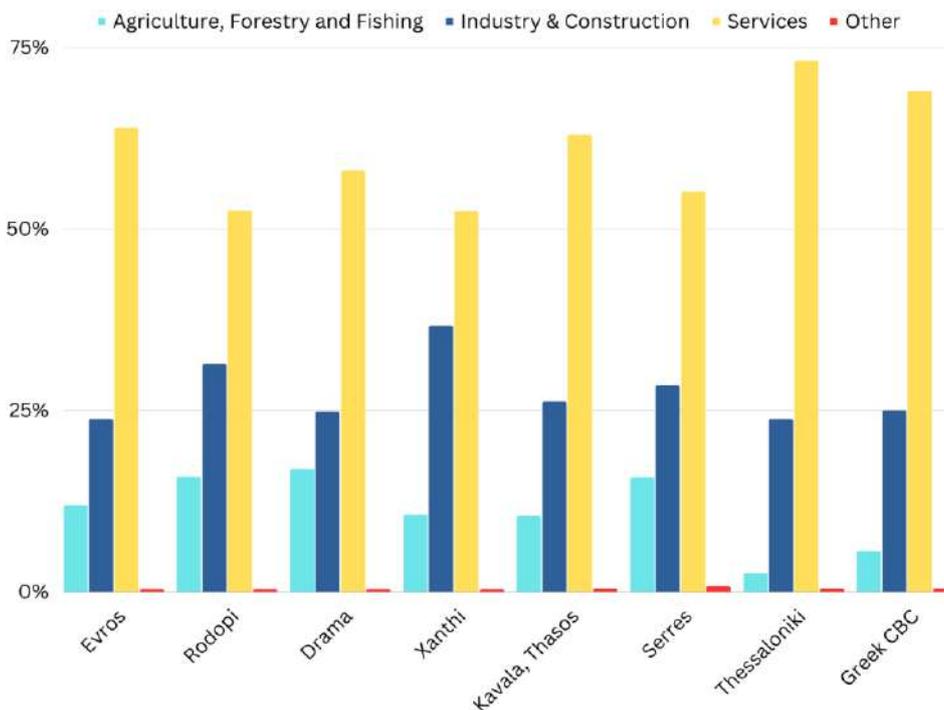


Figure 13: Income share of each major sector in the entire Greek CBC sector and each separate region [11]

In total, these regions presented a total of **215002** operational businesses in 2020, which produced a total income of **30,586,755,000** Euros, employing **608931** people with following distribution per prefecture [11].

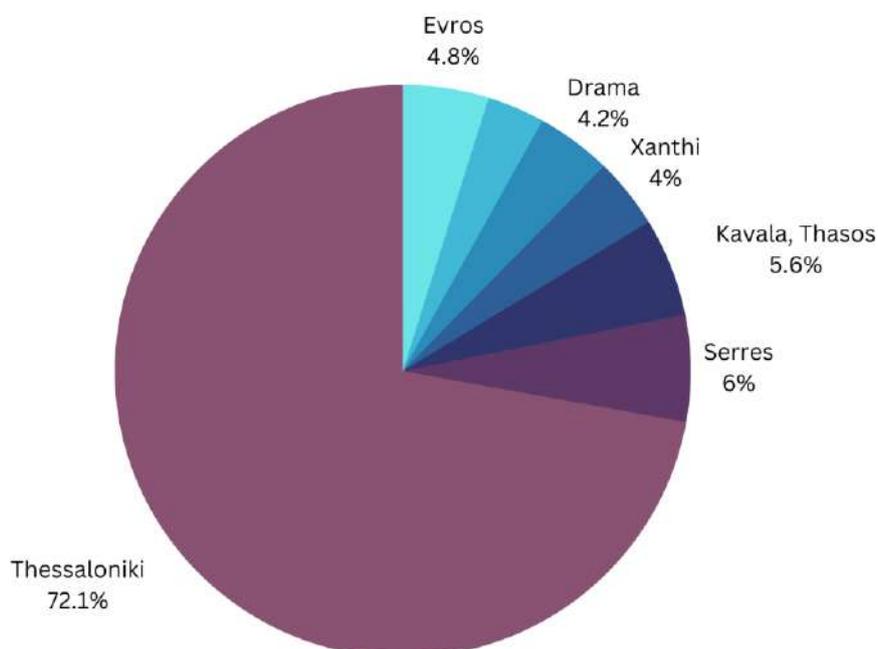


Figure 14: Greek CBC's share distribution [11]

### 3.1.1. Dominant economic sectors in the Greek side of the CBC area

#### 3.1.1.1. *Services*

The Greek service sector is the largest and most heterogeneous component of the national economy. It comprises a considerable variety of activities ranging from street vending and rental of tourist rooms to highly automated telecommunications, sophisticated financial transactions, and public administration. The subcategories of the Greek service sector can be categorized as such [9]:

- Information and Communication
- Financial and insurance activities
- Real estate activities
- Professional, scientific and technical activities; administrative and support service activities
- Public administration and defense; compulsory social security; education; human health and social work activities
- Arts, entertainment and recreation, repair of household goods and other services
- Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; accommodation and food service activities

The service sector also probably includes a good portion of the "underground economy." It is therefore possible that the value of its output and its employment level are understated [12]. Within the Greek CBC area, this sector made a total of 21,009,913,000 Euros within 2020 [11].

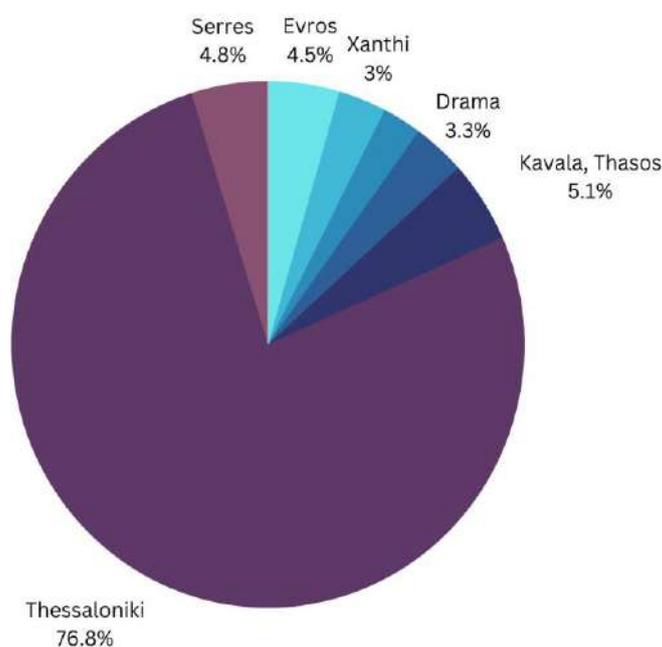


Figure 15: Greek CBC's service sector share distribution [11]

#### 3.1.1.2. *Industry and Construction*

According to the Hellenic Statistical Authority, the industry sector is divided into the following subcategories [9]:

- Mining and Quarrying
- Manufacturing
- Electricity, Gas, Steam and Air Conditioning supply
- Water Supply, Sewerage, Waste Management and Remediation Activities

Combined with the Construction sector, the total income that was recorded in the Greek CBC area within 2020 is 1,061,794,000 Euros [11].

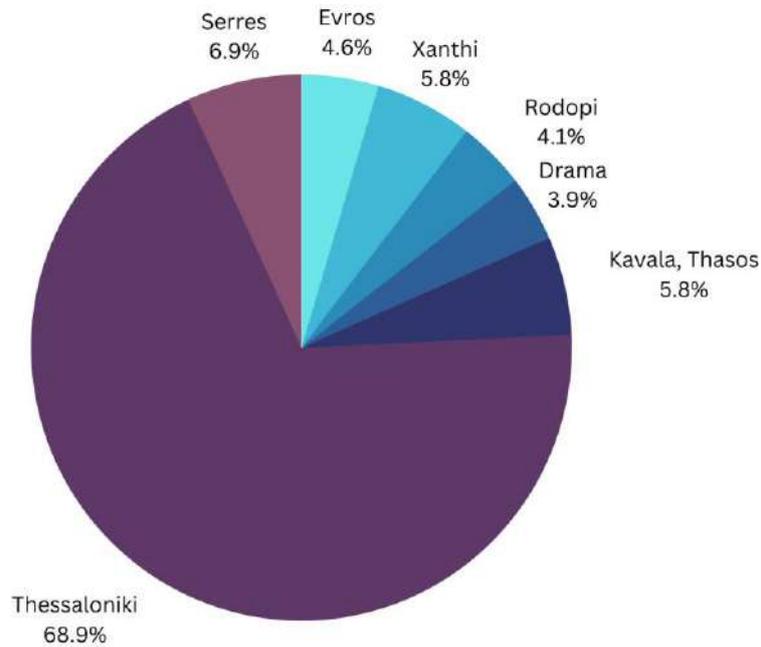


Figure 16: Greek CBC's industry & construction sector share distribution [11]

According to Figure 17, the **dominant Industry subsector in every Greek CBC region is Manufacturing, with Construction and Water Supply, Sewerage, Waste Management & Remediation Activities** ranking second and third respectively. Data retrieved by the Hellenic Statistical Authority suggests that as of 2020, there are 5,769,587 manufacturing businesses within the CBC area [11]. Given the fact that manufacturing industries can greatly benefit by tools and services that Industry 4.0 provides, such as automation, robotics, big data, cloud computing and AI, it is evident that the application of said technologies to all 5.7 million businesses **will give a considerable boost to both the local economies and to the Greek CBC regions' competitiveness on a European scale.**

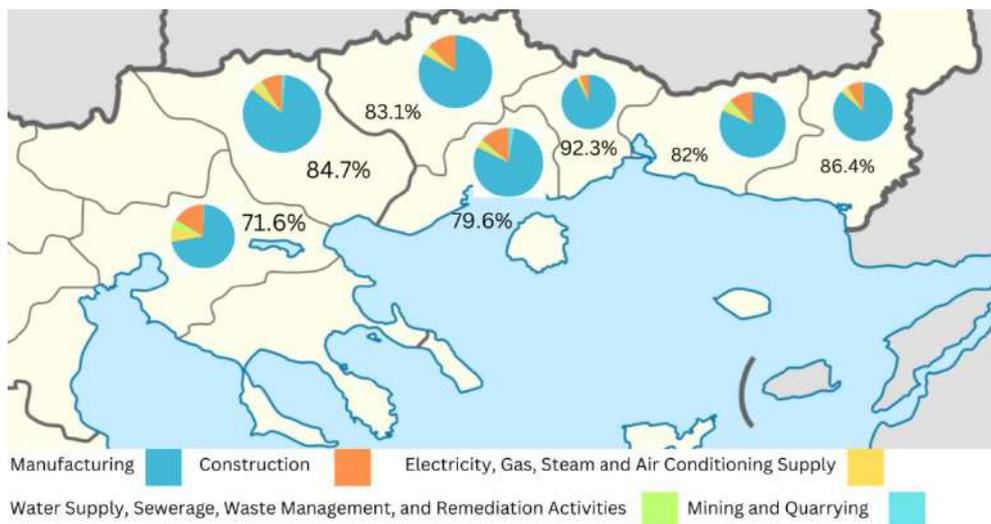


Figure 17: Shares of industry subsectors in the Greek CBC areas [11]

### 3.1.1.3. Agriculture, Forestry and Fishing

The importance of Greece's agricultural, forestry and fishing economy cannot be underestimated. Greek food and agricultural products have always been one of the country's main exports, with significant presence in both the European and US markets. The industry produces a vast variety of products, such as olive oil, flour products, honey, meat and ready meals. Greek companies in this industry also display remarkable innovation, achieving significant market shares abroad by combining traditional Greek ingredients with creative marketing and packaging. The Greek government expects for this sector to significantly contribute to the country's GDP within the next few years. Within the year of 2020, this sector produced an income of 1,708,855,000 Euros [11].

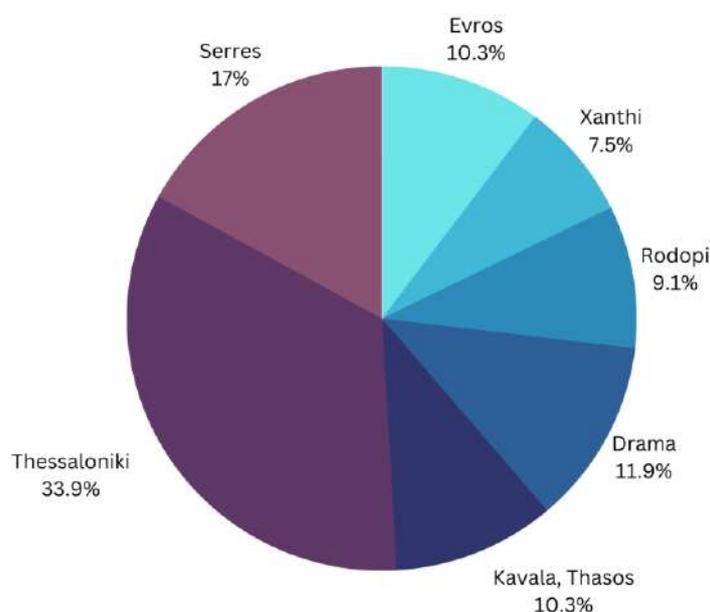


Figure 18: Greek CBC's industry & construction sector share distribution [11]

The data above portrays a national economy that is heavily reliant on the services sector, with the industry/construction and agricultural/forestry/fishing sector coming second and third respectively, both having significantly lower shares in the total national income. The conclusions that can be drawn are that Greece's industrial sector is not as robust as the respective industrial sectors of other EU Member States. **When Greece is compared to the rest of Europe, it is discovered that we underperform in both digital maturity (horizontal axis) and industrial size (vertical axis) as illustrated in Figure 19.**

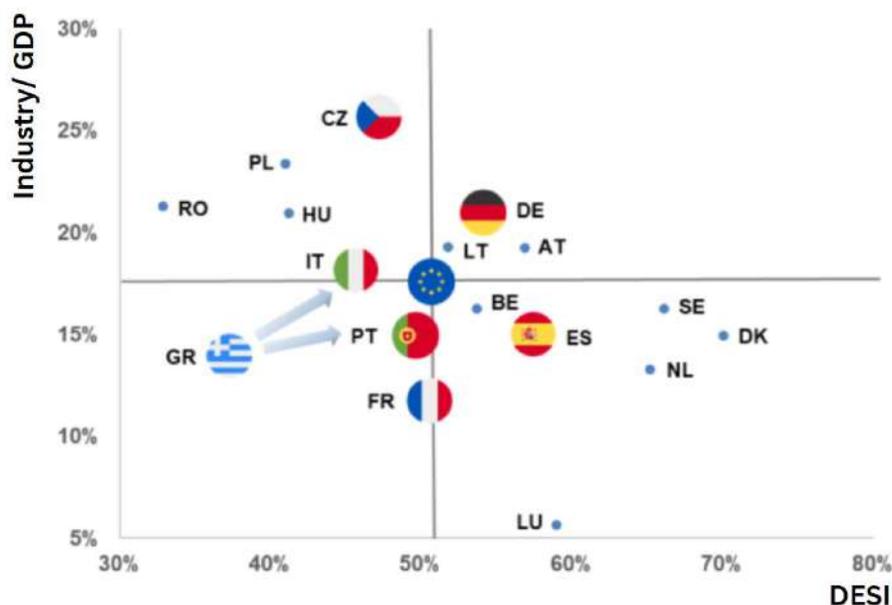


Figure 19: Greece compared to EU countries' digital maturity and industrial size

Based on all of the above, **the chances that Greek enterprises have already taken full advantage of the technological advancements of Industry 4.0 are low**, as will be elaborated in the following Chapters. Notwithstanding, the economy's steady growth rate that has been recorded in the past few years signal that Greece is slowly finding itself in a position where it can authorize investments towards the upgrading of its industries and businesses and incentivize them towards adopting Industry 4.0 tools and solutions, bridging the digital divide between Greece and its fellow Member States.

### 3.2 Bulgaria

The cross-border region with Greece on the Bulgarian side of the border covers the districts of Blagoevgrad, Smolyan, Kardjali and Haskovo as illustrated in Figure 20.

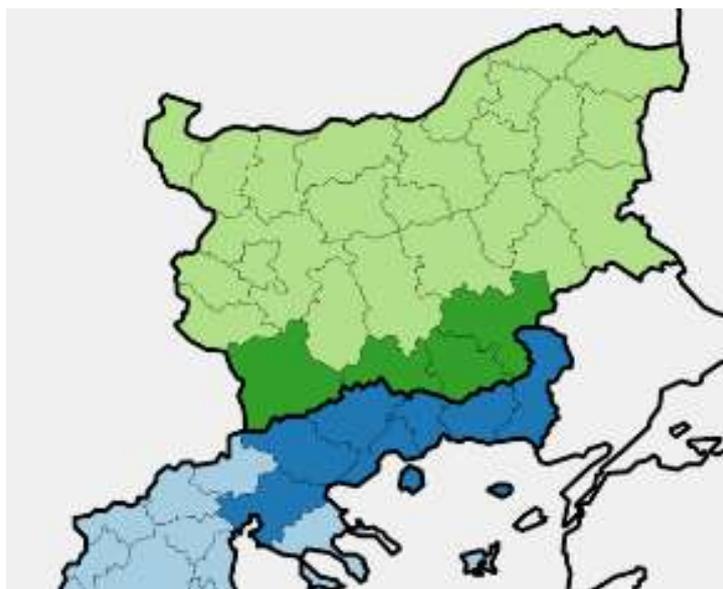


Figure 20: Districts in the cross-border region between Bulgaria and Greece (Source: [www.greece-bulgaria.eu](http://www.greece-bulgaria.eu))

At the end of 2022, the population of the four regions was 731,462 people or 11.3% of the population of Bulgaria. For the four-year period from 2019 to 2022, the population decreased by just over 58,000 people (7.4%). In comparison, Bulgaria's population for the same period decreased by over 500,000 people as a result of mortality and migration (7.2%).

**Table 5: Population of the cross-border region with Greece on the Bulgarian side of the border**

District	2019	2020	2021	2022
Blagoevgrad	302 694	301 138	298 251	288 161
Smolyan	103 532	101 887	99 318	93 354
Kardjali	158 204	160 781	161 024	142 508
Haskovo	225 317	223 625	220 269	207 439
<b>TOTAL</b>	<b>789 747</b>	<b>787 431</b>	<b>778 862</b>	<b>731 462</b>
<b>Bulgaria</b>	<b>6 951 482</b>	<b>6 916 548</b>	<b>6 838 937</b>	<b>6 447 710</b>

Source: National Statistical Institute

Regarding the labour market, in the period from 2018 to 2021, a decrease in the number of employed persons was observed in each of the four districts (a total of 8,373 people), and it was most seriously expressed in the districts of Blagoevgrad and Haskovo, with 3,992 people and 3,895 people, respectively.

**Table 6: Average annual number of employees under labour contract in the enterprises of the cross-border region with Greece on the Bulgarian side of the border, number**

District	2019	2020	2021	2022
Blagoevgrad	88 781	89 026	83 237	84 789
Smolyan	31 476	31 982	30 489	31 136
Kardjali	31 313	31 428	30 245	31 167
Haskovo	53 653	52 870	48 981	49 758
<b>TOTAL</b>	<b>205 223</b>	<b>205 306</b>	<b>192 952</b>	<b>196 850</b>
<b>Bulgaria</b>	<b>2 319 762</b>	<b>2 322 561</b>	<b>2 211 773</b>	<b>2 248 934</b>

Source: National Statistical Institute

In the cross-border region, the average annual salary of employed persons was highest in Kardjali district, followed by Smolyan and Haskovo districts, and was lowest in Blagoevgrad district. In general, the average annual salary in the four regions is persistently lower than the average for Bulgaria by about 25%.

**Table 7: Average annual wages and salaries of the employees under labour contract in the enterprises of the cross-border region with Greece on the Bulgarian side of the border, BGN\***

District	2019	2020	2021	2022	Average for the period 2018 – 2021
Blagoevgrad	9 024	9 810	10 881	12 226	<b>10 485</b>
Smolyan	10 145	11 106	12 037	13 379	<b>11 667</b>
Kardjali	10 419	11 356	12 705	14 508	<b>12 247</b>
Haskovo	9 623	10 566	11 642	12 906	<b>11 184</b>
<b>AVERAGE</b>	<b>9 803</b>	<b>10 710</b>	<b>11 816</b>	<b>13 255</b>	<b>11 396</b>
<b>Bulgaria</b>	<b>13 755</b>	<b>15 209</b>	<b>16 687</b>	<b>18 733</b>	<b>15 209</b>

Source: National Statistical Institute (Note: \*1 BGN = 0.51 EUR)

In terms of the size of the enterprises according to the number of persons employed in them, both at national level and in the four districts, micro enterprises with up to 9 employees prevail (a total share of around or just over 93%), followed by small enterprises (from 10 to 49 employed persons) with a share of about 5.6 – 5.8%, medium-sized (from 50 to 249 employed) with a share of about 1% and large (over 250 employed persons) with a share of about 0.1%.

**Table 8: Number and share of non-financial enterprises in Bulgaria and in the four districts of the cross-border region with Greece by category, 2021**

Category of enterprise	Bulgaria		Cross-border region	
	Number	Share	Number	Share
Micro	383 592	92,9%	39 862	93,3%
Small	24 096	5,8%	2 399	5,6%
Medium-sized	4 436	1,1%	392	0,9%
Large	754	0,2%	49	0,1%
<b>TOTAL</b>	<b>412 878</b>	<b>100,0%</b>	<b>42 702</b>	<b>100,0%</b>

Source: National Statistical Institute

It is worth noting that over the 2018 – 2021 period, the number of larger employers (with a staff of over 50 and over 250 employees, respectively) on the territory of the four districts is decreasing. Medium-sized enterprises have decreased by 49 – from 441 in 2018 to 392 in 2021, while the large ones have decreased by 3 companies – from 52 in 2018 to 49 in 2021. The change in the category of enterprises (from large to medium-sized and from medium-sized to small) is not due to the closure of companies, but to a reduction in the number of their personnel for various reasons, mostly related to the economic consequences of the Covid-19 pandemic.

**Table 9: Dynamics of medium-sized and large non-financial enterprises in the four regions of the cross-border region with Greece, 2021**

District	2019		2020		2021		2022	
	Medium	Large	Medium	Large	Medium	Large	Medium	Large
Blagoevgrad	185	20	188	20	157	21	161	18
Smolyan	60	16	62	15	58	12	65	13
Kardjali	75	8	71	8	68	7	67	8
Haskovo	121	8	113	8	98	9	99	10
<b>TOTAL</b>	<b>441</b>	<b>52</b>	<b>434</b>	<b>51</b>	<b>381</b>	<b>49</b>	<b>392</b>	<b>49</b>

Source: National Statistical Institute

Regarding the key sectors based on the NACE<sup>6</sup> classification, which are shaping the economy of the four districts in the cross-border region with Greece (Blagoevgrad, Smolyan, Kardjali and Haskovo), the sections below examine the 5 leading sectors<sup>7</sup> which have greatest contribution to the local economic development. The analysis is made by examining 4 main indicators:

1. Number of enterprises by leading sectors
2. Number of employed persons by leading sectors
3. Net incomes from sales of the enterprises by leading sectors
4. Exports of the enterprises by leading sectors.

<sup>6</sup> NACE (Nomenclature of Economic Activities) is the European statistical classification of economic activities.

<sup>7</sup> The leading sectors (based on the NACE classification) are those, whose total values account for more than 75% of the aggregated values of the relevant indicator.

Official data provided by the National Statistical Institute for the period from 2018 to 2021 has been taken into account for the analysis. At the time of preparation of this document, data for 2022 has not been available. According to NSI’s schedule for publication of statistical information, information for 2022 is likely to be made public in mid-2024.

### 3.2.1 Dominant economic sectors in the Bulgarian side of the CBC area

The territory of the cross-border region of Bulgaria with Greece comprises 4 districts, covers an area of 18,384 sq. km (16.6% of the territory of Bulgaria) and has a population of 731,462 people (2002).

The leading sectors, according to NACE, based on the number of registered enterprises (with a share of about 75%<sup>8</sup>) in the cross-border region are:

1. Wholesale and retail trade; repair of motor vehicles and motorcycles (38.1%)
2. Transportation and storage (10.9%)
3. Manufacturing industry (10.3%)
4. Accommodation and food services or hotels and restaurant activities (8.0%)
5. Professional, scientific and technical activities (6.5%).

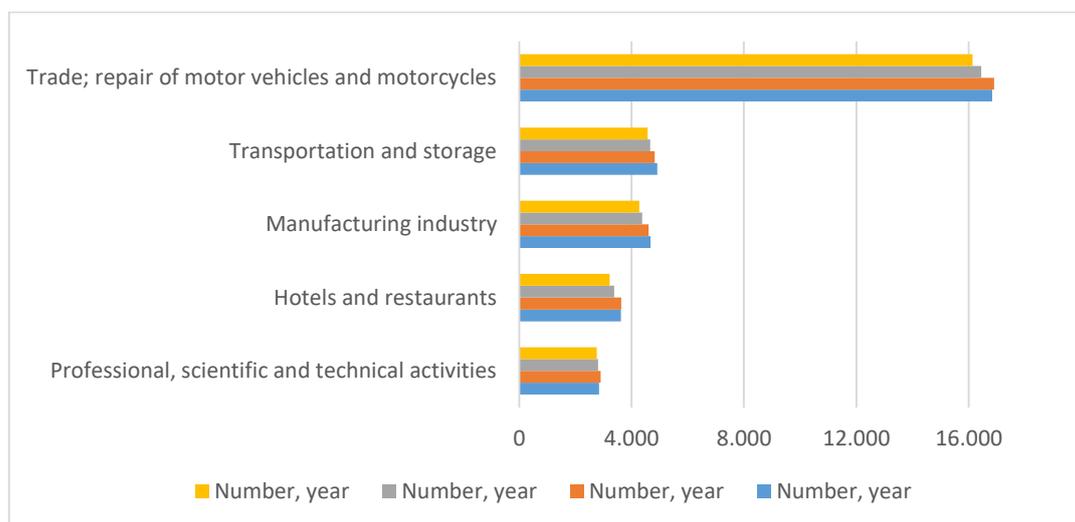
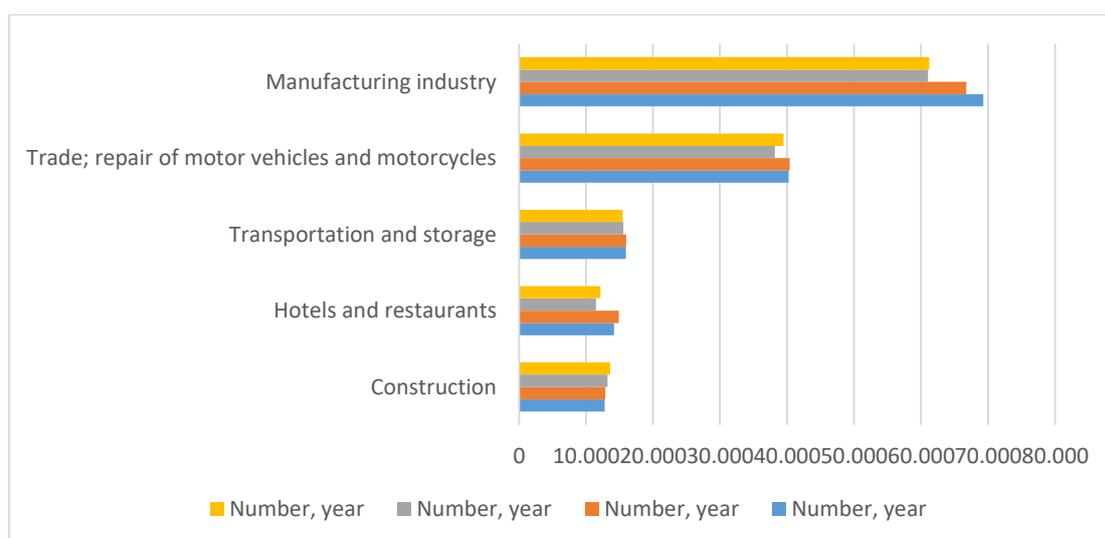


Figure 21: Number of enterprises by sectors in the cross-border region of Bulgaria with Greece (Source: National Statistical Institute)

Sector M „Professional, scientific and technical activities“ (ranked no. 5 in the figure above) includes the following types of enterprises whose activities are, on one hand, influenced by the effects of Industry 4.0 and on the other hand, are part of creative industries:

- Legal and accounting activities
- Architectural and engineering activities
- Technical tests and analyses
- Research and development in the fields of biotechnology, natural, medical, agricultural and technical sciences, social sciences and humanities
- Advertising and market research
- Other professional activities – specialized activities in the field of design, photography, etc.

<sup>8</sup> Here and below, where percentages are indicated, they represent the arithmetic mean value of the indicator for the period 2018 – 2021.



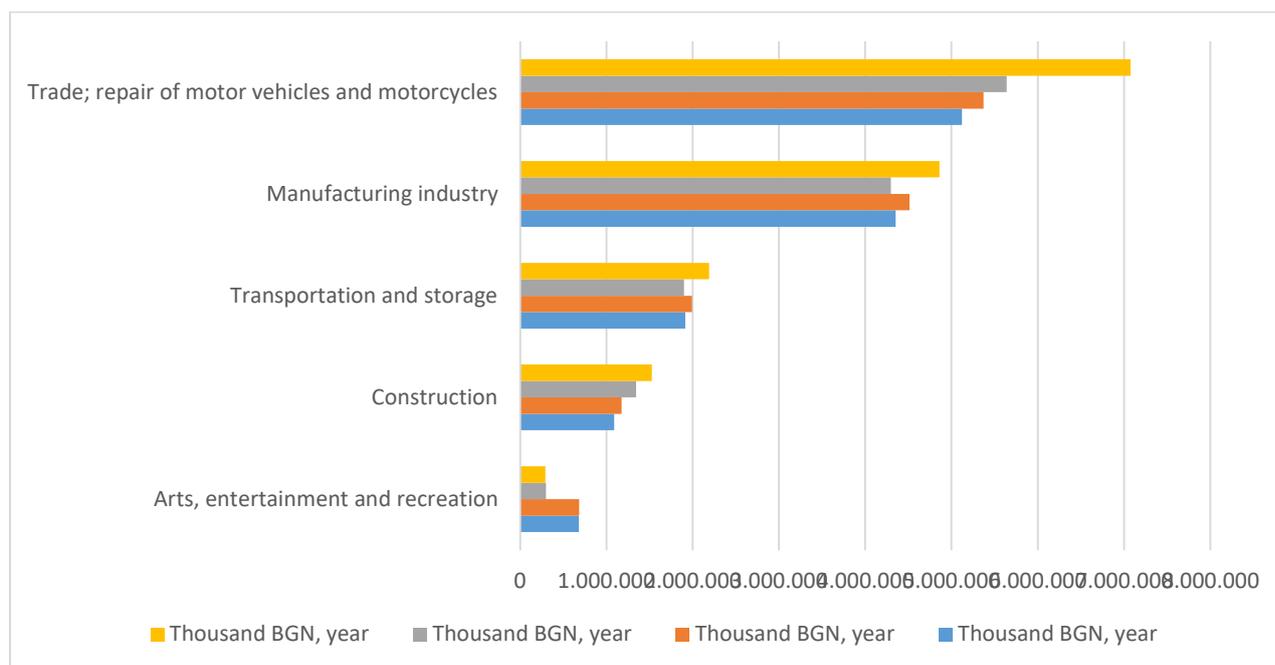
**Figure 22: Number of employed persons in the enterprises by sectors in the cross-border region of Bulgaria with Greece** (Source: National Statistical Institute)

As regards the number of employed persons, the leading sector is C "Manufacturing" (34.2%), followed by sector G "Wholesale and retail trade; repair of motor vehicles and motorcycle" (21.0%), H "Transportation and storage" (8.3%), I "Accommodation and food service activities" (7.0%) и F "Construction" (7.0%).

In terms of "net sales revenues", the sector of trade regains its leading position (35.1%), followed by manufacturing (27.4%), "Transportation and storage" (12.2%), "Construction" (7.8%) and "Arts, entertainment and recreation" (3.0%). The latter sector ("Arts, entertainment and recreation") includes the following activities:

- Creative, arts and entertainment activities (performing arts, artistic creation, etc.)
- Libraries, archives, museums and other cultural activities, as well as Operation of historical sites and buildings and similar visitor attractions
- Operation of sports facilities
- Activities of amusement parks and theme parks, etc.

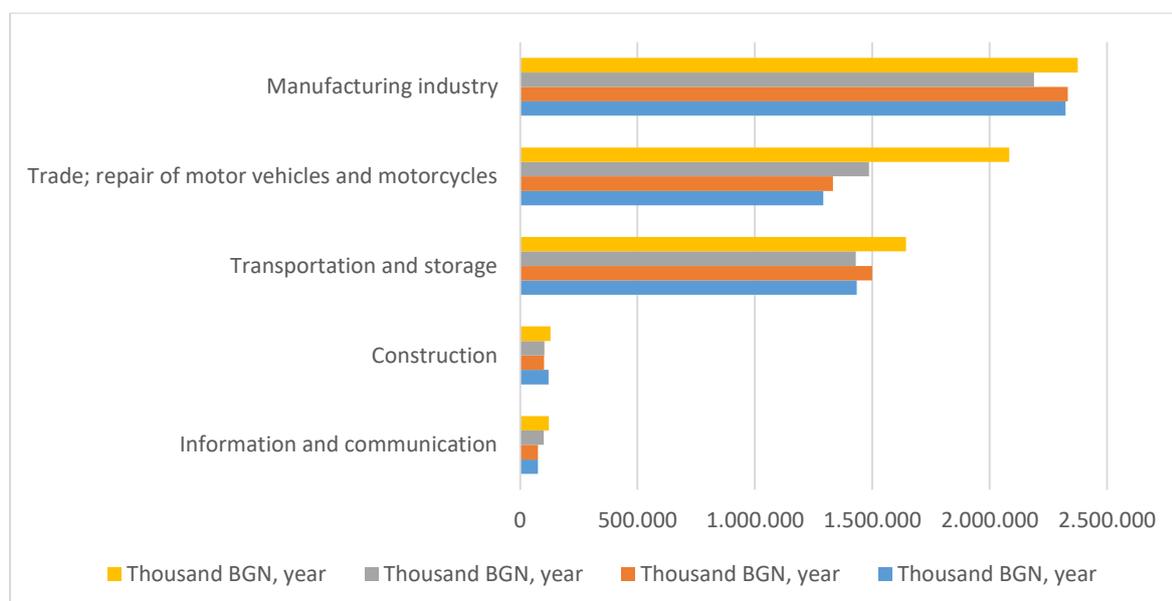
Regarding this sector, turnover has shrunk more than twofold in 2020 and 2021, compared to 2018/2019, mainly as a result of the Covid-19 pandemic.



**Figure 23: Net sales revenues by sectors in the cross-border region of Bulgaria with Greece** (Source: National Statistical Institute)

According to the indicator “exports of enterprises”, processing industry again has taken the lead (39.8%), followed by the sectors of “Wholesale and retail trade; repair of motor vehicles and motorcycle” (26.4%), “Transportation and storage” (25.8%), “Construction” (2.0%) and “Information and communication” (1.6%).

**Graph 13. Exports of enterprises by sectors in the cross-border region of Bulgaria with Greece**



**Figure 24: Exports of enterprises by sectors in the cross-border region of Bulgaria with Greece** (Source: National Statistical Institute)

Although with a smaller share, the ranking of the sector “Information and communication” in the top 5 sectors that export the most, shows the competitiveness of enterprises that work in this

domain (including during the Covid-19 pandemic), namely companies specializing in the following activities:

- Publishing activities (e.g. publishing of computer games)
- Motion picture, video and television programme production, sound recording and music publishing activities
- Programming and broadcasting activities (radio broadcasting, television programming and broadcasting)
- Telecommunications (wired and wireless telecommunications activities)
- Computer programming, consultancy and related activities
- Information service activities (e.g. data processing, hosting and related activities, web portals, etc.).

In summary, the next table visualizes the leading sectors according to four indicators (number of enterprises, employment, turnover and exports) in the four districts, and in summary – in the cross-border region on the Bulgarian side of the border. As expected, the leading sectors in terms of number of enterprises and employment are:

- Wholesale and retail trade; repair of motor vehicles and motorcycles
- Manufacturing industry
- Transportation and storage
- Hotels and restaurant activities.

According to the “net sales revenues” indicator, the leaders are:

- Wholesale and retail trade; repair of motor vehicles and motorcycles
- Manufacturing industry
- Transportation and storage
- Construction.

The predominant share of exports is mainly generated by the following sectors:

- Manufacturing industry
- Wholesale and retail trade; repair of motor vehicles and motorcycles
- Transportation and storage
- Construction.

Given the concept of Industry 4.0, new technologies play the most significant role in the development of processing industry and, to a lesser extent, in transport and construction.

By individual indicators, we observe the distinct role of several other sectors in the cross-border region except the mainstream ones, such as:

- For the indicator “Number of enterprises”: sector M “Professional, scientific and technical activities”
- For the indicator “Number of employed persons”: sector Q “Human health and social work activities” and sector A “Agriculture, forestry and fishing”
- For the indicator “Net incomes from sales”: sector B “Mining and quarrying”, sector Q “Human health and social work activities” and sector R “Arts, entertainment and recreation”
- For the indicator “Exports”: sector J “Information and communication”, sector M “Professional, scientific and technical activities” and sector N “Administrative and support service activities”.

Table 10: Leading sectors by the number of enterprises, employment, net income from sales and exports in each of the four Bulgarian districts (Blagoevgrad, Smolyan, Kardjali and Haskovo) and aggregated data for the whole cross-border region, 2018 – 2021

Indicator	Nº	Blagoevgrad	Smolyan	Kardjali	Haskovo	Cross-border region
Number of enterprises	1	Trade <sup>1</sup>	Trade	Trade	Trade	Trade
	2	Transport <sup>2</sup>	Hotels & restaurants	Hotels & restaurants	Manufacturing	Transport
	3	Manufacturing <sup>3</sup>	Manufacturing	Manufacturing	Hotels & restaurants	Manufacturing
	4	Hotels & restaurants <sup>4</sup>	Transport	Construction	Transport	Hotels & restaurants
	5	Professional activities <sup>5</sup>	Professional activities	Transport	Agriculture	Professional activities
Number of employed persons	1	Manufacturing	Manufacturing	Manufacturing	Manufacturing	Manufacturing
	2	Trade	Trade	Trade	Trade	Trade
	3	Transport	Agriculture <sup>6</sup>	Строителство	Transport	Transport
	4	Hotels & restaurants	Hotels & restaurants	Hotels & restaurants	Agriculture	Hotels & restaurants
	5	Construction	Construction	Healthcare <sup>9</sup>	Hotels & restaurants	Construction
Net income from sales	1	Trade	Manufacturing	Manufacturing	Trade	Trade
	2	Manufacturing	Trade	Trade	Manufacturing	Manufacturing
	3	Transport	Mining <sup>7</sup>	Construction	Transport	Transport
	4	Construction	Construction	Transport	Agriculture	Construction
	5	Culture <sup>10</sup>	Agriculture	Healthcare	Culture	Culture
Exports	1	Transport	Manufacturing	Manufacturing	Manufacturing	Manufacturing
	2	Trade	Transport	Trade	Transport	Trade
	3	Manufacturing	Trade	Transport	Trade	Transport
	4	Construction	Administrative <sup>8</sup>	Construction	Agriculture	Construction
	5	Arts <sup>11</sup>	Construction	Professional activities	Construction	Arts

Source: National Statistical Institute

Notes: <sup>1</sup>Trade = Wholesale and retail trade; repair of motor vehicles and motorcycles

<sup>2</sup>Transport = Transportation and storage

<sup>3</sup>Manufacturing = Manufacturing industry

<sup>4</sup>Hotels & restaurants = Accommodation and food service activities

<sup>5</sup>Professional activities = Professional, scientific and technical activities

<sup>6</sup>Agriculture = Agriculture, forestry and fishing

<sup>7</sup>Mining = Mining and quarrying

<sup>8</sup>Administrative = Administrative and auxiliary activities

<sup>9</sup>Healthcare = Human health and social work activities

<sup>10</sup>Culture = Culture, sports and entertainment

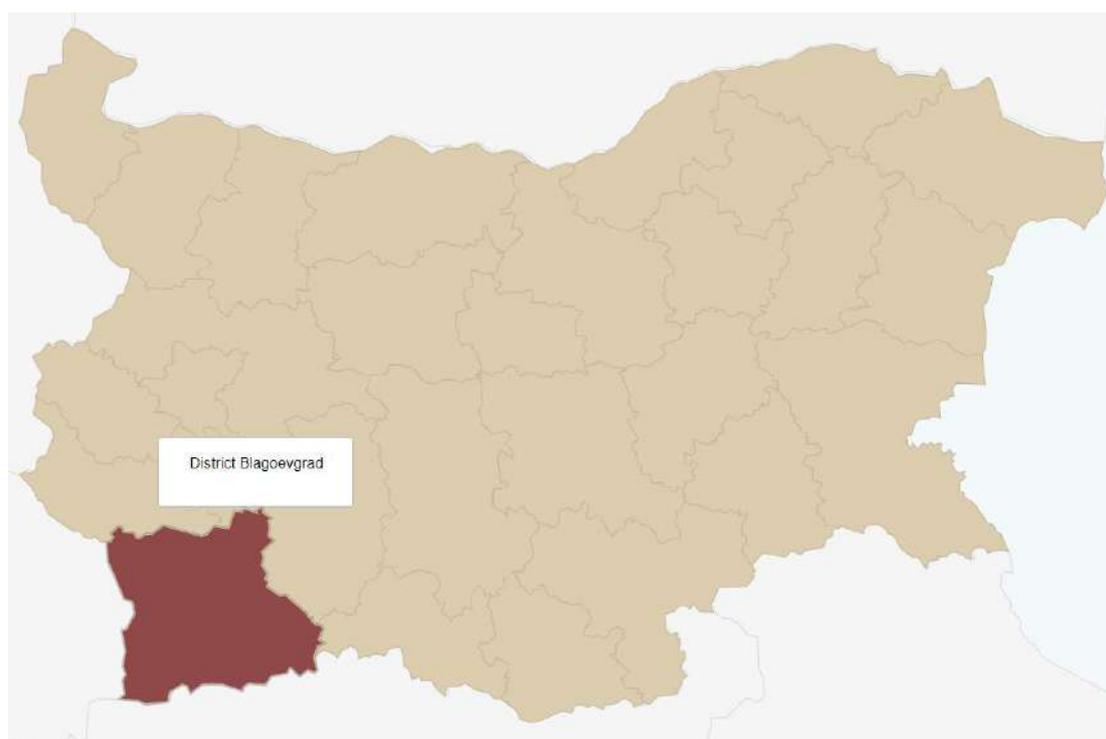
<sup>11</sup>Arts = Arts and entertainment

Below, there is a review of the dominant sectors in each of the four districts of the cross-border region by using the same 4 indicators:

- Number of enterprises
- Employment
- Net revenues from sales
- Exports.

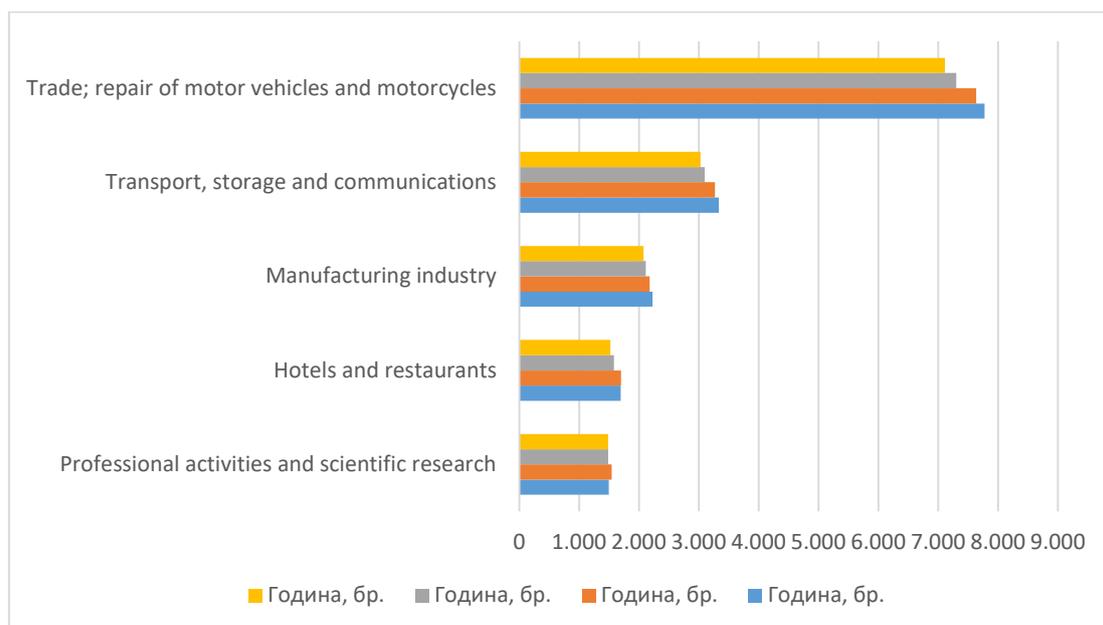
### 3.2.2 Blagoevgrad district

Blagoevgrad district covers 14 municipalities, has a territory of 6,449 sq. km and a population of 288,161 people (2022).



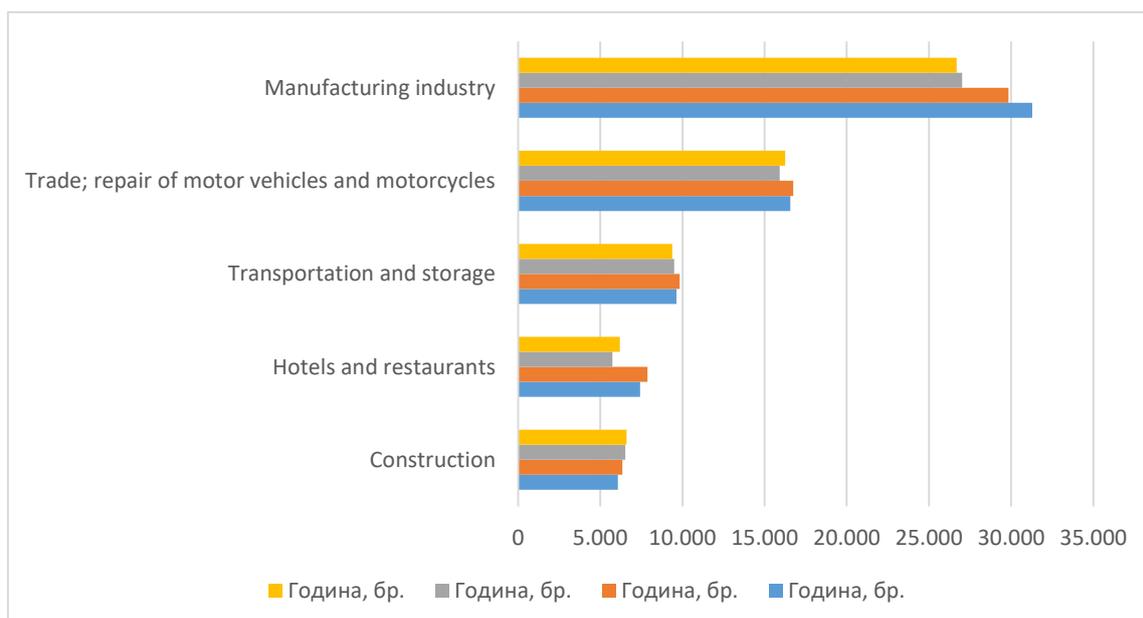
**Figure 25: Location of Blagoevgrad district on the territory of Bulgaria** (Source: National Statistical Institute)

In terms of the number of enterprises in Blagoevgrad district, expectedly, the top-ranking sector is "Wholesale and retail trade; repair of motor vehicles and motorcycles" with 34.8% of all registered companies in the district, followed by "Transportation and storage" (14.9%), "Manufacturing" (10.0%), "Accommodation and food service activities" (7.6 %) and "Professional, scientific and technical activities" (7.0%).



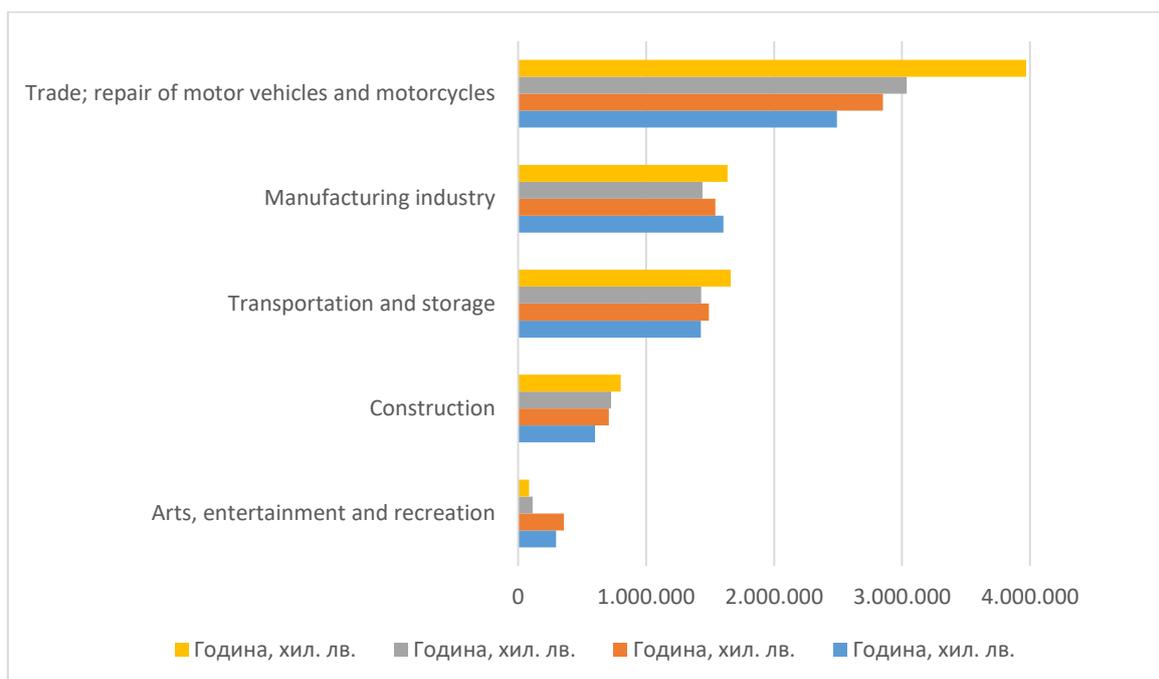
**Figure 26: Number of enterprises in Blagoevgrad district** (Source: National Statistical Institute)

The manufacturing sector has a leading role in terms of employment with a share of 33.7%, followed by trade (19.3%), transport (11.3%), hotels and restaurants (8.0%), and construction (7.5%).



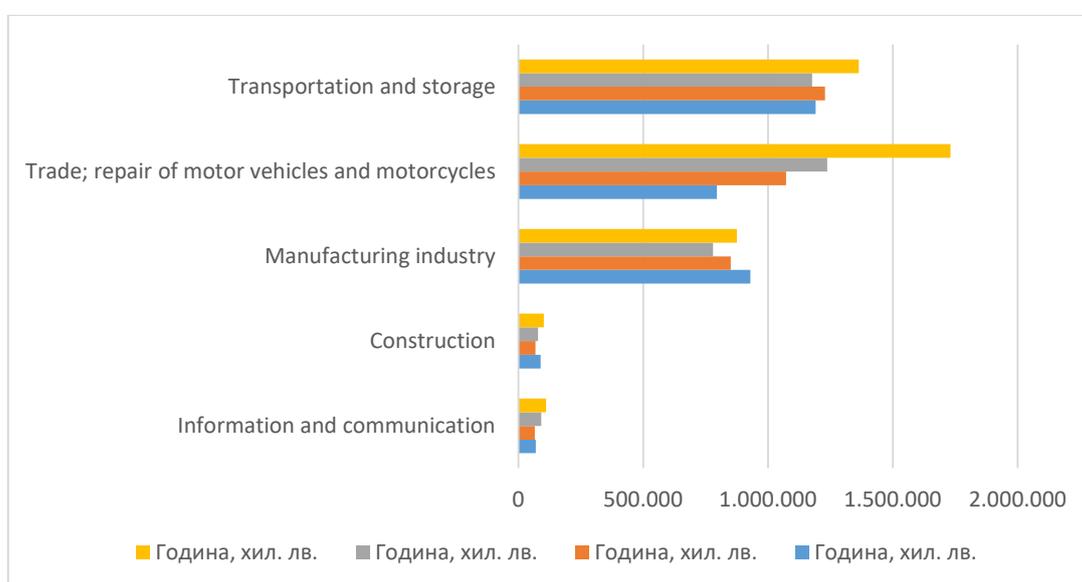
**Figure 27: Number of employed persons in the enterprises in Blagoevgrad district** (Source: National Statistical Institute)

For the indicator “net income from sales”, there is a predominance of trade (38.3%) over manufacturing industry (19.5%), transport (18.8%), construction (8.9%) and the sector “Arts, entertainment and recreation” (2.8%).



**Figure 28: Net income from sales of the enterprises in Blagoevgrad district** (Source: National Statistical Institute)

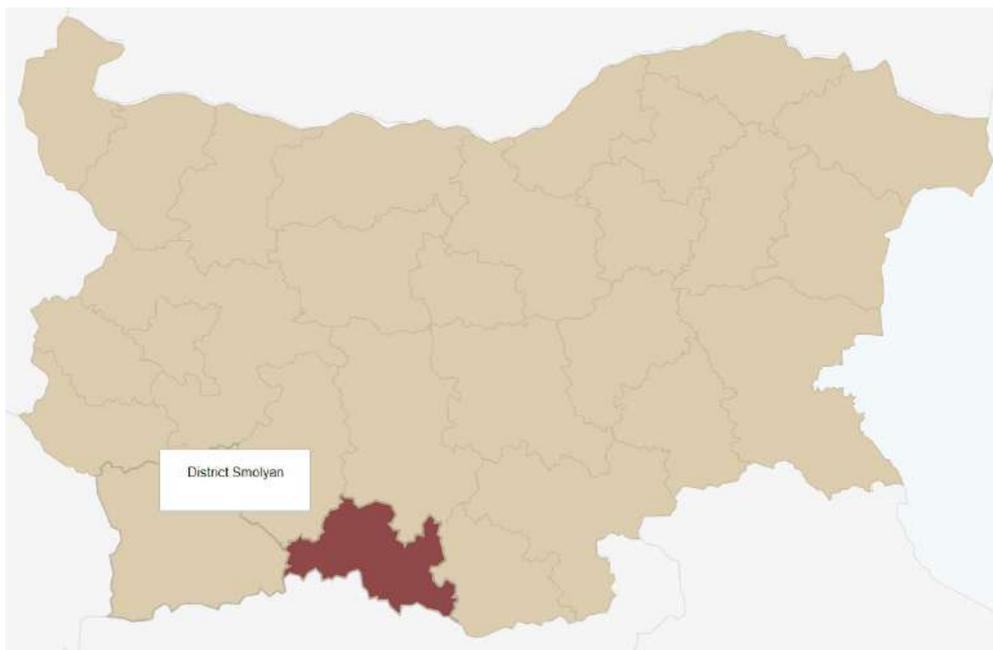
In terms of exports, two of the sectors (“Transportation and storage” and “Wholesale and retail trade; repair of motor vehicles and motorcycles”) have similar values – 34.6% and 32.9 respectively, followed by manufacturing industry (24.10%), construction (2.4%) and the sector “Information and communication” (2.3%).



**Figure 29: Exports of the enterprises from Blagoevgrad district** (Source: National Statistical Institute)

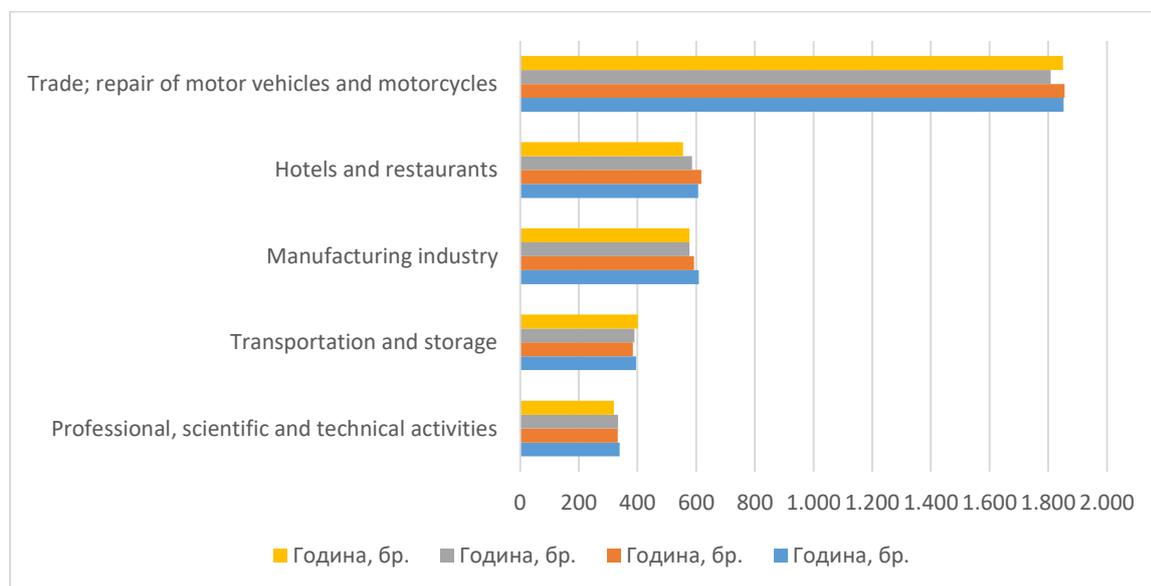
### 3.2.3. Smolyan district

Smolyan district covers 10 municipalities, has a territory of 3,193 sq. km and a population of 93,354 people (2022).



**Figure 30: Location of Smolyan district on the territory of Bulgaria** (Source: National Statistical Institute)

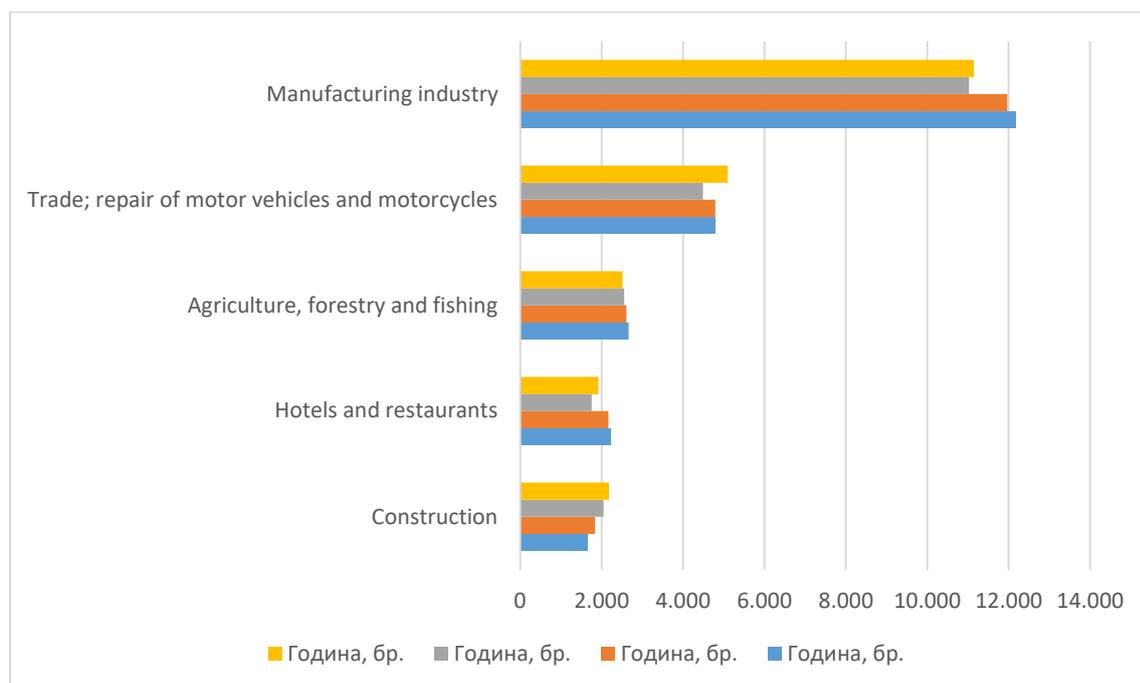
Just like in the other 2 districts, the leading sector in terms of the number of registered enterprises is the sector of trade (about 1,840 companies), followed by the hotel and restaurant industry (about 590 companies), processing industry (about 590 companies), transport (about 390 companies) and the sector "Professional, scientific and technical activities" (about 330 companies).



**Figure 31: Number of enterprises in Smolyan district** (Source: National Statistical Institute)

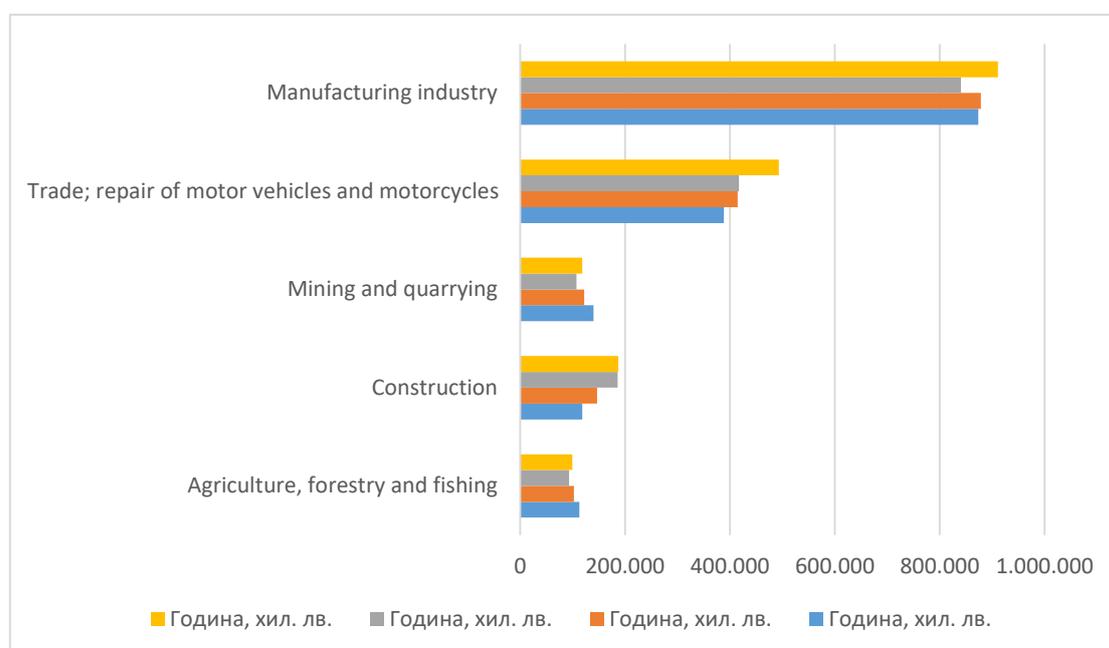
Employment in the enterprises from Smolyan district is largest in the processing industry, followed by trade, agriculture, the hotel and restaurant industry and construction.

**Graph 19. Number of employed persons in the enterprises in Smolyan district**



**Figure 32: Number of employed persons in the enterprises in Smolyan district** (Source: National Statistical Institute)

In Smolyan district, the relatively smaller number of enterprises in the processing industry (compared to the sector of “trade”) generate the highest turnover with a share of about 44.3%. For this district, it should be noted that high turnover is generated by enterprises in sectors with low added value – the mining industry with a share of about 6.2% and the agricultural sector with a share of about 5.2%.



**Figure 33: Net income from sales of the enterprises in Smolyan district** (Source: National Statistical Institute)

The huge share of exports of the enterprises registered on the territory of the district is due to the companies in the processing industry - 84.1%.

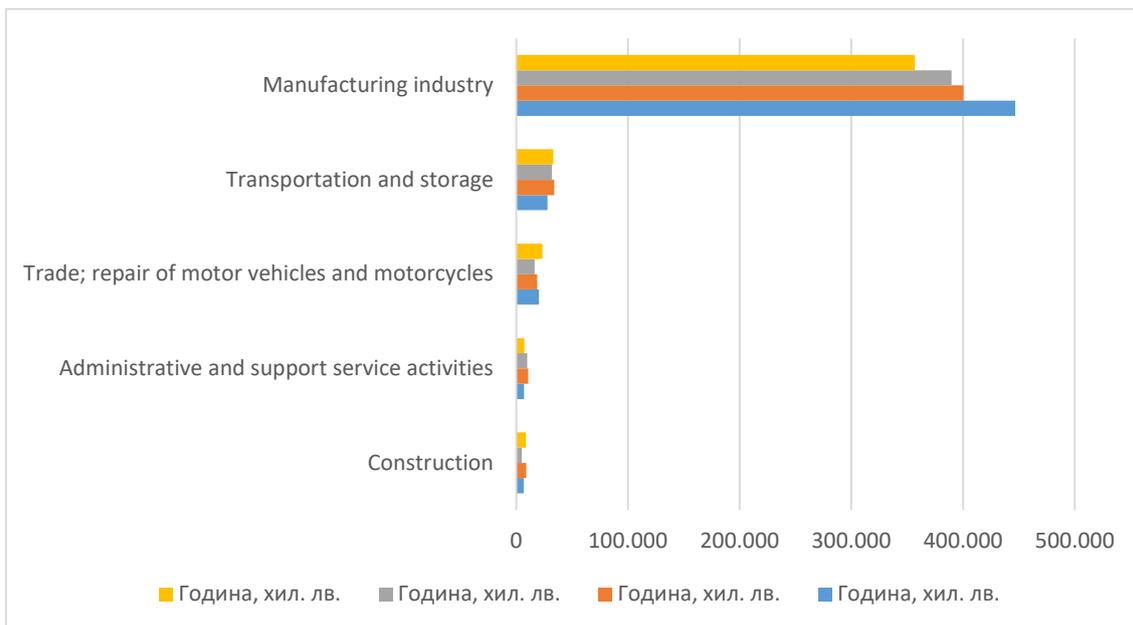


Figure 34: Exports of the enterprises from Smolyan district (Source: National Statistical Institute)

### 3.2.4. Kardjali district

Kardjali district covers 7 municipalities, has a territory of 3,209 sq. km and a population of 142,508 people (2022).

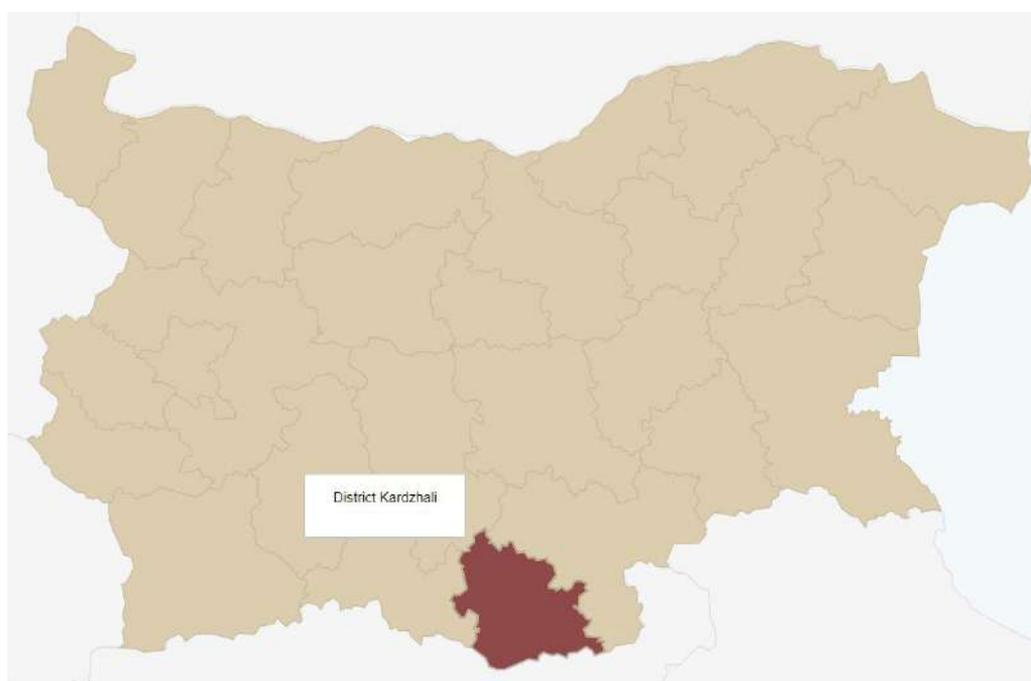
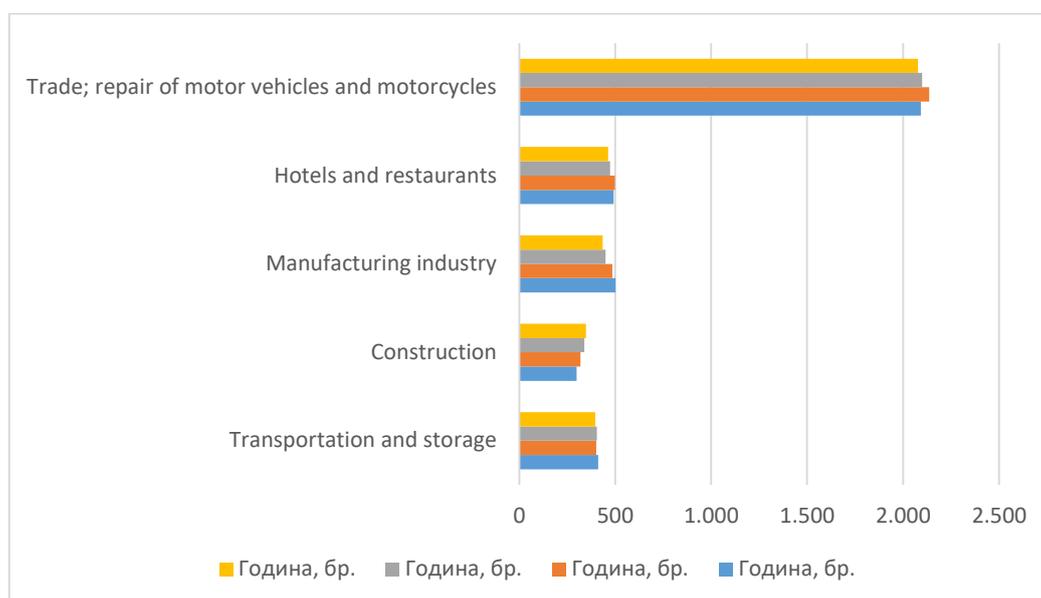


Figure 35: Location of Kardjali district on the territory of Bulgaria (Source: National Statistical Institute)

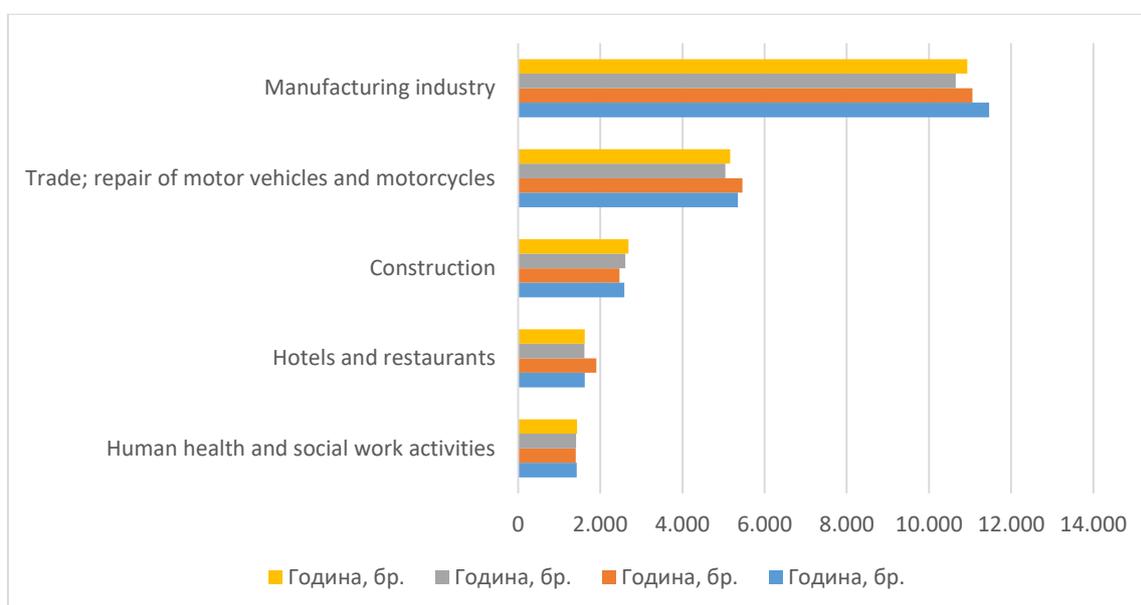
### Deliverable D.3.2

In Kardjali region, the largest share in the number of registered enterprises is accounted to the sector of trade (41.2%), followed by the accommodation and food service activities (9.4%), processing industry (9.2%), transport (7.9%) and construction (6.4%).



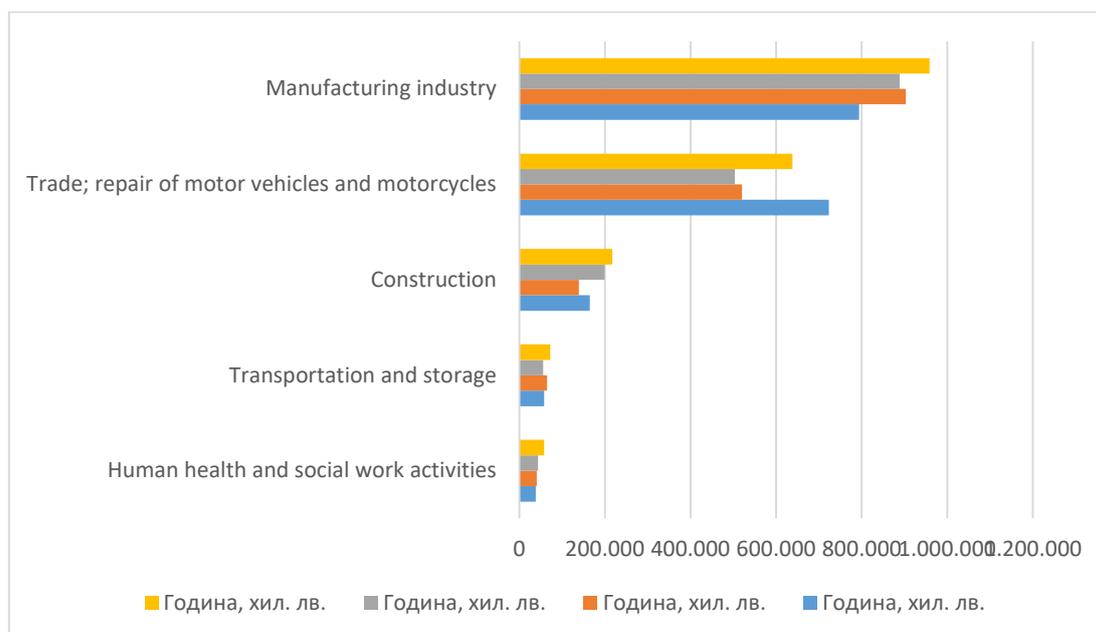
**Figure 36: Number of enterprises in Kardjali district** (Source: National Statistical Institute)

In terms of employment figures, the leading sector is manufacturing (40.1%), followed by trade (19.5%), construction (9.6%), accommodation and food service activities (6.3%) and healthcare (5.3%), mainly due to the large number of staff of Multiprofile Hospital for Active Treatment “Dr. Atanas Dafovski” – Kardjali.



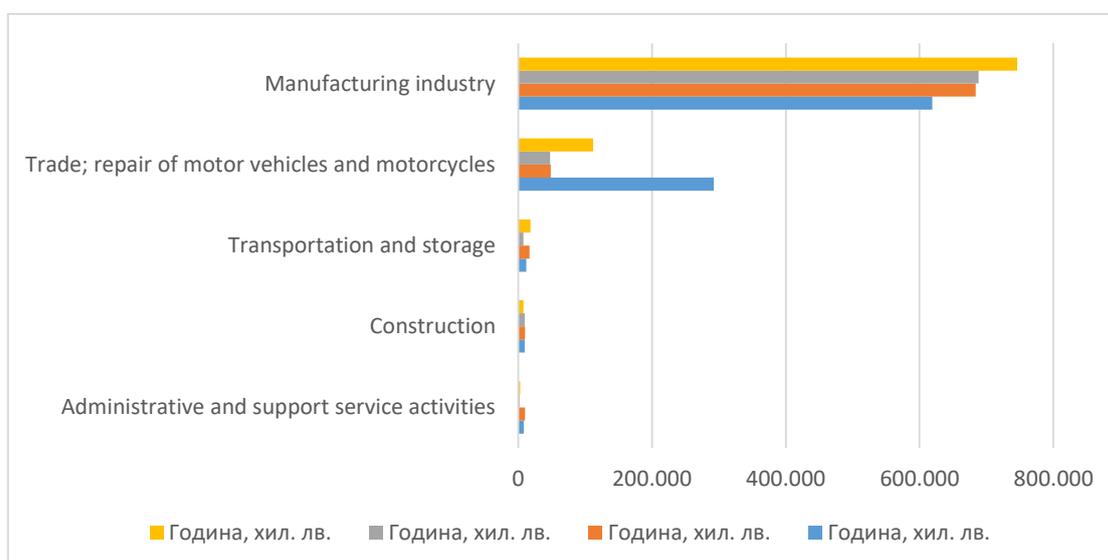
**Figure 37: Number of employed persons in the enterprises in Kardjali district** (Source: National Statistical Institute)

The largest turnover is realized by the manufacturing industry (40.1%), followed by trade (27.8%), construction (8.3%), transport (2.9%) and healthcare (2.1%). In terms of healthcare, the vast majority of revenues comes from funding provided by the National Health Insurance Fund.



**Figure 38: Net income from sales of the enterprises in Kardjali district** (Source: National Statistical Institute)

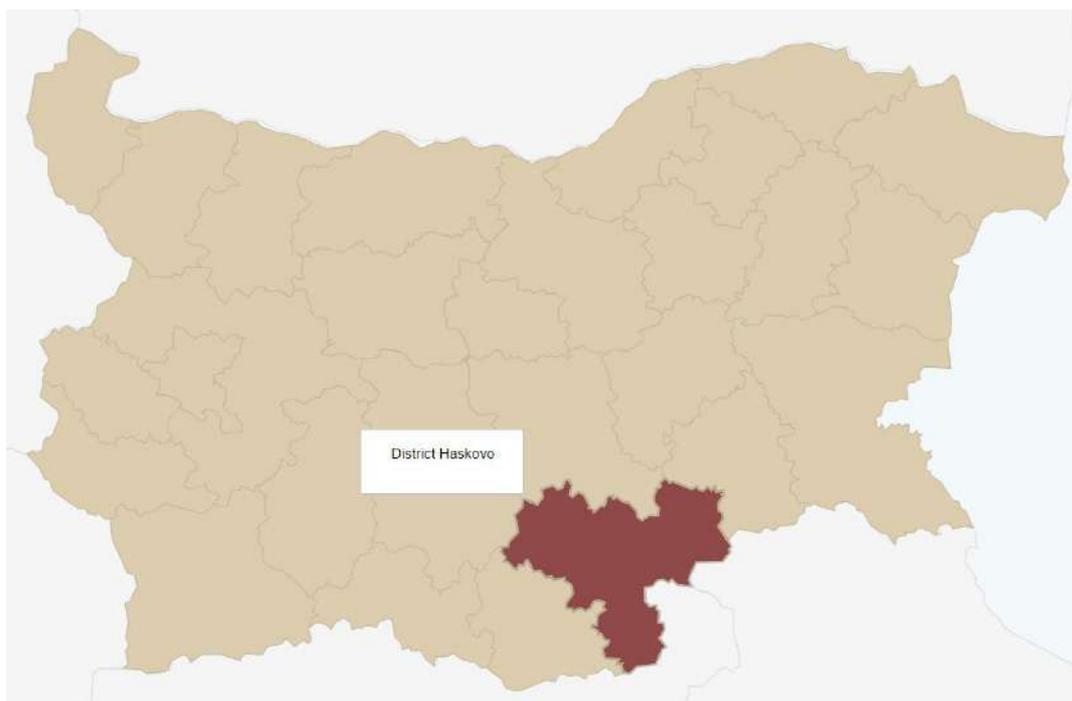
The leading exporting sector with a huge advantage over the others is “Manufacturing” with a share of about 74.8%, followed by trade (13.4%), transport, construction, administrative and support service activities with a share of about 1% each.



**Figure 39: Exports of the enterprises from Kardjali district** (Source: National Statistical Institute)

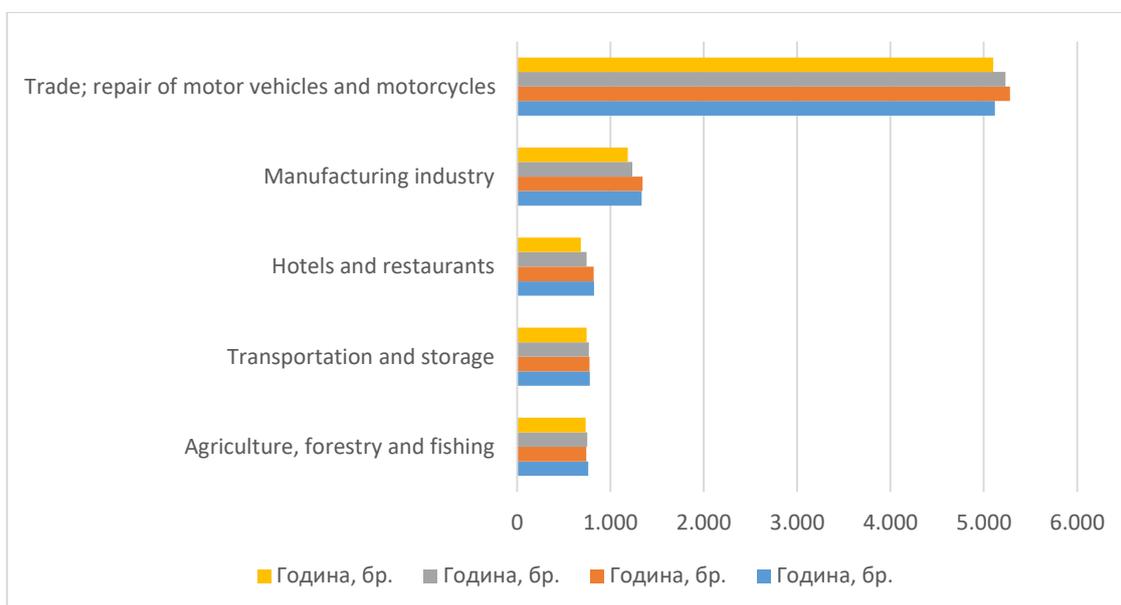
### 3.2.5. Haskovo district

Haskovo district covers 11 municipalities, has a territory of 5,533 square km and a population of 207,439 people (2022).



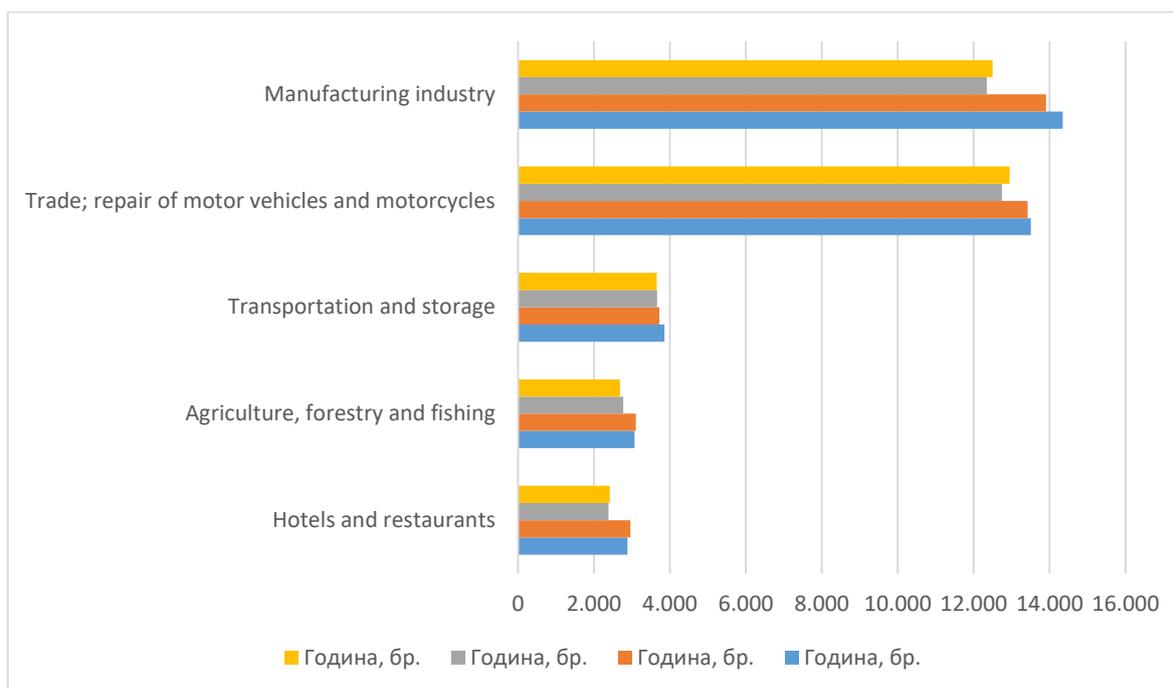
**Figure 40: Location of Haskovo district on the territory of Bulgaria** (Source: National Statistical Institute)

In Haskovo district, the leading sector having the greatest number of registered enterprises is trade with a share of about 43.9%, followed by the processing industry, hotels and restaurants, transport, and agriculture (the latter four sectors with a combined share of about 30%).



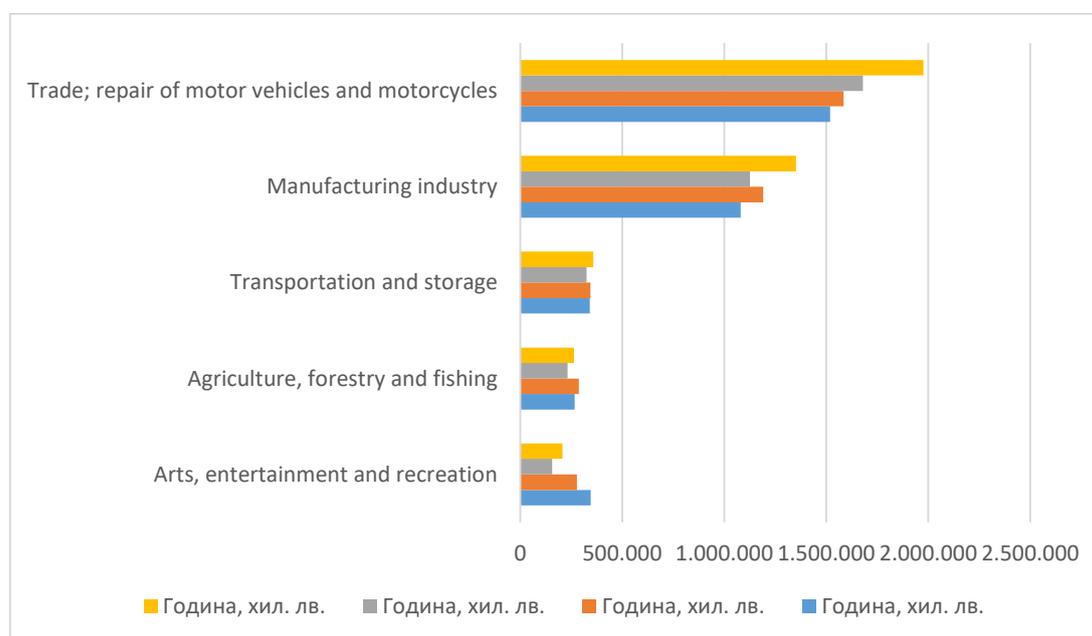
**Figure 41: Number of enterprises in Haskovo district** (Source: National Statistical Institute)

The number of employed persons in Haskovo region is the largest in the processing industry (28.1%), followed by trade (27.9%), transport (7.9%), agriculture (6.2%) and hotels & restaurants sector (5.6%).



**Figure 42: Number of employed persons in the enterprises in Haskovo district** (Source: National Statistical Institute)

The net income from sales in the trade sector (39.1%) and in the processing industry (27.5%) dominate over the other 3 leading sectors in Haskovo district's economy. Interestingly, the sector "Culture, sports and entertainment" also has a notable share of around 5.8%.



**Figure 43: Net income from sales of the enterprises in Haskovo district** (Source: National Statistical Institute)

The largest share in exports have processing enterprises (44.4%), followed by transport firms (26.4%) and commercial companies (23.8%). Although among the top 5 exporting sectors, agriculture and construction have a relatively small share (about 2% each).

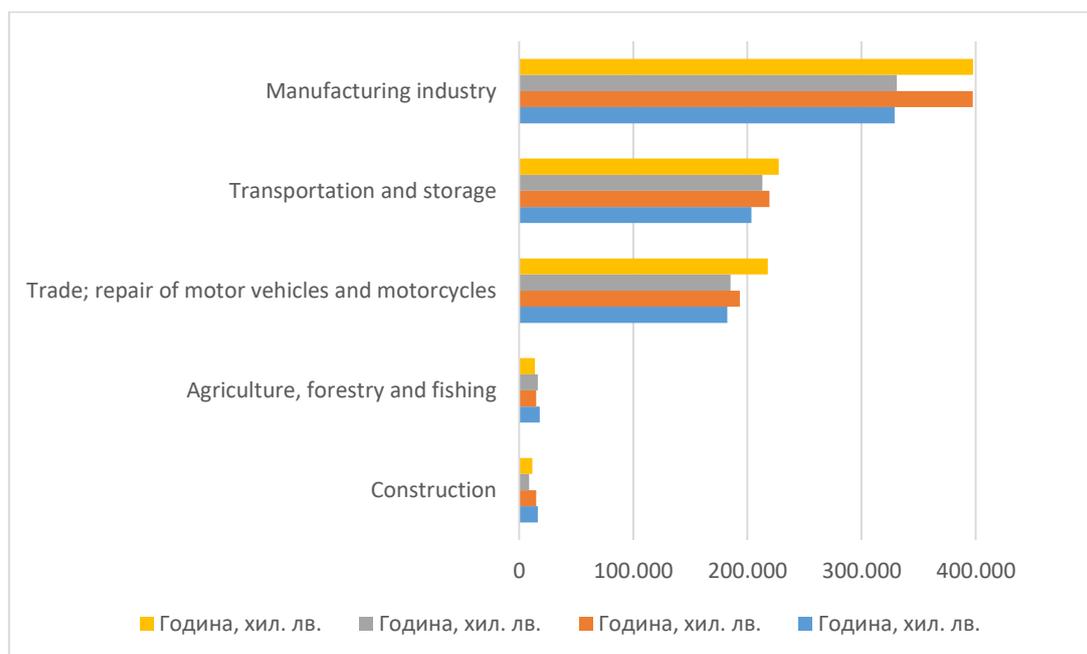


Figure 44: Exports of the enterprises from Haskovo district (Source: National Statistical Institute)

## 4 OPPORTUNITIES

Industry 4.0 is the next great technological step that can create unprecedented change in multiple industries across the world. **The companies that understand the importance of the new technologies that Industry 4.0 has to offer and put them to use will gain a major competitive advantage.** However, these benefits are still unknown to the majority of companies, particularly SMEs. Within the EU, very few regions have all Industry 4.0 competences/facilities at their disposal. One of the main reasons behind this (and this is particularly true for SMEs) is that companies are still uncertain about the technologies that they'll have to adopt, and they have a lack of staff that may be properly skilled/trained to use them. The high investment costs for these kinds of technologies also play a contributing factor in the lack of Industry 4.0 tech absorption [13].

### 4.1 EU programmes that can be exploited by Greek SMEs

Within the EU, Greece is a country that could largely benefit from European programs that can help it invest and adopt Industry 4.0 technologies. The necessity of taking advantage of EU Programs and initiatives is highlighted by the 2022 EU DESI Index which showed that Greece ranked 25<sup>th</sup> out of the 28 EU member states regarding digital maturity [14].

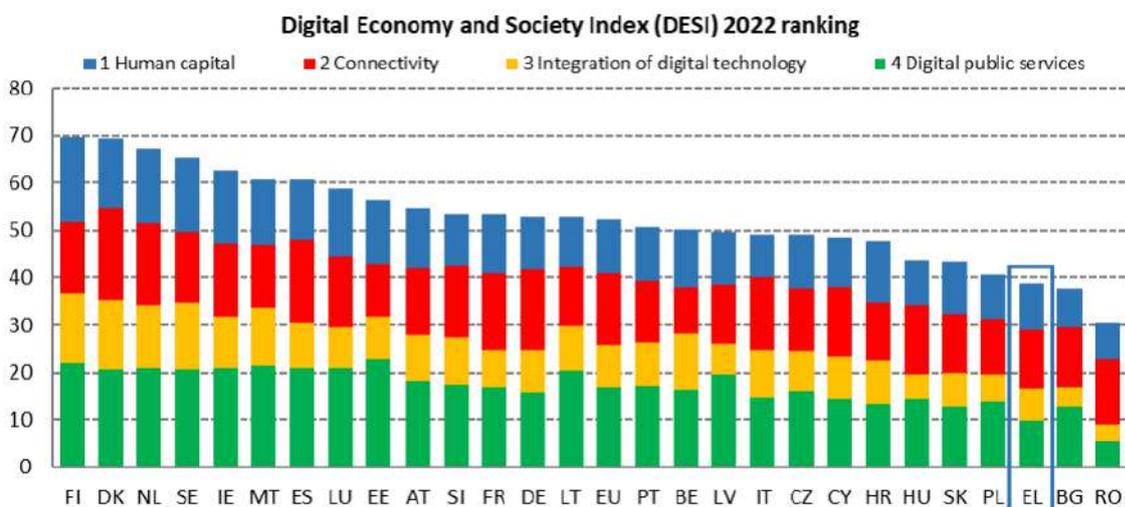


Figure 45: Digital Economy and Society Index (DESI) 2022 Ranking: Greece

The funding programs mentioned below, that Greek SMEs can take advantage of, shall be divided in two categories. **The first category includes programs that provide funding exclusively to Greek SMEs and the second one includes programs which provide funding at a pan-European scale.**

#### 4.1.1. EU programmes to be exploited exclusively by Greek SMEs

##### 1. National Strategic Reference Framework 2021-2027 (NSRF 2021-2027)

Co-funded by the European Union, this funding program plans to provide 26.2 billion Euros within a span of seven years towards Greek enterprises. The program is comprised of six main pillars as criteria for funding. **Twenty percent (about 5.24 billion Euros) of the total amount of funds will go to Pillar 1, known as "Smarter Europe", which aims -among other things- towards the digitization of businesses by applying I4.0 technologies [15].**

Within this framework, the **Digital Transition Program 2021-2027 has been approved**. With a projected budget of 943,004,309 Euros, it aims to contribute to the vision of a digital Greece by contributing to the following [16]:

- The provision of new and upgraded public digital services and applications to businesses and citizens,
- Ensuring the interoperability of digital systems and services,
- The development of digital platforms to support business activity,
- The digital transformation of local government,
- Ensuring ultra-high-speed connectivity,
- Meeting the needs in digital skills,
- The integration of cutting-edge technologies.

In July 2021, the Ministry of Digital Governance announced the **Digital Transformation Bible**<sup>9</sup> for the period 2020-2025, which covers the broadest sector of the national economy transformation, focusing to a particularly large extent in the digital transition of the public sector. The "Digital Transformation" program will play a big part in creating a "Digital Greece" by pushing the country's economic change. This includes making the most of new technologies and improving digital skills.

The Operational Program "Digital Transformation" has three main goals as illustrated in Figure 4:

- Improve the digital capabilities of the Public Sector with a budget of 400 million euros.
- Enhance digital connectivity with better broadband access, allocating an additional 400 million euros for this goal.
- Develop digital skills with a funding of 113 million euros.

---

<sup>9</sup> Digital Transformation Bible, <https://www.e-nomothesia.gr/kat-demosia-dioikese/upourgike-apophase-120301-eks-2021.html>



Figure 46: Digital Transformation Operational Program [36]

The Bible includes an extensive portfolio of approximately 450 digital transition projects, with an estimated budget of €7 billion. Of these, approximately 20 are actions of general strengthening of products within the framework of Industry 4.0 [17].

Of the 20 projects, only 4 (the Digitometer tool, the National Network of Digital Innovation Hubs, the National Platform for Digital Industry and the cyber-security toolbox) are in development, while the rest are formulated. In any case, the success of the Bible will depend on the speed of implementation and absorption of resources. The Table below presents selected Industry 4.0 programs and initiatives highlighting the ones already in development [17].

Table 11: National Industry 4.0 Programs and Initiatives [17]

Program/ Initiative	Details	Status
Digital Transformation of Businesses, with an emphasis on SMEs / Advanced 5G/FTTx productivity readiness	Enabling Greek businesses to immediately shape their "digital receptors" required for their transformation. Examples: Virtual Private Networks, Cloud infrastructure, Big data analytics & AI capabilities, IoT, industrial automation.	Formulated
Elaboration of Cybersecurity Investment Toolkit	Elaboration of a toolkit in order to provide targeted incentives to the private sector for cybersecurity investments.	In development

Program/ Initiative	Details	Status
<p><b>Strengthening the digital skills of citizens employed in specific sectors economy but also in all SMEs with cutting - edge educational and asynchronous media tools</b></p>	<p>Design and implementation of specialized training programs that combine modern and asynchronous means of education and intend to strengthen the digital skills of citizens who are employed in specific sectors of the economy but also in all SMEs. The programs will focus on learning services, certification of knowledge and skills, in thematic categories such as: e-commerce services, next-generation networks, digital marketing, download support systems decisions, e-gov services, collaboration &amp; project management using IT tools, robotics, IoT, 3d Design &amp; 3d Printing, cloud computing services, etc.</p>	<p>Formulated</p>
<p><b>Development of a system for assessing the digital maturity of businesses and documenting the planning of state aid for the digital transformation of businesses (Digitometer)</b></p>	<p>Introduction of an easy-to-use digital online tool for assessing the degree of digital maturity of small and very small enterprises. The tool provides through a structured questionnaire a high-level assessment of the digital maturity of the business and identifies potential areas for progress. From the picture of the intensity of the digital maturity of businesses by industry, policies that support businesses to achieve their digital transformation can be documented.</p>	<p>In development</p>
<p><b>Advanced and integrated manufacturing systems, automation and robotics</b></p>	<p>Promoting the use of advanced manufacturing systems, such as industrial robots, by enterprises, which will significantly contribute to improving their competitiveness.</p>	<p>Formulated</p>
<p><b>Development of digital services/systems to support start-ups or established businesses (scale-ups)</b></p>	<p>Development and utilization of digital platforms for provision of support services (e.g. finding partners for the implementation of business objectives, securing financial resources for making investments, locating a suitable place / industrial building for the establishment of economic activity, finding suppliers or research partners). The services may cover: Digital Transformation &amp; Restructuring, Innovation &amp; Organization, Finance Opportunities, Internationalization &amp; Extroversion, Synergies &amp; Networking.</p>	<p>Formulated</p>
<p><b>Creation of a National Network of Digital Innovation Hubs</b></p>	<p>Creation of an organized, reliable, sustainable and coordinated network of digital innovation hubs at the national level, in alignment with European strategy. The development and operation of the network will be carried out with the cooperation of agencies from both the public and private sectors (competent ministries, chambers, social partners, collective bodies, research and academic institutions, large companies) and will cover issues such as the utilization of new cutting-edge</p>	<p>In development</p>

Program/ Initiative	Details	Status
	technologies and ICT adoption in the organization and operation of businesses.	
<b>Development of a central support mechanism for Digital Innovation</b>	Providing guidance to all the agencies participating in the digital transformation of businesses, coordination of joint actions, information and know – how transfer. Actions: Mapping of actors (public and private) supporting digital transformation and innovation. Needs mapping: number, geographical distribution, thematic specialization of DIHs. Establishment of a framework for the definition and selection of DIHs. Preparation of operating and monitoring model performance. Action plan to connect with financing mechanisms and businesses.	Formulated
<b>ICT4Growth 2</b>	Enhancing mature investment projects for the design, development and commercialization of innovative value-added products and services involving or based on ICT. The products and services that will be developed through the investment projects can be addressed both to individual consumers and to other businesses.	Formulated
<b>Strengthening the use of supercomputers by SMEs</b>	Participation of SMEs in the SHAPE program (SME HPC Adoption Program in Europe), through the country's participation in PRACE. It is a pan-European program that supports the adoption of supercomputers by SMEs. It helps European SMEs to overcome barriers to using supercomputers, such as operating costs, lack of knowledge and lack of resources. It facilitates the process of defining both a workable supercomputer-based solution and an appropriate business model.	Formulated
<b>National Platform for Digital Industry</b>	Development of a new platform for Digital Industry ( <a href="http://www.industry4.o.gov.gr">www.industry4.o.gov.gr</a> ) following the standards of other European countries, with the aim of informing all interested parties about the benefits of the digital transformation of the industry and promoting the digitization of businesses.	In development
<b>Other projects with relevance to Industry 4.0 are:</b>	Development of basic skills in the general population with possibility of certification, Development of advanced skills in citizens of medium and high digital maturity, Operation of Model Digital Centers throughout the territory, Contribution to integration of digital skills development programs in primary and secondary education, Contribution in integrating digital skills development programs into their curricula of Universities	Formulated

## **2. NextGenerationEU Greece (available until December 2026)**

After the COVID-19 pandemic struck, the EU responded to this significant health and socio-economic crisis with the "NextGenerationEU" funding program. This program is designed to raise over 806 billion Euros in addition to the regular EU budget in financial markets and is divided in six distinct branches [18]:

- Green Transition
- Policies for the next Generation
- Smart, sustainable and inclusive growth
- Digital transformation
- Social and territorial cohesion
- Health and economic, social and institutional resilience.

The **digital transformation branch** aims to promote very high-capacity networks, the digitalization of public services, government processes and businesses, **especially SMEs. The program also includes the development of basic and advanced digital skills, the support of digital-related R&D and the deployment of advanced technologies** [18].

The program's core is the Recovery and Resilience Facility (RRF), the largest EU funding program so far, which aims to disburse approximately 723.8 billion Euros in grants and loans to member states. Each member state is obligated to submit a national Recovery and Resilience Plan (NRRP) that will pinpoint the reforms and investments that it will implement [19].

The Recovery and Resilience Fund (RRF or "Greece 2.0") includes the following indicative projects to support the transition of businesses to Industry 4.0 [17]:

- **Project "Digital Transformation of Small and Medium Enterprises":**

- Reinforcement with subsidies totaling €375m of SME investments in new electronic payment technologies, remote work, digital office (document, project management, etc.), digital marketplace, cyber security, etc. 100,000 businesses are expected to benefit. Aids will be provided by voucher/cheque.

- Creation of a central digital infrastructure, through which SMEs will come into contact and acquire digital tools and services (digital marketplace). Services provided: information and awareness of executives on technological issues, needs assessment, transfer of know-how, etc.

- Encouraging digital transformation investments with tax incentives on tangible and intangible assets. These incentives will take the form of over-depreciation of costs and fixed assets for the supply of software, cloud computing services, installation of specialized equipment, etc.

- **"Smart Manufacturing" project:** Acceleration of the upgrading of production equipment and infrastructure of manufacturing SMEs with financial support for related investments in smart manufacturing and artificial intelligence systems, totaling €75 million. Co-financing up to 50% is foreseen.

- **Over-depreciation on digital transformation investments**

- **"Education, Vocational Education and Training and Skills" project,** which contains (among others) the thematic section on digital skills

- **Industrial PhDs,** which can potentially relate to Industry 4.0 topics

In the **"Digital Transformation of Small and Medium Enterprises"** project, the following have recently received implementation approval: a) €180 million for the integration of digital products

and services, b) €100 million for the transition of SMEs in the cloud (sub-project "Industrial Data Platforms") and c) €20 million for the provision of value-added services, from planning to the completion of the action (concerns support services to SMEs, in addition to financial assistance) [17].

#### 4.1.2. EU programmes to be exploited by SMEs across Europe

##### 1. Horizon Europe (available until 2024) [20]

Horizon is the key funding program for R&I in the EU. It's projected that 95.5 billion Euros will be funded to companies across Europe and it's divided in three basic pillars:

- **Pillar 1 - Excellent Science (total funding of 25 billion Euros)**
- **Pillar 2 - Global Challenges & European Industrial Competitiveness (total funding of 53.5 billion Euros)**
- **Pillar 3 - Innovative Europe (total funding of 13 billion Euros).**

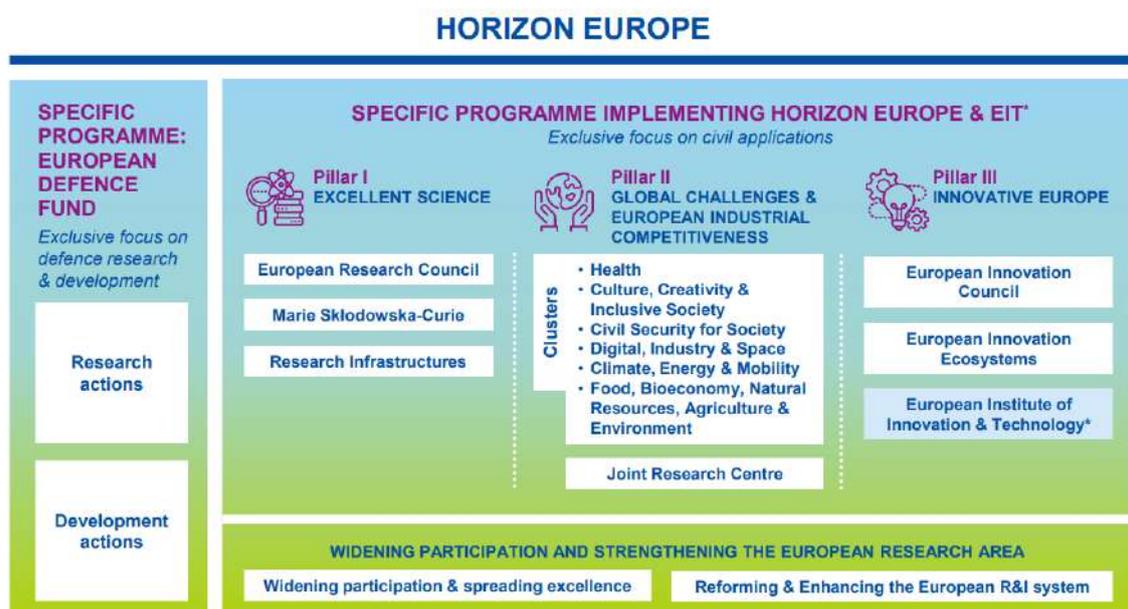


Figure 47: Overview of the Horizon Europe framework [21]

In this particular case, emphasis must be given on the fourth cluster of Pillar 2, known as **Digital, Industry and Space**. This cluster has a projected budget of 15.349 billion Euros. The ambition behind this initiative is the manufacturing of advanced technologies that will make Europe a global leader in key areas by creating a competitive, digital, low-carbon and circular industry. Cluster 4 is focused on the following interventions, many of which can help enterprises include I4.0 technologies in their ecosystems [21]:

- Manufacturing technologies
- Key digital technologies including quantum technologies
- Emerging enabling technologies
- Advanced materials
- Artificial intelligence and robotics
- Next generation internet
- Advanced computing and Big Data
- Circular industries
- Low carbon and clean industries

- Space including earth observation.

Actions under this cluster will support key enabling technologies that are strategically important for Europe's industrial future, and deliver on the following six expected impacts in the Strategic Plan, through matching destinations in this Work Programme [22]:

- Global leadership in clean and climate-neutral industrial value chains, circular economy and climate-neutral digital systems and infrastructures (networks, data centres), **through innovative production and manufacturing processes and their digitisation, new business models, sustainable-by-design advanced materials and technologies** enabling the switch to decarbonisation in all major emitting industrial sectors, including green digital technologies.
- **Industrial leadership and increased autonomy in key strategic value chains with security of supply in raw materials, achieved through breakthrough technologies in areas of industrial alliances, dynamic industrial innovation ecosystems and advanced solutions** for substitution, resource and energy efficiency, effective reuse and recycling and clean primary production of raw materials, including critical raw materials and leadership in circular economy.
- Sovereignty in **digital technologies and in future emerging enabling technologies** by strengthening European capacities in key parts of digital and future supply chains, allowing agile responses to urgent needs, and by investing in early discovery and industrial uptake of new technologies.
- Globally attractive, secure and dynamic data-agile economy by **developing and enabling the uptake of the next-generation computing and data technologies and infrastructures (including space infrastructure and data)**, enabling the European single market for data with the corresponding data spaces and a trustworthy artificial intelligence ecosystem.
- Open strategic autonomy in **conceiving, developing, deploying and using global space-based infrastructures, services, applications and data**, including by reinforcing the EU's independent capacity to access space, securing the autonomy of supply for critical technologies and equipment, and fostering the EU's space sector's competitiveness.
- A human-centred and ethical development of digital and industrial technologies, through a **two-way engagement in the development of technologies**, empowering end-users and workers, and supporting social innovation.

### 2. Invest EU (available until 2027)

This program will provide funding to enterprises across Europe [23], focusing on four distinct policy areas: Sustainable infrastructure, R&I and digitization, SMEs and Social Investment and skills.

The program consists of three building blocks [24]:

1. The InvestEU Fund

This fund brings together the European Fund for Strategic Investments (EFSI) and thirteen other EU financial instruments in order to stimulate 372 billion Euros of public and private investment. One of the of the portfolio guarantee products are:

- a. **The Innovation and Digitalization Portfolio Guarantee Product.**  
This portfolio aims to finance innovation and digitalization-driven businesses in order to contribute to Europe's economic growth and increased competitiveness. In terms of Innovation, financing will be provided towards improved products, processes, services, intellectual property investment or organizational approach and also towards fast-growing R&I-driven enterprises. In terms of Digitization, funding will be provided for advancements such as the digitalization of business models, supply chain management, CRM, business development, cybersecurity, training and upskilling [25] [26]
2. **The InvestEU Advisory Hub**  
Building on the success of the European Investment Advisory Hub, this hub is the central entry point for promoters and intermediaries that seek financial advisory and technical assistance from the European Investment Bank (EIB) for the identification, preparation and development of investment projects across the Union. The services that the EIB provides include strategic advice for national or local digitization initiatives, technical and financial advisory, business planning and market analysis. **These advisory services cover a range of topics, including digital and innovative technologies that are related to I4.0 (sustainable industry, cybersecurity, 5G, IoT, blockchain, AI, quantum technologies, smart transport/cities).** [27]
3. **The InvestEU Portal**  
The InvestEU Portal is meant to bring together investors and project promoters on a single, easily-accessible and user-friendly EU-wide platform. It continues on the principle that was set up by the European Investment Project Portal (EIPP) and can facilitate the communication between investors and project promoters that would otherwise not be able to reach each other. As the platform allows for project promoters to also reach investors outside the borders of the EU, it provides more opportunities for project funding. [28]

**Among its initiatives, InvestEU plans to focus on strengthening investments in digital infrastructures, technologies, and skills.** Its main digitization goals will be the following [29]:

1. The increase and improvement of connectivity and reduction of digital divide within the EU
2. The development of super-computing, artificial intelligence, blockchain, cloud, data, and Internet of Things.
3. The strengthening of European presence in key parts of the digital supply chain, such as semiconductors, including microprocessors, data technologies, 5G and quantum technologies.
4. The digital transformation of ecosystems and businesses across economic sectors, strengthening their potential and equipping them with the necessary digital tools and processes to compete and be resilient.
5. Innovative media content and technologies

**Greek SMEs can search for funding from this program via EURAZEO,** an equity/venture capital firm with global market reach. The company's investments focus mainly on the following [30]:

1. **Cleantech & Sustainability**
2. **Digitalisation**
3. **Mobility**

4. **Transport & automotive**
5. **Transition to a circular economy.**
3. **Digital Europe Program (available until 2027)**

With a projected budget of 7.59 billion Euros, **the Digital Europe Program aims to benefit EU citizens and all kinds of businesses, especially SMEs.** It supports the EU's objectives for green transition and digital transformation and is designed to bridge the gap between digital technology research and market deployment. Funding shall go to projects that focus in five crucial categories [31] [32]:

1. **Supercomputing**  
This category will provide 2.2 billion Euros from the total budget towards the advancement of Europe in supercomputing and data processing capabilities. The initial phase is to facilitate the purchase of world-class exascale supercomputers between 2022 and 2023, followed by posting exascale facilities between 2026 and 2027.
2. **Artificial intelligence**  
This category will provide 2.1 billion Euros from the total budget towards investments in artificial intelligence both for businesses and public administrations. The goal is to set up a safe data space across Europe and facilitate access to and storage of large datasets and trustworthy and energy efficient cloud infrastructure.
3. **Cybersecurity**  
This category will provide 1.6 billion Euros from the total budget towards investments in modern cybersecurity systems. The goal is to strengthen cybersecurity coordination within the EU.
4. **Advanced digital skills**  
This category will provide 580 million Euros from the total budget towards investments in the organization of specialized programs and traineeships. The goal is to prepare the workforce to properly utilize tools such as Big Data, AI, cybersecurity and quantum/high performance computing.
5. **Ensuring the wide use of digital technologies across the economy and society**  
This category will provide 1.1 billion Euros from the total budget towards investments in high impact deployments in areas of public interest, such as health, Green Deal, smart communities and the cultural sector. The goal is to construct a strong network among European Digital Innovation Hubs, aiming to have a Hub in every region that will help companies benefit from digital opportunities. Industries, notably SMEs, will be provided the proper funding to purchase advanced digital and related technologies and also deploy/access state-of-the-art digital technologies.

#### 4. **Euratom Research and Training Programme (2021-2025)**

**The Euratom Research and Training Programme**, functioning alongside Horizon Europe for 2021-2025, focuses on nuclear research and innovation with a budget of €1.38 billion. It adheres to the same participation rules as Horizon Europe. The program supports both direct actions carried out by the European Commission's Joint Research Centre and indirect actions by collaborative consortia. The budget allocation includes €583 million for fusion research, €266 million for nuclear fission, safety, and radiation protection, and €532 million for the Joint Research Centre's direct actions. The programme aligns with the Euratom Treaty, set for a five-year term and potential two-year extension to match the EU's 2021-2027 budget cycle [38].

The Euratom Research and Training programme is strategically designed with the following business-oriented objectives, with an emphasis on incorporating SMEs [38]:

- To advance nuclear safety, security, and radiation protection, manage spent fuel and radioactive waste, and oversee decommissioning processes. This initiative aims to bolster the safe and secure application of nuclear power and the industrial utilization of ionising radiation, providing opportunities for SMEs to contribute to and benefit from these advancements.
- To preserve and escalate the nuclear sector's expertise and competencies, ensuring a robust community of knowledge that SMEs can tap into for innovation and growth.
- To support the evolution of fusion energy as a viable future electricity source, aligning with the European fusion roadmap and opening avenues for SMEs in cutting-edge energy research and development.
- To reinforce the EU's commitment to the continuous elevation of nuclear safety, safeguards, and security standards, a policy that extends potential for SME involvement in setting industry benchmarks.

The programme will also extend its scope to research on the non-power applications of ionising radiation, with improvements in education, training, and access to research infrastructure, all of which present SMEs with new prospects for development and collaboration.

Emphasizing the cultivation of nuclear skills and competence, the Euratom programme seeks to maintain Europe's leadership in nuclear safety and waste management, areas where SMEs can play a pivotal role. This commitment to excellence in radiation protection is expected to open up additional markets and opportunities for SMEs.

Furthermore, the programme will facilitate the mobility of researchers in the nuclear field, particularly through Horizon Europe's Marie Skłodowska-Curie Actions (MSCA), creating collaborative opportunities for SMEs across Europe.

### 5. Connecting Europe Facility (CEF) (2021-2025)

The **Connecting Europe Facility (CEF)** is a crucial EU funding instrument designed to help achieve the European Green Deal and the Union's decarbonization targets for 2030 and 2050. It focuses on enhancing trans-European networks in **transport, energy, and digital services**, ensuring high performance, sustainability, and efficient connections [39]. The CEF aims to bridge gaps in Europe's infrastructure, thereby improving travel, increasing energy security, promoting renewable energy use, and facilitating digital interactions. It supports all Member States and uses grants, guarantees, and project bonds to finance projects, leveraging the EU budget to draw additional investment from private and other public sources. The CEF strengthens travel, energy security, and the adoption of renewables, while fostering cross-border digital integration between businesses—including SMEs—and public administrations. The CEF not only provides grants but also offers financial incentives like guarantees and project bonds to amplify the impact of the EU budget, thereby incentivizing additional investments from SMEs, private, and public sectors [39].

In the **energy domain**, with a budget of **€5.84 billion for 2021-2027**, the CEF focuses on cross-border renewable projects and network digitalization, aligning with the Trans-European Networks for Energy (TEN-E) policy, which underpins energy infrastructure upgrades crucial for SMEs in the energy sector.

**For transport**, the CEF allocates **€25.81 billion**, concentrating on cross-border infrastructure, bottleneck removal, and innovation to enhance infrastructure utility, reduce environmental impact, and bolster safety—all of which provide SMEs in the transport sector with improved operational conditions and market access.

The digital arm of the CEF, managed by HaDEA, promotes the digitalization essential for SMEs to compete in the modern digital economy, providing a foundation for innovation and cross-border digital services.

## 6. Single Market Programme (2021-2027)

The Single Market Programme (SMP) is the EU's funding initiative with a budget of **€4.2 billion for 2021-2027**, aimed at helping the single market reach its full potential and assisting Europe's recovery from the COVID-19 pandemic. This programme is essential for SMEs as it simplifies the funding process and enhances the single market's governance [40].

The single market has been a key part of the EU for almost 30 years, allowing people to move freely, protecting consumers, and providing a variety of quality products and services at competitive prices. For SMEs, it offers clear rules, access to markets and funding, and investment chances – all crucial for business growth. The pandemic has shown that there are still areas where the single market can be fully realized and improved, demonstrating its importance for a strong economy and for the success of SMEs.

The SMP consolidates funding from several previous initiatives into a single, more efficient programme. This will make it easier for SMEs to navigate and benefit from the single market, fostering their ability to innovate, expand, and compete effectively.

The objectives of the Single Market Programme are as follows [40]:

- **Food Safety:** Ensure a safe and sustainable food chain.
- **Consumer Protection:** Guarantee a high level of consumer protection and product safety; amplify the voice of consumers.
- **Support to SMEs:** Enhance the competitiveness and sustainability of small and medium-sized enterprises (SMEs).
- **Effective Single Market:** Improve the functionality of the internal market with better market surveillance and support for solving issues faced by citizens and businesses, along with a strengthened competition policy.
- **Quality Statistics:** Produce and disseminate high-quality European statistics.
- **European Standards:** Develop effective European standards, including international financial and non-financial reporting and auditing standards.

## 7. Union Anti-Fraud Programme (2021-2027)

**Article 325** of the **EU Treaty** states that both the EU and its Member States must work together to prevent fraud and any illegal activities that could harm the EU's finances. To help Member States and potentially SMEs combat fraud, the EU [41]:

- Continues to guard the EU's money by giving financial help, like the support once provided by the Hercule III program. This includes technical help, help with investigation operations, training, and research.
- Helps customs and farming sectors work together to stop fraud, especially through the Anti-Fraud Information System (AFIS).
- Runs the Irregularity Management System (IMS) which allows Member States to report any financial irregularities they find.

The program is allocated a budget of approximately EUR 181 million for the duration of 2021-2027, as depicted in Figure 48.

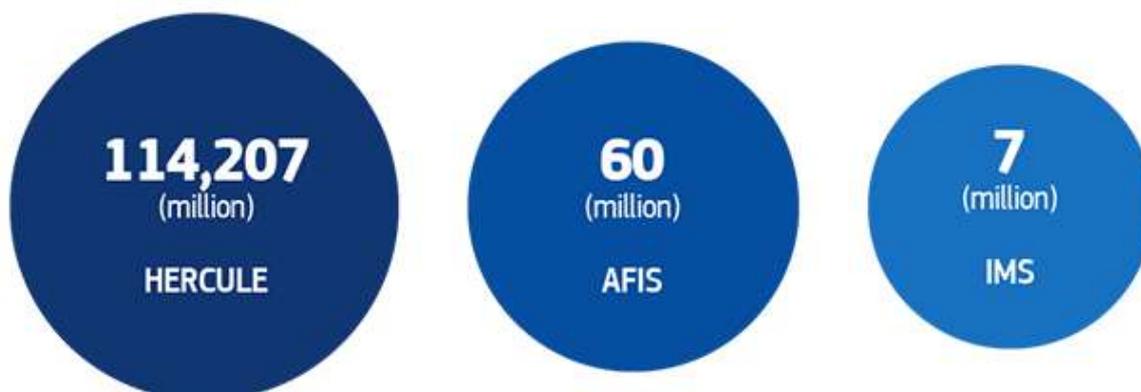


Figure 48: Union Anti-Fraud Programme Budget

The AFIS component offers financial support to ensure laws regarding customs and agriculture are applied correctly, helping to prevent fraud in these areas [41].

- **Union Anti-Fraud Programme - Hercule component:** This component of the Union Anti-Fraud Programme previously provided funding specifically aimed at combating fraud, corruption, and other illegal activities affecting the financial interests of the EU.
- **Union Anti-Fraud Programme – AFIS component:** This initiative invites entities to submit project proposals that aim to fight fraud and protect the EU's financial interests. The selected projects receive financial support.
- **Union Anti-Fraud Programme - IMS component:** The IMS component is an electronic system used by EU Member States and beneficiary countries to report financial irregularities, facilitating the process of identifying and managing instances of fraud.

## 8. European Regional Development Fund (2021-2027)

The European Regional Development Fund (ERDF) aims to make the EU stronger economically, socially, and in terms of how well different regions are doing. It helps reduce the differences between regions by investing in areas that make Europe smarter, greener, better connected, and more social. This includes support for small and medium-sized businesses (SMEs), digital upgrades, and helping regions handle climate change better [42]. The budget for the **ERDF from 2021 to 2027** is approximately **€200 billion**, underpinning its commitment to fostering a more cohesive European Union [42].

The ERDF plans to use its funds from 2021 to 2027 as follows [43]:

- **Boosting business and technology:** Helping SMEs grow with new innovations and better digital connections.
- **Protecting the environment:** Investing in projects that reduce pollution and help with climate change.
- **Improving transport:** Making it easier for people to get around.
- **Helping communities:** Supporting jobs, education, skills, and making sure everyone has the same chance to get healthcare. It also includes funding for cultural projects and tourism that doesn't harm the environment.

- **Focusing on local needs:** Putting money into local projects to improve cities and towns across the EU.

The ERDF requires that each region in the EU focus on these main areas [42]:

- More developed places will spend most of their money on business, technology, and green projects.
- Transition regions will spend a good part of their money on making their economy more advanced.
- Less developed areas will spend at least a quarter of their money on similar projects.

Every region should also spend some of their money on projects that improve city life through local groups. Plus, 30% of all the money from the ERDF will go to projects that help the climate.

### 4.1.3. Other EU Initiatives [33]

**Technology centers, competence centers, and Open Innovation Test Beds (OITBs)** are pivotal entities, both public and private, that actively engage in applied research and innovation activities within the realm of Industry 4.0, typically within the Technology Readiness Levels (TRL) ranging from 3 to 8. **These centers possess the essential expertise, infrastructure, and equipment necessary to support Small and Medium Enterprises (SMEs) in the development of Industry 4.0 solutions. Additionally, they play a critical role in assisting SMEs in adopting emerging technologies associated with Industry 4.0, which can significantly enhance their sustainability and competitiveness.** Despite their significance, the European landscape of these centers remains largely undiscovered by SMEs, which could greatly benefit from collaboration with these entities in the context of Industry 4.0.

At the European Union (EU) level, various initiatives acknowledge the pivotal role of these centers in driving Industry 4.0 innovation and enhancing the competitiveness of industries. These initiatives share the common goal of **fostering stronger connections between industry players, SMEs, and these centers, while utilizing different configurations and mechanisms to achieve this objective.** Below, key initiatives that feature technology centers, competence centers, and OITBs as central actors specifically in the context of Industry 4.0 are outlined:

- **Digital Innovation Hubs (DIHs):** DIHs serve as dynamic ecosystems that encompass SMEs, large industries, startups, researchers, accelerators, and investors. Their primary mission is to create optimal conditions for long-term business success for all participants, particularly in the context of Industry 4.0. These hubs act as "one-stop-shops" that facilitate the enhancement of companies' competitiveness by integrating digital technologies into their business processes, products, or services. DIHs must meet specific criteria, including alignment with regional, national, or European policies to digitize industries, non-profit status, physical presence in the region, and a track record of aiding companies in digital transformation within the Industry 4.0 framework. **The Digital Europe Programme<sup>10</sup> seeks to enhance the capabilities of selected DIHs, with a particular focus on fostering collaboration and knowledge exchange among hubs to drive Industry 4.0 innovations.**
- **Technology Centers and Competence Centers:** These centers play a crucial role in assisting SMEs in overcoming the challenges associated with Industry 4.0 adoption. They

---

<sup>10</sup> <https://digital-strategy.ec.europa.eu/en/activities/work-programmes-digital>

specialize in developing and producing Industry 4.0-based products and solutions, helping companies reduce time-to-market for innovative ideas in this domain. These centers typically operate within the TRL range of 3 to 8, focusing on Advanced Technologies for Industry 4.0. To be recognized as an ATI technology center or competence center, entities must adhere to qualitative criteria, including providing services to industry and SMEs, engagement in at least one Key Enabling Technology relevant to Industry 4.0, and active involvement in higher Technology Readiness Levels (TRLs) – specifically TRL 5, TRL 6, TRL 7, or TRL 8. Quantitative criteria, based on self-declaration, further establish the centers' credibility by requiring engagement in a substantial number of Industry 4.0 projects with SMEs over the past two years.

- Open Innovation Test Beds (OITB):** OITBs encompass entities established in at least three EU Member States or Associated Countries and offer common access to physical facilities, capabilities, and services necessary for the development, testing, and upscaling of Industry 4.0 technologies in industrial settings. OITBs aim to progress from laboratory-based validation (TRL 4) to the creation of Industry 4.0 prototypes in industrial environments (TRL 7). Access to OITBs is governed by transparent and equitable conditions, including considerations for security, safety, and intellectual property rights. Users span individuals, teams, and institutions from both the public and private sectors, including SMEs, who are keen on developing and validating their Industry 4.0 solutions.

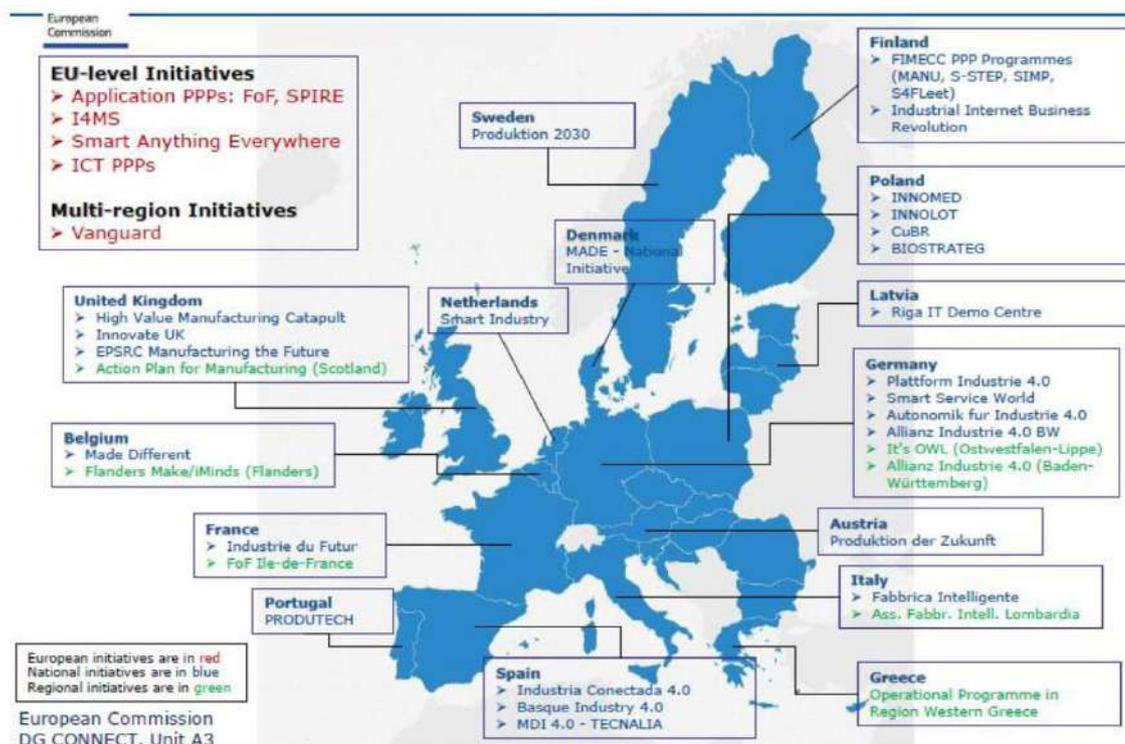


Figure 49: I4.0 EU Competence Centers

The EU's initiatives involving technology centers, competence centers, and Open Innovation Test Beds hold immense potential for driving Industry 4.0 innovation and enhancing the competitiveness of SMEs. These initiatives collectively aim to bridge the gap between SMEs and advanced Industry 4.0 technologies, fostering collaboration, knowledge exchange, and

**skills development.** By harnessing the expertise and infrastructure of these centers, SMEs can navigate the path from research and development to market deployment more effectively. Ultimately, these collaborative efforts contribute to the growth and sustainability of European industries in the era of Industry 4.0 while empowering SMEs to thrive in an increasingly competitive landscape.

## **4.2 EU programmes that can be exploited by Bulgarian SMEs**

### **4.2.1 Opportunities to encourage the development of small and medium-sized enterprises (EU funded instruments)**

During the new programming period (2021 – 2027), there is a large range of opportunities for financial support for the development of small and medium-sized enterprises in the cross-border region. In general, they can be grouped into the following areas:

- Financing from the European Structural and Investment Funds in Bulgaria
- Financing from the Recovery and Resilience Plan
- Financing from seed, venture and mezzanine funds
- Financing from the Cooperation Programme Interreg VI-A "Greece-Bulgaria 2021 – 2027"

### **4.2.2 Financing from the European Structural and Investment Funds in Bulgaria**

According to the Partnership Agreement, until the end of 2029, Bulgaria can invest significant funds to increase the competitiveness of its small and medium-sized enterprises, and these lines of financial support correspond to the following policy objectives (PO) of the European Union:

- PO 1: A smarter Europe (innovative & smart economic transformation)
- PO 2: A greener, low-carbon Europe (including energy transition, the circular economy, climate adaptation and risk management)
- PO 4: A more social Europe (the European Pillar of Social Rights)

Given the challenges that Industry 4.0 poses to enterprises in Bulgaria and the need to find an adequate response on their part to preserve their competitiveness, local companies may receive financial support under the following new programmes:

- Programme "Competitiveness and Innovation in Enterprises"
- Programme "Research, Innovation and Digitization for Smart Transformation"
- Programme "Human Resources Development".

#### **4.2.2.1 Programme "Competitiveness and Innovation in Enterprises" 2021 – 2027**

The programme is aimed at achieving intelligent and sustainable growth of the Bulgarian economy, as well as the implementation of industrial and digital transformation. It has a budget of nearly BGN 3 billion and is structured around two main priorities:

- Priority 1 "Innovations and growth"
- Priority 2 "Circular economy".

Support under Priority 1 is directly aimed at:

- Increasing the innovation activity of enterprises by encouraging the implementation of internal R&D and innovation for enterprises, creation of new and development of innovative enterprises, application and protection of industrial property

- Increasing the level of digitization of enterprises by promoting the development and implementation of Industry 4.0 technologies, as well as the implementation of appropriate processes for cyber security and data privacy
- Stimulating the growth, competitiveness and internationalization of enterprises by promoting entrepreneurial activity, supporting enterprises according to the regional development potential, providing complex services in support of SMEs on the principle of “one-stop service”, developing export potential and supporting the attraction of investments

Priority 2 will provide financing to companies for the implementation of projects related to:

- Reducing the energy intensity and energy independence of enterprises through the introduction of energy efficiency measures and support for the use of energy from renewable sources for own consumption
- Promotion of the transition to a circular economy by introducing circular models of production and consumption in enterprises, support for industrial symbiosis, as well as development and implementation of innovations in the field of clean technologies, circular and low-carbon economy

### 4.2.2.2 Programme “Research, Innovation and Digitization for Smart Transformation” 2021 – 2027

The programme meets the strategic needs and priorities of Bulgaria for accelerated economic development through investments in the development of scientific research, scientific infrastructure, innovation and smart industry and the rapid entry of digital technologies into the economy and society. Higher schools, research organizations and enterprises can apply under the programme.

The main objective of the actions under **Priority 1 “Sustainable development of the Bulgarian research and innovation ecosystem”** of the programme is to strengthen the contribution of scientific research and innovation to higher economic and social development of Bulgaria. The focus of the interventions is on strengthening the administrative and scientific capacity of scientific organizations and higher schools; strengthening the cooperation of research organizations and higher schools with business and industry; increasing market demand orientation; shortening the path from research to innovation; implementation and transfer of technologies and knowledge, together with their market realization and creating conditions for internationalization and increasing the share of people employed in R&D in the public and private sectors and creating and sharing data for the purposes of scientific research and implementation of innovations.

Under Priority 1, projects that have received the **“Seal of Excellence”** quality mark under the **“Digital Europe”** and **“Horizon Europe”** programmes of the European Commission will also be financed. Investments will be made in industrial innovation programmes to develop technologies to make regions more competitive and climate neutral.

The planned activities under **Priority 2 “Digital transformation of the public sector”** will be tailored to the potential and needs for research and innovation activities, e.g. related to big data, open access, cybersecurity, etc.

When determining the conditions for implementing certain interventions under Priority 2, both the established scientific research infrastructure (including in the field of data, artificial intelligence, supercomputer and quantum technologies), as well as the results of the implementation of

scientific programmes and the created scientific potential in the Centers of competence and Centers of excellence funded during the previous programming period (2014-2020) will be used.

#### 4.2.2.3 Programme "Human Resources Development" 2021 – 2027

The programme will provide funding to improve the capacity of human resources in the field of new technologies and innovations in enterprises, targeting the areas of smart specialization and the technologies of Industry 4.0 and Industry 5.0.

A major part of the programme is aimed at supporting the labour market, including persons employed in enterprises. Priority 1 "Promoting employment and skills development" aims to address employment challenges, job quality, new skills for the workforce and the adaptability of businesses and the workforce to changing skills requirements and working conditions. Taking effective measures to improve access to quality jobs and a work environment adapted to change is a key factor in overcoming the challenges arising from globalization, the digital revolution, changing work patterns, the social and demographic situation, the transition to a resource-efficient, circular and a climate-neutral economy and the related diversification and modernization, especially in relation to the acquisition of green skills and relevant reskilling of the workforce.

The Programme activities will support these transitions by creating new jobs and acquiring new skills while other jobs change or even disappear. Measures are planned for the development and implementation of work process optimization systems for the adaptation of enterprises and workers to changes. The provision and maintenance of a healthy, safe and productive work environment will be supported.

A major focus of the programme's support is lifelong learning, with a particular focus on acquiring competences and supporting the labour market of the future, which will require new skills. Increasing the level of digital skills of the workforce will be financed. Investments in qualification and retraining of the workforce will be directed to the requirements of employers and the new needs of the labour market.

The growing implementation of digital technologies implies the acquisition and construction of new competences corresponding to the "skills of the future" in the context of Industry 4.0, which the Programme will support. A large part of the trainings will be tied to the forecasts developed and the studies made for the development of the labour market, taking into account the specific needs of employers at regional level. Given the growing role of non-formal and independent learning for the acquisition and continuous development of knowledge and skills, the programme will support their recognition and validation activities, incl. validation of key competencies and soft skills of both unemployed and employed individuals.

#### 4.2.3 Financing by the Recovery and Resilience Plan

The main objectives of the Recovery and Resilience Plan are to facilitate the economic and social recovery of Bulgaria from the crisis caused by the COVID-19 pandemic and to create a more sustainable, fair and successful economy. In pursuit of these goals, the plan contains a set of measures and reforms that will not only restore the growth potential of the economy, but also develop and enhance it.

The structure of the Recovery and Resilience Plan consists of four pillars, some of which will provide financing for business transformation to Industry 4.0, as follows:

- **Pillar "Innovative Bulgaria"** with key components:

- Education and skills
- Scientific research and innovation
- Smart industry.

Component “Education and skills” will fund the creation of STEM centers and innovation in education, as well as the provision of digital skills training and the creation of an adult learning platform.

Under component “Scientific research and innovation” investments are planned to strengthen the innovation potential and accelerate the internationalization of the Bulgarian research and innovation system. Funding of innovative enterprises awarded the “Seal of Excellence” is foreseen, as well as the creation and development of a network model of research universities to support industry and society.

Component “Smart industry” foresees the realization of an Economic Transformation Programme with the following main activities:

- Providing support for the recovery and growth of enterprises, creating sustainability in the innovation ecosystem and growth in sectors with high innovation and export potential, as well as increasing equity investments in green and digital infrastructure
  - Providing support to encourage SMEs to introduce new digital technologies and solutions, specialized hardware and software to increase the level of digitization in enterprises and technological modernization
  - Improving energy and resource efficiency, increasing the use of renewable energy sources and improving the capacity of SMEs in connection with the transition to a circular and low-carbon economy, with a particular focus on implementing the principles of the circular economy, creating new production chains and reducing the resource footprint
- **Pillar “Green Bulgaria”** with key components:
    - Low-carbon economy
    - Biodiversity
    - Sustainable agriculture

Under component “Low-carbon economy”, the digital transformation and development of the information systems and real-time systems of the Energy System Operator in the context of low-carbon energy will be financed, as well as the national infrastructure for storing electrical energy from renewable energy sources.

Under component “Sustainable agriculture” a Fund will be created to promote the technological and ecological transition of agriculture.

- **Pillar “Connected Bulgaria”** with key components:
  - Digital connectivity
  - Transport connectivity
  - Local development

Funds from the “Digital connectivity” component will be invested in:

- Large-scale deployment of digital infrastructure on the territory of Bulgaria
- Construction, development and optimization of the digital TETRA system and radio relay network

- The digital transformation of the state enterprise “Bulgarian Posts” EAD and provision of complex services.

Part of the funding under component “Transport connectivity will be directed towards digital investments, for example:

- Implementation of the European Rail Traffic Management System (ERTMS)
- The implementation of a pilot scheme to support sustainable urban mobility through measures to develop ecological, safe, functional and energy-efficient transport systems.

In the “Local development” component, investments are foreseen for digitalization of the complex management, control and efficient use of water.

- **Pillar “Fair Bulgaria”** with key components:
  - Business environment
  - Social inclusion
  - Healthcare.

Under “Business environment” component, projects will be realized for:

- Digitization of key judicial processes in the system of administrative justice
- Support of a pilot project for the introduction of building information modeling in investment design and construction as a basis for digital reform of the construction sector in Bulgaria
- The creation of a unified information system for territorial planning, investment design and construction authorization, etc.

Under the “Social inclusion” component, resources are foreseen, which will be invested through the Ministry of Culture for the development of the cultural and creative sectors, as well as for the digitization of collections of museums, libraries and archives.

Finally, under the “Healthcare” component, funds are provided for the creation of a national digital platform for medical diagnostics.

### **4.2.4 Financing from seed, venture and mezzanine funds**

The financial instruments that are managed by the Bulgarian “Fund Manager of Financial Instruments in Bulgaria” EAD (Fund of Funds) represent specialized financing schemes with funding from the various operational programmes. They are of two main types:

- Debt instruments (75% of the financial resource)
- Equity and quasi-equity investments (25% of the financial resource)

The Managing Authorities of the EU-funded programmes in Bulgaria conclude financial agreements with the Fund of Funds, by which they entrust it with the management of the funds intended for financial instruments under the relevant European programmes.

According to a EU-wide methodology, the Fund of Funds performs a preliminary assessment of the demand and supply of financial products and determines the size and type of financial instruments in accordance with the goals set in the relevant European programmes. Then, it selects financial intermediaries through open and transparent procedures in accordance with the European regulations and established market practices. The fund provides public resource to financial

intermediaries who complement it with private funds. Subsequently, the fund managers provide the funds to eligible final recipients in the form of loans, equity and quasi-equity financing. The use of funds from financial instruments is controlled by national and European institutions at all levels – European programme, Fund of Funds, financial intermediary and final recipient.

More specifically, part of the funds of operational programme “Innovations and Competitiveness” 2014 – 2020 were specially intended for companies, which were realized on the market through 5 funds, which are still active:

- Seed/Acceleration and Start-Up Fund I
- Seed/Acceleration and Start-Up Fund II
- Seed/Acceleration and Start-Up Fund III
- Venture Capital Fund
- Mezzanine/Growth Fund.

In addition to these 5 funds, a “Recovery” programme was implemented through the commercial banks, aiming to facilitate business access to loans for the recovery of activity after the gradual lifting of measures related to the COVID-19 pandemic. Through the programme, Bulgarian small and medium-sized enterprises gained access to financial resources mainly to meet their current liquidity needs, for new investments, transformation and growth.

### **4.2.5 Financing from the Cooperation Programme Interreg VI-A “Greece-Bulgaria 2021 – 2027”**

The Programme is the main instrument for the development of bilateral cooperation between Greece and Bulgaria with funding from the European Regional Development Fund.

The total budget of the Programme is nearly EUR 84 million, of which EUR 67.2 million (80%) is provided by the European Regional Development Fund, and EUR 16.8 million (20%) is national co-financing – by the participating countries in the programme.

The programme will finance projects under three priorities as follows:

- Priority 1: A more Resilient and Greener Greece-Bulgaria Cross Border Territory
- Priority 2: A more accessible Greece-Bulgaria Cross Border Territory
- Priority 3: A more Inclusive Greece-Bulgaria Cross Border Territory

The target groups and main types of beneficiaries are national, regional and local authorities, non-governmental public and private organizations and commercial companies.

In view of Industry 4.0, under Priority 1, projects of small and medium-sized enterprises will be financed for promoting the transition to a circular and resource efficient economy (green and circular business models) in the following areas:

- Smart monitoring of materials, energy, and wastes flows
- Development of circular business models to favor the establishment of regional close-loop value chain by employing B2B, B2C and C2C models of cooperation.
- Applied research and cooperation between research centres and SMEs for the promotion of eco-innovation, design of new, sustainable material and more friendly to the environment products based on local resources or traditional products.

Under the same priority, there will be funding for enterprises aimed at enhancing the role of culture and sustainable tourism in the economic development, social inclusion and social innovation:

- Promotion of digitization of tourism resources and processes and adoption of digital and innovative tools in local tourism industry
- Creation/Provision of innovative touristic services
- Technological and digital platforms and tools for cooperative tourist development and promotion, strengthening digital governance of tourist destinations cooperation for joint touristic utilization
- Promotion of thematic routes in areas such as geo-tourism etc.

## 5 POLICIES AND MEASURES

### 5.1 Digital Transformation in Europe

The European Union (EU) is steering towards a “**Digital Decade**” with a well-defined agenda laid out in the program called “**The Path to the Digital Decade**”. Aiming for digital transformation by 2030, this initiative sets ambitious benchmarks monitored through the evaluation of **Digital Economy and Society Index (DESI)** indicators across member states. At the core of this initiative is the 2030 Digital Compass, a meticulously drafted roadmap guiding member states in achieving digital milestones [34].

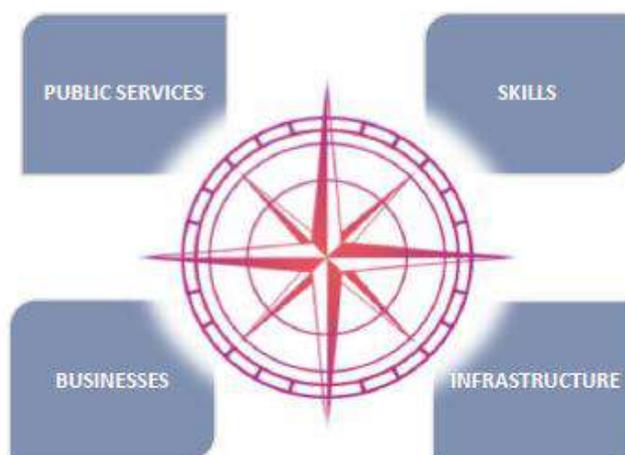


Figure 50: The 2030 Digital Compass [34]

The compass spins around four pivotal axes - honing digital skills, fostering digital transformation within businesses, building secure and sustainable digital infrastructures, and digitalizing public services. The 2030 Digital Compass outlines a comprehensive roadmap for the EU's digital transition over the next decade, acknowledging the pivotal role of Small and Medium-sized Enterprises (SMEs) as significant players in achieving this digital metamorphosis.

- **Digital skills** initiative aims to improve digital literacy among the EU populace, with a special emphasis on enabling 80% of adults with basic digital skills by 2030. A robust pool of 20 million employed ICT specialists is envisioned, where SMEs can find a skilled workforce to aid in their digital transformation endeavors. Efforts to achieve gender balance within ICT specialists can foster a more inclusive digital ecosystem, encouraging a diversity of ideas and innovations beneficial for SMEs.
- **Secure and Sustainable Digital Infrastructure** is essential, ensuring SMEs have the necessary digital backbone to operate efficiently and innovate. Achieving Gigabit network and 5G

connectivity across populated areas aims to provide SMEs with high-speed, reliable communication infrastructure crucial for their digital operations. The ambition of establishing a European quantum computer by 2025 and 10,000 climate-neutral edge nodes indicates a stride towards offering cutting-edge computational resources, potentially aiding SMEs in harnessing advanced data processing and analytics capabilities.

- **Digital Transformation of Businesses** aims to accelerate digital adoption within European businesses, particularly SMEs, in order to enable them to leverage advanced digital technologies as quickly as possible. Manufacturing, healthcare, construction, agriculture, and mobility are five critical ecosystems where digital technologies may greatly benefit SMEs. Aiming to achieve a basic level of digital intensity for 75% of EU companies and 9 out of 10 SMEs, the Compass reflects a concerted effort to strengthen digital capabilities within SME markets.
- **Digitalization of Public Services** through digital platforms is envisioned to ease interactions between European citizens, businesses, and the state, providing SMEs with a simplified, efficient interface for regulatory and administrative processes. A digital ID provision and access to digital health records can also benefit SMEs by alleviating bureaucratic hurdles and supporting a more transparent interaction with government agencies. A "Government as a Platform" model is an attempt to streamline public service delivery through digital means, which could reduce operational friction for SMEs and foster an environment conducive to digital growth and innovation.

In order to prepare for an inclusive, sustainable digital decade, the EU envisions multi-country, large-scale projects and synergized investments from the Recovery and Resilience Facility (RRF), as well as the national and private sectors.

The "**ManuFUTURE Vision 2030**" delineates a strategic framework geared towards bolstering Europe's manufacturing sector, ensuring its competitive edge on the global stage while fostering sustainability [35].

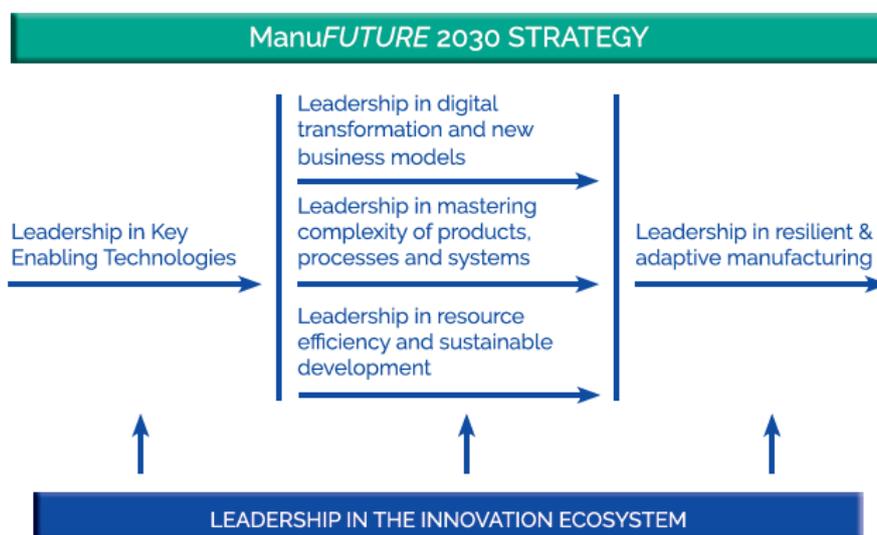


Figure 51: ManuFUTURE Vision and Strategy for 2030 [35]

There are the six pivotal dimensions outlined in the vision, each fostering a balanced synergy of innovation, sustainability, and economic vigor:

- **Key Enabling Technologies:** Advocates for policies that foster the development and adoption of critical technologies essential for propelling manufacturing innovation and sustaining a competitive edge in the global market.
- **Digital Transformation and New Business Models:** Stresses on policy frameworks that facilitate digital integration and encourage the emergence of innovative business models, aiding in driving operational efficiency and unveiling new value propositions within the manufacturing sector.
- **Mastering Complexity of Products, Processes, and Systems:** Calls for policies that support capacities in managing intricate products, processes, and systems to deliver high-quality, custom-tailored solutions amid an increasingly complex global market.
- **Resource Efficiency and Sustainable Development:** Emphasizes the need for policies promoting resource efficiency and sustainable practices within manufacturing, with a goal to minimize environmental footprints and uphold circular economy principles.
- **Resilient and Adaptive Manufacturing:** Urges the formulation of policies that bolster a resilient manufacturing ecosystem capable of adapting to an array of challenges including fluctuating market demands and emerging environmental and social requisites.
- **Innovation Ecosystem:** Advocates for policy frameworks that nurture an innovation ecosystem conducive for creativity, advanced research, and collaborations, setting the stage for long-term success and global leadership in Europe's manufacturing sector.

The **ManuFUTURE Vision 2030** thereby serves as a **blueprint for policy-makers**, urging the orchestration of **supportive policies** that can steer Europe's manufacturing domain towards achieving long-term competitiveness, resilience, and sustainable growth.

### 5.2 Overview of EU level policies for SMEs

The literature identifies internal and external factors that negatively impact SME growth [44]. These factors include the **inherent small size of SMEs** which limits their financial and human resources, posing a significant barrier to market expansion and internationalization. Additionally, SMEs often face **challenges in research and development**, particularly in sectors like manufacturing, which results in less competitive products for external markets. In terms of **company performance** metrics such as turnover and value added, SMEs typically lag behind larger enterprises. These constraints in expanding to new markets, innovating, and company performance contribute to restricted growth potential for SMEs. The overview of the key obstacles impacting the growth of SMEs is given in Figure 52.

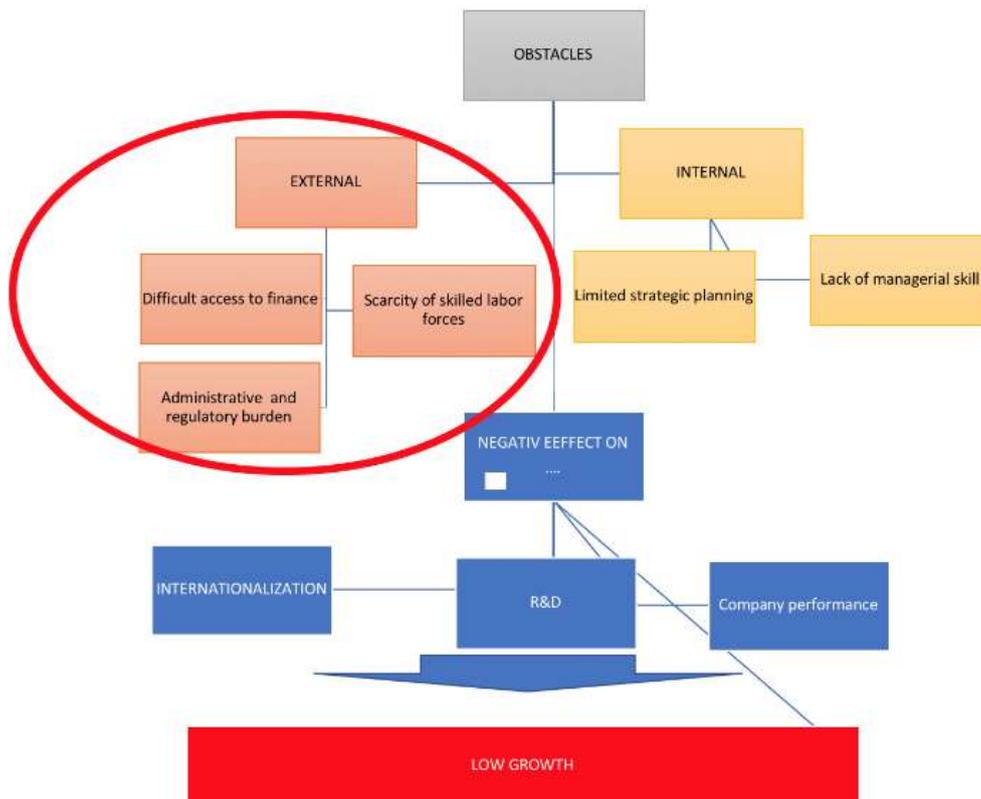


Figure 52: Key obstacles impacting SME growth (source [44])

SMEs encounter significant external challenges, including a **scarcity of skilled labor, financing difficulties** that restrict investment in training and R&D, and **inadequate regulatory structures** alongside subpar government support. Consequently, EU policies predominantly target these external elements: **skilled labor availability, financial accessibility, and regulatory and administrative frameworks** like taxation and legislation. These hurdles can instigate a negative feedback loop, where limited SME expansion and competitiveness stifle regional economic progression, which then further hampers SME growth and market success, thus undermining the broader regional business ecosystem.

The Lisbon Treaty of 2007 emphasizes how vital small and medium-sized enterprises (SMEs) are to the EU's goal of having a top-notch, knowledge-driven economy [59]. Following the economic crisis of 2007, which deeply affected SMEs, the EU's policy efforts to support these businesses have become increasingly important.

### 1.1.1 The Small Business Act (SBA)

The **Small Business Act (SBA)**, launched by the European Commission in 2008, represents a key policy blueprint for reinforcing the support framework for SMEs within the EU [44]. This policy aims to energize SME growth and competitiveness, a vital factor for the prosperity of the European Union. Embracing the **'Think Small First'** principle, the SBA introduces an innovative entrepreneurial strategy, focusing on simplifying regulatory processes, enhancing access to financing, increasing SME presence in the Single Market, and refining competition policy to be more SME-centric. The Act delineates ten fundamental principles, proposing specific actions for Member States and regional authorities to operationalize in support of SMEs, thereby laying the groundwork for comprehensive, SME-inclusive economic development across the EU. The SBA principles are:

1. Create an environment in which entrepreneurs and family businesses can thrive and entrepreneurship is rewarded
2. Ensure honest entrepreneurs who have faced bankruptcy quickly get a second chance
3. Design rules according to the 'Think Small First' principle
4. Make public administration responsive to SME needs
5. Adapt public policy tools to SME needs: facilitate SME participation in public procurement and use State Aid possibilities for SMEs better
6. Facilitate SME access to finance and develop a legal and business environment supportive of timely payments in commercial transactions
7. Help SMEs to benefit more from opportunities offered by the Single Market
8. Promote skill upgrading in SMEs and all forms of innovation
9. Enable SMEs to turn environmental challenges into opportunities
10. Encourage and support SMEs to benefit from the growth of markets.

Regional authorities are crucial for the effective implementation of the Small Business Act (SBA) as they are often more attuned to the needs of SMEs due to their proximity and understanding of the local economic landscape [45]. They are tasked with taking an active role in various areas such as education, entrepreneurship, advisory services, and financial support, tailored to the unique legal and institutional frameworks of each Member State. Some European regions have proactively embraced the SBA on a regional level, which is critical for the swift and efficient application of its principles and actions. These regions have a range of options and measures within the SBA's ten principles to structure their support for SMEs effectively.

### **The SME Policy Index**

The SME Policy Index is a tool created by the OECD, along with the European Commission, EBRD, and ETF in 2006 to evaluate and track progress in SME policy development and execution. It aligns with the ten principles of the EU's Small Business Act (SBA), offering measures for pro-enterprise policy formulation. The index is used across nearly 40 economies in regions including Eastern Partnership (EaP) countries, the Western Balkans and Turkey, Middle East, and North Africa (MENA), the Association of Southeast Asian Nations (ASEAN), and Latin America and the Caribbean.

The SME Policy Index differentiates itself from other business environment assessments for EU's Eastern Partnership (EaP) countries by offering a comprehensive view of SME policy development. It serves as a one-stop reference for policymakers to track advancements in specific sectors. Over time, the Index has become a key tool for change management, enabling national governments to set reform priorities and benchmark their policy evolution.

In 2020, the SME Policy Index was restructured to enhance user navigation and align the assessment with the stages of an entrepreneurial journey from a public policy perspective. It connects the 10 principles of the SBA to 12 quantifiable dimensions [46]. These are further segmented into sub-dimensions and thematic blocks that encompass various indicators, offering a detailed framework for analysis as illustrated in Figure 53.

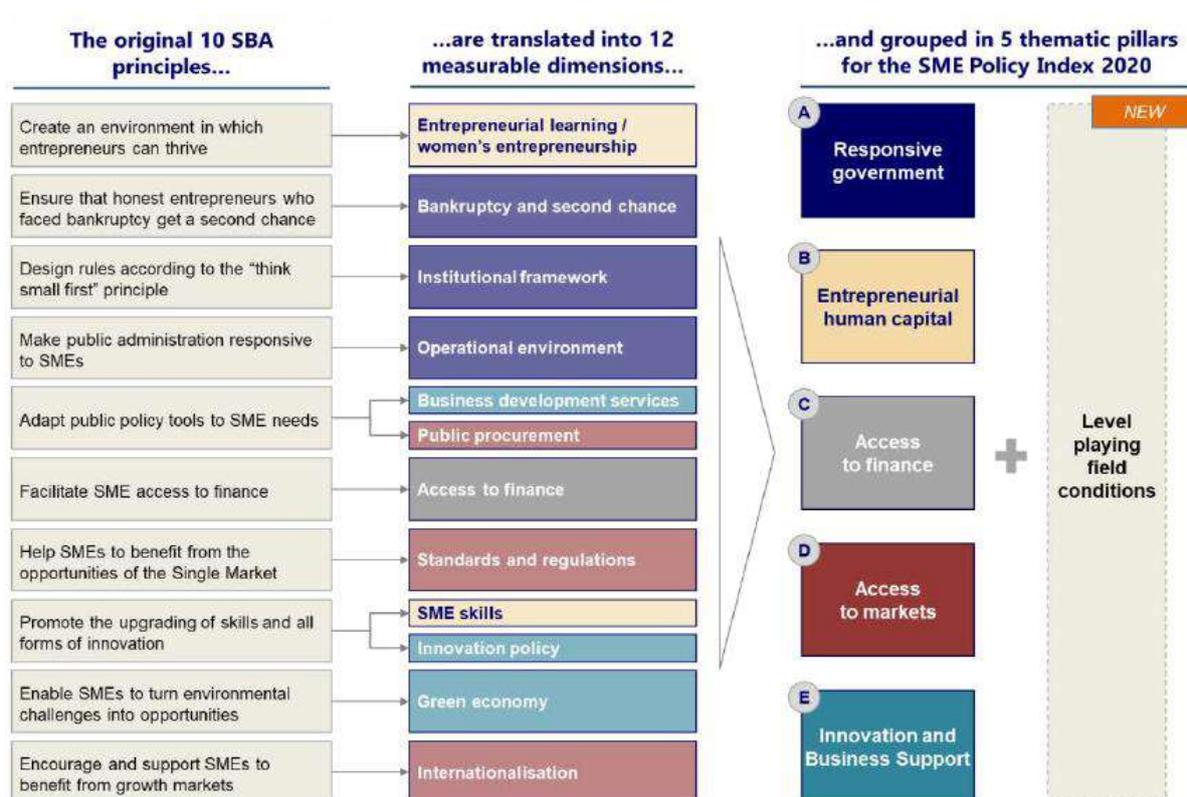


Figure 53: The detailed SBA assessment framework and its links to the Small Business Act principles [46]

The five pillars of the framework focus on fundamental queries that should guide government action in crafting policies that support SME growth [46]:

- **Responsive Government:** How well does the business environment foster new ventures and entrepreneurial risk? Does the SME policy framework meet the unique needs of small and medium-sized entrepreneurs?
- **Entrepreneurial Human Capital:** Is the development of entrepreneurial skills and competencies a focus within public policy? Are these efforts inclusive, offering support for women's entrepreneurship in particular?
- **Access to Finance:** What is the state of external funding availability for startups and SMEs? Are there targeted policy measures in place to simplify and reduce the cost of finance for small business owners to initiate and expand their operations?
- **Market Accessibility:** Do SMEs have the capacity to offer their goods and services within local and international markets? Are public policies in place to streamline the process for small businesses to expand into new markets?
- **Innovation and Business Support:** Are there opportunities for SMEs to access expert advice and innovative technologies to stay ahead and improve productivity? Does the government actively encourage innovation within the SME sector?

The expanded SBA assessment framework includes a crucial analysis aimed at fostering a fair business environment for all enterprises, without bias towards their size or ownership structure [44]. This "Level Playing Field" pillar assesses the effectiveness of authorities in maintaining fair competition, the efficiency of contract enforcement and alternative dispute resolution, and the enforcement of business integrity policies to deter corruption. While not included in the scoring, this pillar enriches the SBA assessment by offering a broader view of the business ecosystem's

equity. The elements of the assessment framework for the "Level playing field pillar" are presented in Table 12.

**Table 12: Assessment framework for the Level Playing Field pillar**

Dimension	Sub-dimension	Elements of analysis
Competition	Scope of action	Competences, powers to investigate and to sanction/remedy, private enforcement
	Anti-competitive behaviour	Mergers, horizontal and vertical agreements, exclusionary conduct
	Probity of investigation	Independence, accountability, procedural fairness
	Advocacy	Advocacy
Contract enforcement and alternative dispute resolution	Enforcing contracts by judicial system	Case management system, small claims courts/ simplified procedures for small claims, court automation
	Mechanisms for protection of property rights	Protection against malpractice of public authorities, settlement of disputes on intellectual property rights
	Alternative dispute resolution (ADR)	ADR mechanisms, promotion of ADR for commercial dispute settlement
Business integrity	Legal and institutional framework	Anti-corruption policy, laws on prevention of and combatting corruption
	Mechanisms for prevention and enforcement of corruption	Disclosure of beneficial owners of companies, criminal liability of legal persons for corruption, reporting corruption and whistle-blower protection
	Promoting business integrity	Financial and non-financial incentives, awareness-raising activities

Source: SME Policy Index © OECD, ETF, European Union and EBRD 2020

In the 2020 SME Policy Index, three significant enhancements were made:

- The **assessment's scope was expanded** to evaluate the broader business environment, including competition, contract enforcement, and business integrity.
- The **qualitative analysis was deepened** with more quantitative indicators, utilizing statistics from various sources for a more comprehensive policy assessment.

- **A sector-specific focus was added**, identifying unique challenges for SMEs within each country, incorporating more input from the private sector throughout the assessment process.

These updates were designed to enrich the evaluation without altering the fundamental structure of the Index, ensuring that results remain consistent and comparable over time. Following the SBA, additional EC communications were published addressing enterprises, in particular SMEs. The EU supports business growth through various horizontal policy measures including regional growth, social initiatives, tax regulation, fair competition, and environmental protection.

According to [44], between 2011 and 2018, EU Member States rolled out almost 3,300 initiatives in line with the Small Business Act (SBA) principles. The focus was predominantly on creating a favorable environment for entrepreneurs, easing SMEs' access to finance, promoting timely payments, and advancing skills and innovation in SMEs. These three principles, addressing the critical SME challenges of finance access and skilled labor scarcity, made up 55% of the SME support measures and were also prominent at the regional level.

### 1.1.2 The e-government action plan (2011-2015)

In 2010, the **e-government action plan for 2011-2015** was initiated to facilitate the deployment of e-government services across national, regional, and local levels. The strategy emphasized aiding public administrations in streamlining administrative processes to be more accommodating and efficient for SMEs, helping them save time and resources. One of the key initiatives promoted under this plan was cross-border e-procurement, which aimed to leverage digital platforms to simplify procurement processes for businesses operating in multiple EU countries. This move towards digitalization was intended to support the growth and operational efficiency of SMEs within the internal market [47].

### 1.1.3 An action plan to improve access to finance for SMEs – COM (2011) 870

COM(2011) 870 sought to address the challenge SMEs face in accessing finance by proposing regulations that support SME funding, particularly through:

- **Venture Capital:** Establishing a dedicated regulatory framework and taxation regimes to eliminate barriers to cross-border investments, aiming to create a unified venture capital market.
- **State Aid:** Adjusting regulations to support SMEs indirectly, by allowing aid to banks for financial stability and aiding Member States in applying State aid rules that align with EU2020 objectives.
- **Access to Markets:** Enhancing SME visibility to investors, increasing the availability of SME financial data to lower investment risks, streamlining accounting rules, and reducing administrative burdens to aid in the comparability of financial statements, thereby facilitating more informed investment decisions.
- **Information Accessibility:** Improving the dissemination of information to, from, and about SMEs to better facilitate access to financial instruments and capital markets, with national, regional, and local authorities playing a crucial role in implementing measures to improve information availability. This multi-level governance approach is essential for providing the necessary infrastructure and regulatory environment to foster SME growth and investment.

### 1.1.4 EU Regional Policies

The core aim of the EU's regional policy is to level out economic and regional differences by reallocating funds from more prosperous to less affluent EU regions. This policy works in tandem

with national measures and strategies under the subsidiarity principle to promote even development and strengthen the EU's single market. The primary mechanism for these goals is the **European Structural Investment Funds (ESIF)**<sup>11</sup> [54], which draw from the EU budget—supported by contributions from all member states. ESIF's operations are governed by a unified regulatory framework and comprise funds dedicated to regional development, social inclusion, cohesion, rural advancement, and maritime and fisheries support<sup>12</sup>. ESIF is comprised of the European Regional Development Fund (ERDF) [49], the European Social Fund (ESF) [50], the Cohesion Fund [51], the European Agricultural Fund for Rural Development (EAFRD) [52], and the European Maritime and Fisheries Fund (EMFF) [53].

Regulation EC 1303/2013 is the legislative document that guides the European Commission in enhancing the impact of the European Structural and Investment Funds (ESIF) [54]. It also ensures their coordination with other EU financial tools, including those from the European Investment Bank (EIB). The regulation's goal is to address the growing social, economic, and territorial divides, particularly in the aftermath of the EU's expansion, focusing on nations and regions that lag economically.

### 1.1.5 EU Competition Policy

All SME and entrepreneurship support programs must adhere to the EU's state aid rules as set out in **Article 107 TFEU**, which generally prohibits state aid that distorts competition within the internal market [55]. However, certain types of aid are deemed acceptable if they target economic development in disadvantaged regions, support social objectives, or respond to extraordinary circumstances like natural disasters. The **European Commission's Directorate-General for Competition (DG-COMP)** scrutinizes state aid to ensure it aligns with EU law, allowing exceptions under specific conditions [56]. This regulatory oversight is vital to maintaining fair competition across the EU while allowing for necessary state interventions in the economy.

### 1.1.6 EU Strategic Policy

The EU has strategic policies to better the overall business climate and encourage innovation, which in turn, helps companies, especially SMEs, to access the single market by overcoming structural hurdles. Notably, the **Entrepreneurship 2020 Action Plan**, established in 2012, rests on improving educational and training frameworks for entrepreneurship, refining the business environment to eliminate systemic barriers, and instilling a robust entrepreneurial culture, particularly among underrepresented and underserved groups [57]. Additionally, the plan calls for an engaged role from regional authorities to ensure that SMEs have access to ESIF funds. Complementing this, recent communications aimed at upgrading the **Single Market** address **SME-specific challenges** such as complicated VAT procedures and innovation roadblocks, suggesting improvements in the regulatory environment to empower SMEs to effortlessly engage with markets and consumers across different Member States [58]. These measures are designed to streamline cross-border trade and leverage the full potential of the Single Market for SMEs, thus encouraging their growth and contribution to the EU economy.

---

<sup>11</sup> Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No 1083/2006

### 1.1.7 EU Policy for SMEs post-2020

For the **2021-2027 period**, EU programs are set to continue supporting SMEs with a renewed focus. Changes in thematic priorities, scope, and funding distribution will address SME challenges like access to finance, R&D, innovation, skills development, and market access. Based on 2018's regulatory proposals, the forthcoming framework suggests expanded opportunities for SME support, with shifts in budget allocations and the introduction of new programs alongside the continuation of established ones [44]. The role of Local and Regional Authorities (LRAs) will vary, with shared management systems in **European Structural Investment Fund (ESIF)** allowing for more direct support to SMEs compared to other centrally managed EU programs.

From 2021 to 2027, EU programs, particularly ESIF, will continue to support SMEs by adapting to new thematic orientations and financial frameworks. The support, which varies by fund, will focus on fostering **a smarter Europe** through innovation and economic transformation, **a greener Europe** with clean energy transitions, and **a more connected Europe** with enhanced mobility and ICT connectivity. While the overall **ESIF budget is expected to decrease**, the **European Regional Development Fund (ERDF) remains a key source of SME support** [43]. Changes in policy aim to provide more flexibility for SMEs to benefit, with a special emphasis on integrating SME support with R&D and skills development under a 'smarter Europe' objective.

For the 2021-2027 period, the European Structural and Investment Funds (ESIF) have identified five key strategic objectives [60]:

- **A smarter Europe:** Encouraging innovation and smart economic transformation.
- **A greener, low-carbon Europe:** Promoting a clean and fair energy transition, investment in green and blue technologies, the circular economy, and climate change adaptation.
- **A more connected Europe:** Improving mobility and regional digital connectivity.
- **A more social Europe:** Implementing the European Pillar of Social Rights.
- **A Europe closer to citizens:** Supporting the sustainable and integrated development of urban, rural, and coastal areas through local initiatives.

Within the ESIF for 2021-2027, the ERDF stands out as the main fund designated for SME support, with possibilities for targeted allocation to specific policy objectives. The restructuring of thematic objectives may affect the clarity of SME support assessment, with a slight reinforcement in regions with higher Gross National Income (GNI) ratios and new classification for regions with GNIs close to the EU average. Overall, the focus on SMEs within the 'smarter Europe' objective, encompassing R&D and ICT, remains consistent. The table below presents the proposed adjustments to thematic focus based on different regional classifications.

**Table 13: Comparison of ERDF thematic focus for the 2014-2020 and 2021-2027 funding cycles [61]**

ERDF	2014-2020	2021-2027
<b>More developed regions / group 1</b>	Minimum 80% to any two or more TOs of 'R&D', 'ICT', 'SMEs' and 'lowcarbon'; of which at least 20% to 'low-carbon'	Minimum 60% to 'smarter Europe' Minimum 85% to 'smarter Europe & 'greener, lowcarbon Europe' together
<b>Transition regions / group 2</b>	Minimum 60% to any two or more TOs of 'R&D', 'ICT', 'SMEs' and 'lowcarbon'; of which at least 15% to 'low-carbon'	Minimum 45% to 'smarter Europe; Minimum 30% to 'greener, low-carbon Europe'

<b>Less developed regions / group 3</b>	Minimum 50% to any two or more TOs of 'R&D', 'ICT', 'SMEs' and 'lowcarbon'; of which at least 12% to 'low-carbon'	Minimum 35% to 'smarter Europe Minimum 30% to 'greener, low-carbon Europe'
---	---	--

Source: Spatial Foresight based on Regulation 1301/2013 Article 4 and Article 3 in European Commission

ERDF emerges as the primary source of SME support within ESI Funds due to its expansive thematic alignment with SME-centric objectives. The European Maritime and Fisheries Fund (EMFF) and European Agricultural Fund for Rural Development (EAFRD) provide targeted support for fisheries and farming sectors but are restricted by their specific territorial and sectoral focus. In contrast, ERDF, alongside the Cohesion Fund and European Social Fund Plus (ESF+), offers wide-ranging support to SMEs across various sectors. The central role of ERDF is further highlighted by a slight increase in its budget share for the period, as illustrated in the accompanying Figure 54.

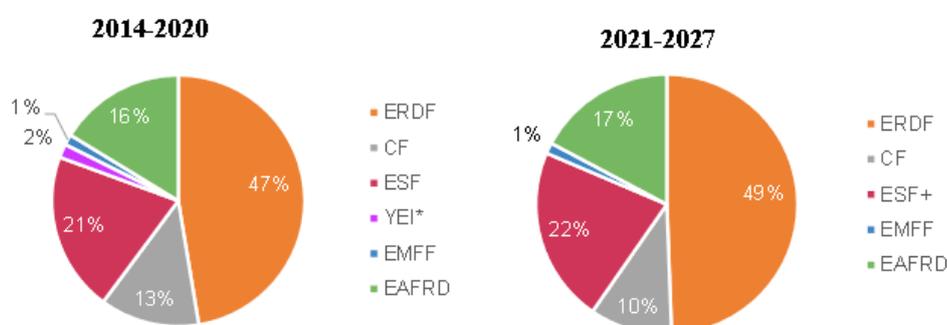


Figure 54: Share of ESIF allocation by fund 2014-2020 versus 2021-2027 [61]

### 5.3 National Polices and Measures in Greece

Throughout recent years, Greece has taken steps toward digital transformation in an effort to modernize its industry and public administration in alignment with broader European digital policies and strategies. Efforts are being made to enhance the competitiveness of Greece and to ensure a sustainable, human-centered shift towards a digital economy. Despite its nascent stage, the journey has already manifested through several **policy frameworks** and **legislative measures**, as well as the establishment of dedicated **government bodies**. It is the main objective of these initiatives to create an ecosystem that facilitates digital adoption, which extends to small and medium businesses (SMEs), so as to set a roadmap towards Industry 4.0.

In line with the guidelines of the European Commission, the **National Digital Strategy (2016-2021)** aimed to orchestrate digital transformation throughout the country. Priority was placed on the transition towards Industry 4.0, acknowledging the need to adopt digital technologies strategically throughout the industrial sector. At first, however, there was no structured policy or action from the Greek government specifically targeted at Industry 4.0.

In 2019, Greece established the **Ministry of Digital Governance (MDG)**, consolidating major stakeholders and outlining the **Digital Transformation Bible (DTB)**, an all-encompassing digital strategy for Greece, endorsed in June 2021 [37]. Greece is embarking on a digital transition journey as part of a comprehensive scheme aimed at achieving complete digitization of the nation by 2025.

The Digital Transformation Bible is a well-structured, practical, and **measurable strategy** that lays out the guidelines and framework the government plans to use to speed up Greece's digital progress in both societal and economic areas. This blueprint includes 450 projects, backed by €6.4 billion from the EU Recovery Fund, all aimed at fast-tracking the digital advancement of both the public and private sectors, thus improving Greece's digital readiness. Special emphasis is placed on the utilization of emerging technologies for the development of advanced solutions. There are seven specific goals clearly defined in the DTB [37]:

- To enable every Greek citizen to work with speed, reliability, and security on the Internet
- To serve the needs of citizens directly and efficiently through a digital state
- To promote the development of digital skills for all Greeks
- To help every Greek business to become a digital business
- To support and enhance digital innovation
- To release and utilize the productive value of public data
- To integrate modern technologies in all sectors of the economy.

### 1.1.8 Research and Innovation Strategy for Smart Specialization (2021-2027)

**Smart specialization** involves recognizing the distinct qualities and strengths of each country and region, focusing on their competitive edges, and uniting regional stakeholders and resources towards a vision that is both driven by excellence and oriented towards external engagement. Developing a **Research and Innovation Strategy for Smart Specialization (RIS<sub>3</sub>)** was a prerequisite for funding research and innovation under the 2014-2020 Partnership Agreement (PA). Greece's 2014-2020 RIS<sub>3</sub>, managed by the General Secretariat for Research and Innovation (GSRI), was approved in 2015. For 2021-2027, the updated national strategy aligns with the European Structural Funds' Policy Objective 1: "A smarter Europe." This includes enhancing research and innovation, digitization benefits, SME growth, and skills development for smart specialization. Collaboration among co-competent ministries is crucial for this strategy, led by the Ministry of Development and Investments, with key roles for the General Secretariats for Research and Innovation, Industry, and Public Investment and National Strategic Reference Framework (NSRF) [63].

The **National Smart Specialization Strategy (ESEE)** outlines strategic investment focus areas, chosen based on economic strengths and potential [62]. These priorities stem from an **Entrepreneurial Discovery Process (EDP)** that involves key stakeholders. The EDP takes an outward-looking stance on innovation and relies on robust monitoring systems for support. The table x outlines the regional and national priority areas for Greece in general, Eastern Macedonia – Trace (EL51), and Central Macedonia (EL52) for the period 2014-2020.

Table 14: Regional S<sub>3</sub> priorities for 2014-2020

Region	S <sub>3</sub> Priorities
Greece	<ul style="list-style-type: none"> <li>• Materials - Construction</li> <li>• Culture, Tourism, Creative Industries</li> <li>• Agri-food</li> <li>• Environment &amp; Sustainable Development</li> <li>• Life Sciences, Health &amp; Medicine</li> <li>• Transport &amp; Logistics</li> <li>• Energy ICT</li> </ul>
Eastern Macedonia – Trace (EL51)	<ul style="list-style-type: none"> <li>• Capacity building and human capital</li> <li>• Targeted supply of knowledge to stimulate</li> </ul>

	<p>entrepreneurial dynamics</p> <ul style="list-style-type: none"> <li>• Agri-food complex</li> <li>• Emerging economic sectors</li> </ul>
<b>Central Macedonia (EL52)</b>	<ul style="list-style-type: none"> <li>• Agri-food</li> <li>• Building materials</li> <li>• Textiles and apparel</li> <li>• Tourism</li> <li>• ICT</li> <li>• Energy technology</li> <li>• Environmental technology</li> <li>• Transportation and supply chain technology</li> </ul>

The following 8 priority areas were identified based on the ESEE for 2014-2020 period [62]:

1. Agro-food value chain
2. Bio-sciences, Health and Pharmaceuticals
3. Digital Technologies
4. Sustainable Energy
5. Environment and Circular Economy
6. Transport and Logistics
7. Materials, Constructions, and Industry
8. Tourism, Culture and Creative Industries.

The National Smart Specialization Strategy (S3), encompassing both national and 13 regional strategies in Greece, is sustained financially by the 2021-2027 Partnership Agreement Programmes. The national part largely draws from the "Competitiveness" Programme, while regional initiatives receive funding from corresponding Regional Programmes. Additionally, the National Recovery and Resilience Plan provides supplementary financial backing. Previously, for the 2014-2020 period, S3 was allocated about €1 billion from the Operational Programme for Competitiveness, Entrepreneurship, and Innovation (OP CEI), with an extra €143 million from regional operational programmes. This funding supports innovation and growth, adhering to the smart specialization principles vital for Greece's economic advancement [70].

The vision and strategy for ESEE is [62]:

- the transition to a new growth model that will be sustainable in social, financial, and environmental terms, based on knowledge and its utilization in the production of high added value products and services that can be integrated into global value chains.

The five strategic objectives of the ESEE 2021-2027 are [62]:

- Production of New Knowledge
- Effective utilisation and diffusion of new knowledge
- Technological streamlining – Innovation adoption
- Development, networking and internationalisation of Greek enterprise
- Increase in extroversion – Involvement in Research, Technological and Entrepreneurial Global Value Chains.

To fulfill its strategic goals, ESEE has pinpointed several key actions grouped into eight categories of intervention areas [62]:

- Human Resources (business and academia)

- Research and Innovation Infrastructures
- Innovation support mechanisms, services and facilities
- Link of Research with Production
- Digital Transformation
- Regulatory Framework (Regulations, Administration, Taxation)
- Promotion of innovation by public sector
- Visibility – Publicity.

In Greece, the implementation of the Smart Specialization Strategy (S3) showcased several successes and faced multiple challenges. Positively, regional innovation policy skills and knowledge have improved, and there has been beneficial engagement with stakeholders. There have also been advances in creating a governance framework suited to regional innovation needs. However, S3 did not achieve a seamless integration of funds, and administrative and IT complications caused delays in funding distribution. Additionally, crafting an effective S3 was a significant challenge for many regions. Maintaining the initiative's momentum and achieving international reach also presented considerable difficulties [69].

The Joint Research Centre (JRC) has played a significant role in backing the Smart Specialization Strategy (S3) in Greece by offering a range of supportive actions. From 2015 to 2017, it assisted the Region of Eastern Macedonia and Thrace, including conducting surveys to assess S3 execution. The JRC also facilitated workshops in 2018 and 2019 to discuss S3 application within Greece and conducted a pilot study on monitoring systems specific to S3. Comprehensive reports detailing the progress of S3 implementation in Greece were provided for 2018 and 2019. The JRC has maintained a pivotal and leadership position in supporting the Smart Specialization Strategy (S3) for Greece, continuing its integral role into the 2021-2027 period [69].

The JRC's assessment of Greece's industrial transition highlighted future manufacturing and innovation opportunities in renewable energies, batteries, and their applications across various sectors including mobility, agriculture, shipping, and defense [70]. To capitalize on these opportunities, key initiatives such as improved coordination, development of enabling infrastructure and skills, bolstered R&D, and innovation support are crucial [69]. The JRC also advocates for evidence-based policymaking, suggesting models like the Dutch "Top Sectors" and Catalan "Shared Agendas" for inspiration. For successful strategy execution, it is recommended that Greece builds a robust national evidence base with continued JRC support, employing smart specialization and place-based innovation strategies while enhancing policy coherence, workforce skills, and data-driven policy development.

### 1.1.9 Greece 2.0 National Recovery and Resilience Plan

The **National Recovery and Resilience Plan**, called **Greece 2.0**, is an ambitious program designed to transform Greece's economy, governance, and societal structures. It aims to foster an outward-looking, competitive, and eco-friendly economic framework, streamline state functions through digitalization, establish a tax system that encourages growth, shrink the informal economy, and build a robust, inclusive social safety net [65] [67]. Greece submitted its national recovery and resilience plan, termed "**the Greek RRP**," to the European Commission on April 27, 2021. This was in compliance with Article 18(1) of EU Regulation 2021/241 and followed a consultation process in accordance with the national legal framework of Greece [64]. The Greece 2.0 plan secures €31.16 billion, distributed via grants and loans, and aims to stimulate a total of €60 billion in investments within Greece by the end of 2026, which is the target completion date for all the projects under the plan. This initiative encompasses 106 investments and 68 reforms, designed to drive significant economic growth and transformation across various sectors in the country. The overview of the Greek RRP is shown in Figure 55 [65].

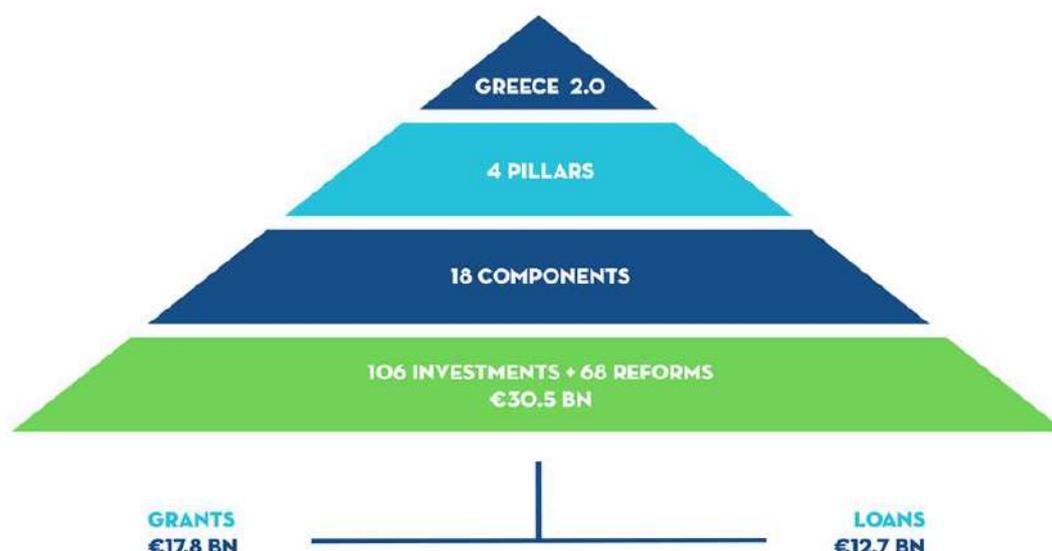


Figure 55: National Recovery and Resilience Plan at a Glance [65]

The Greek RRP is structured around four main pillars: (i) **Green Transition**, (ii) **Digital Transformation**, (iii) **Employment, Skills and Social Cohesion**, and (iv) **Private Investment and Transformation of the Economy**. The brief description of each pillar and associated measures and reforms is outlined in Table 15.

Table 15: Four main pillars of the Greece 2.0 RRP

Pillar	Description
<b>Green Transition</b>	The green transition component targets €6.2 billion in resources. It includes investments and reforms in renewable energy, energy efficiency, sustainable transport, biodiversity protection, and climate change adaptation and resilience. Key projects include support for energy storage systems, electric vehicle charging infrastructure, renovation of residential and public buildings, urban regeneration projects, and forest restoration. Reforms aim to streamline licensing for renewable energy projects and promote e-mobility [67] [68].
<b>Digital Transformation</b>	This component targets €2.2 billion for digital investments. It includes the rollout of 5G networks, fiber optic infrastructure, digitization of public services, support for SME digitalization, and investments in digital skills. Key projects involve the development of 5G corridors, submarine fiber optic cables, fiber connectivity in buildings, and the digitization of archives and public registries. Reforms aim to transition to fast broadband and promote cybersecurity [67] [68].
<b>Employment, Skills, and Social Cohesion</b>	This component targets €5.2 billion for investments and reforms in healthcare, education, social inclusion, and the labor market. It includes the digitization of healthcare, upgrades to hospitals and primary care, investments in education infrastructure, and reforms of active and passive labor market policies. It also aims to improve access to social services [67] [68] [65].
<b>Private Investment and Economic Transformation</b>	This component targets €4.9 billion to promote competitiveness, private investment, research, and exports. It includes tax reforms, upgrades to infrastructure like ports and industrial parks, support for strategic industries like tourism and manufacturing, and reforms to streamline

	public administration, justice, and public procurement. Key reforms involve modernizing the public and justice systems, improving the business environment, and incentivizing mergers and economies of scale in firms. The plan is expected to have significant positive macroeconomic and employment impacts according to impact assessments. Key success factors will be effective implementation and coordination across different levels of government and EU funds. Regular monitoring of targets and milestones will also be important [67] [68].
--	---

These pillars are divided into 18 specific areas, as detailed in Table 16. The "Mobilized Investments" column in this table highlights private investments in areas like green and digital transition and innovation. These investments are co-financed by a minimum of 50% through a mix of investors' equity, financial market loans, and funds from European institutions like the European Investment Bank and the European Bank for Reconstruction and Development.

**Table 16: Total Investment Resources mobilized by RRP [68]**

Pillars and Components	RRF Budget (mil. €)	Mobilised Investment Resources (mil. €)
<b>1. Green Transition</b>		
1.1 Power Up	1,200	2,348
1.2 Renovate	2,689	5,203
1.3 Recharge and refuel	520	1,305
1.4 Sustainable use of resources, climate resilience and environmental protection	1,763	2,726
<b>Total Resources Pillar 1</b>	<b>6,172</b>	<b>11,582</b>
<b>2. Digital Transformation</b>		
2.1 Connect	522	582
2.2 Modernise	1,303	1,303
2.3 Digitalisation of businesses	375	475
<b>Total Resources Pillar 2</b>	<b>2,200</b>	<b>2,360</b>
<b>3. Employment, skills, and social cohesion</b>		
3.1 Increasing job creation and participation in the labour market	776	776
3.2 Education, vocational education, training, and skills	2,311	2,395
3.3 Improve resilience, accessibility and sustainability of healthcare	1,486	1,486
3.4 Increase access to effective and inclusive social policies	611	611
<b>Total Resources Pillar 3</b>	<b>5,184</b>	<b>5,268</b>
<b>4. Private investment and transformation of the economy</b>		
4.1 Making taxes more growth friendly, and improving tax administration and tax collection	187	215
4.2 Modernise the public administration, including through speeding up the implementation of public investments, improving the public procurement framework, capacity building measures and fighting corruption	189	189
4.3 Improve the efficiency of the justice system	251	464
4.4 Strengthen the financial sector and capital markets	20	20
4.5 Promote research and innovation	444	612
4.6 Modernise and improve resilience of key economic sectors	3,743	7,233
4.7 Improve competitiveness and promote private investment and exports	5	5
Technical Assistance	40	40
<b>Total Resources Pillar 4</b>	<b>4,879</b>	<b>8,778</b>
<b>Sum of Grants</b>	<b>18,436</b>	<b>27,988</b>
<b>Loans</b>	<b>12,728</b>	<b>31,819</b>
<b>Total Investment Resources</b>	<b>31,164</b>	<b>59,807</b>

Table 17 outlines the reforms and investments within the Greek RRP pertinent to Industry 4.0, connecting them to the national RIS3. Investments with direct linkages provide financial backing for innovative endeavors that align with the areas prioritized by Smart Specialization. Meanwhile, investments with indirect linkages influence the regional innovation ecosystem, addressing the various barriers or challenges that innovation activities or business operations may face. The complete list of matching interventions and reforms of the Greek RRP and the Smart Specialization priorities is available in [64].

**Table 17: Matching interventions and reforms of the Greek RRP and the RIS3 priorities**

Measure ID <sup>13</sup>	Description	Amount (€million)	Contribution to RIS3	Priority Areas (s)	Region(s) Affected
--------------------------	-------------	-------------------	----------------------	--------------------	--------------------

<sup>13</sup> D (Direct Linkage) and I (Indirect Linkage)

## Deliverable D.3.2

Measure ID <sup>33</sup>	Description	Amount (€million)	Contribution to RIS <sub>3</sub>	Priority Areas (s)	Region(s) Affected
16624/D	Improve infrastructure in 13 (named) research centres and establishment of a new Research Centre in Ioannina (Epirus, EL54)	207	Updated research infrastructures in all Greek public Research Centres	All	Attica Central Macedonia Crete Western Greece Epirus
16618/D	(i) provision of horizontal financing for basic research; (ii) financial support to flagship research projects in interdisciplinary sectors with practical applications for the Greek economy; (iii) financial support to applied research for precision medicine implemented through a non-profit organisation Hellenic Precision Medicine Network; (iv) provision of funding for unmanned systems research and development centre to support applied research on drones; (v) establishment of an applied R&I institute on artificial intelligence, data processing and algorithm development; (vi) financial support for the delivery of market-translatable sustainable materials technologies; (vii) financial support for the participation in European partnerships, namely Euro-HPC (High Performance Computing) and Key Digital Technologies.	140	Retention of young researchers ('brain-gain') Focused applied research	(i) All (ii) All (iii) Health/Pharma (iv) None (v) ICT (vi) Materials (vii) ICT	All
16654/D	Development of a "next generation" information system, which is expected to combine different types and forms of collaborative infrastructures to enhance institutions' decision-making in real time. The system shall be composed of state-of-the-art technologies, such as artificial intelligence, and shall be designed to meet the needs of a diverse range of end users on a long term basis.	50	Focused applied research	ICT	All (not specified)
16622/D	Support 13 project proposals by small and medium-sized enterprises that have received the HORIZON 2020 "Seal of Excellence" quality label and are eligible for a grant, but not financed under HORIZON 2020 due to budgetary constraints.	18	Applied research in RIS <sub>3</sub> priority areas	All	Not specified
16621/D	Provide accredited start-ups with promotion services globally and expand these services to the entire national innovation ecosystem including research centres, innovation clusters,	3	Support access to global markets to start-ups	All	Not specified

Measure ID <sup>43</sup>	Description	Amount (€million)	Contribution to RIS3	Priority Areas (s)	Region(s) Affected
	competence centres and highly innovative companies.				
16792/1	Labour force skilling, reskilling and upskilling through a reformed training model (Vocational Education & Training Reform). 1) improving quality control (e.g., evaluation systems tracking progress and performance of trainees); 2) updating their modules in accordance to current and future labour market needs, as part of the comprehensive reform of OAED's active labour market policies (ALMPs), 3) promoting e-learning and digitisation of training content, 4) reform of the 'Account for Employment and Vocational Training' (LAEK) that funds vocational training programs for employees.	131	Better forecasting of the demand for skills and preparation of relevant curricula.	All	All
16721/1	Acceleration of smart manufacturing. Financial support for small and medium sized enterprises in the industrial sector to upgrade their manufacturing equipment and infrastructure with state-of-the-art smart technologies with a low environmental impact. The measure shall also support industrial schemes and clusters of enterprises in important industrial value chains that promote the competitiveness of the Greek industry and its transition to Industry 4.0.	75	A value-chain oriented intervention to support transition to Industry 4.0	ICT Industrial production, materials, construction	All
16653/1	Digital Transformation of the Agri-Food Sector	47	A demand-side measure to support the digital transformation of the agri-food sector	Agri-food ICT	All

Source: Elaboration based on [64] and [67]

The Greek Recovery and Resilience Plan outlines an ambitious yet coherent strategy to fundamentally transform the Greek economy and institutions through targeted green and digital investments combined with structural reforms. If successfully implemented, it has the potential to boost long-term growth, productivity, competitiveness and living standards in Greece.

## 5.4 National Policies and Measures in Bulgaria

The development of a Concept for the digital transformation of the Bulgarian industry (Industry 4.0) is closely related to the development of the digital economy, which implies the widespread entry of digital technologies into the socio-economic life. The term "Digital Economy" includes a large range of digital technologies and their application in various social spheres, which implies a more detailed coordination of strategic and reference policies.

The vision of the Concept is as follows:

- By 2030, Bulgaria should be recognized as a regional center of the digital economy through the implementation of products, technologies, business models and processes from Industry 4.0

The principles for introducing Industry 4.0 in Bulgaria are as follows:

- Institutional support for the development of Industry 4.0: identification of specific policies, mechanisms and tools to support the development of Industry 4.0 in view of the specifics of Bulgarian organizations
- Creating opportunities for synergy with existing policies, programmes and support mechanisms
- Developing educational and scientific initiatives in order to create capacity for institutional and organizational acceptance of the requirements and prerequisites of Industry 4.0
- Realization of pilot projects and demonstration installations in order to visualize and present good practices.

The concept envisages the realization of activities in 3 directions:

- Direction 1: Strengthening the relationship between science and industry in the country and accelerated integration of Bulgaria into European and international programmes, initiatives and networks related to the development and implementation of Industry 4.0
- Direction 2: Technological renewal of the Bulgarian economy through: introduction of standards, construction of infrastructure, development of specific mechanisms to stimulate the development and market implementation of technological innovations (new products, services and production processes) through the technologies of Industry 4.0
- Direction 3: Building human, scientific, organizational, and institutional capacity for the development of Industry 4.0 in Bulgaria

#### **5.4.1 Policy for smart specialization in the new programming period (2021 – 2027)**

On the basis of the Innovation Strategy for Smart Specialization (ISSS) 2014 – 2020, 4 priority areas for smart specialization have been defined, further developed in the new programme document for the 2021 – 2027 period, where they are now 5, as follows:

1. Informatics and ICT
2. Mechatronics and microelectronics
3. Industries for a healthy life, bioeconomy<sup>14</sup> and biotechnology
4. New technologies in creative and recreative industries
5. Clean technologies, circular and low-carbon economy (*a new horizontal thematic area during the current programming period*)

The vision of ISSS 2021-2027 is:

---

<sup>14</sup> The bioeconomy covers all sectors and systems that rely on biological resources (biomass of animals, plants, microorganisms, including organic waste), their functions and principles. It includes and interconnects: terrestrial and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services.

## Deliverable D.3.2

- Transformation of Bulgaria into an innovative, smart, green, digital and connected country through a new common policy for interaction between scientific research, innovation and technology, as well as increasing international and cross-sectoral cooperation and intensive use of data for accelerated specialization in products and services with high technological and scientific intensity and significant economic impacts for sustainable competitiveness, technological transformation of the economy, increasing resource efficiency and digitization

The strategic goals of ISSS 2021 – 2027 are:

- To develop and position Bulgaria as a center of medium- and high-tech innovations in strategic areas, in which the country has established capacity and market positions, as well as recognized competencies to compete on the international market, by increasing the country's national and regional innovation performance
- To support the deployment and establishment of sustainable, modern, dynamic, inclusive, data-driven and globally connected research, innovation and entrepreneurship ecosystem in Bulgaria

The operational objectives of ISSS 2021 – 2027 are:

1. Improvement of the research system and innovation performance of enterprises
2. Improvement of the technological capacity of enterprises, increasing the environmental friendliness and internationalization of Bulgarian products and services
3. Improving the capacity of human resources in the field of new technologies and innovations

According to ISSS 2021 – 2027, there is a regional prioritization of interventions in the different thematic areas for smart specialisation. Regarding the four districts of the cross-border region with Greece, they cover all five with a focus on „Mechatronics and micro-electronics“.

**Table 18: Regional prioritization in the four districts of the cross-border region with Greece under ISSS 2021 – 2027**

District	Informatics and ICT	Mechatronics and micro-electronics	Industry for healthy living	New technologies in the creative and recreative industries	Clean technologies, circular and low-carbon economy*
	1	2	3	4	5
Blagoevgrad	X			X	X
Smolyan		X	X		X
Kardjali		X	X		X
Haskovo	X	X			X

Source: ISSS 2021 – 2027

Note: \* The fifth thematic area for smart specialisation is horizontal and applies to all four cross-border districts

### **Blagoevgrad district**

Blagoevgrad district is a home to 9 mountains, two of the three national parks and 40% of the flow of mineral springs in Bulgaria. These facts, together with the rich cultural and historical heritage, make the area particularly suitable for the development of traditional economic activities (sectors, such as food industry, wine production, tobacco industry, woodworking, tourism and agriculture) that have already created capacity for development and implementation of new technologies in the field of creative and recreative industries. The goals of the research and development activity of the Southwest University "Neofit Rilski" coincide with those of ISSS and give a serious impetus to the development of informatics and ICT.

According to the analyzes of the available capacity, as well as based on the opinions of the interested parties, the following thematic areas have been identified as priority areas for intelligent specialization of Blagoevgrad district over the period 2021 – 2027 within the framework of ISSS:

1. **"Informatics and ICT"** with sub-fields: ICT approaches in mechanical engineering, medicine and creative industries, incl. digitization of cultural and historical heritage, entertainment and educational games, tele-medicine and tele-care and "embedded" software and 3D digitization, visualization and prototyping
2. **"New technologies in creative and recreative industries"** with sub-fields: cultural and creative industries, including digitization (as defined by the EC: architecture, archival and librarianship, arts and crafts, audio-visual forms (film, TV, video games and multimedia), cultural heritage, design, including fashion design, festivals, music, performing and visual arts, publishing, radio); production of goods and equipment with direct application in these areas (e.g. national (regional) costumes, bicycles, climbing walls, etc. goods for alternative and extreme sports, costumes, sets, materials for historical reenactments, specialized equipment and equipment, printed editions)

### ***Smolyan district***

Smolyan district is located in the Rhodopes, and the mountainous relief makes it the only one in the country that develops business and supplies its population with the necessary products only with the help of road transport. There is no highway or first class road, nor does it have direct access to such, as well as to a rail network, port or an airport.

The economy of the district has the capacity for smart specialization in the fields of mechatronics and healthy lifestyle industry and biotechnology, which can be further developed and upgraded under the following ISSS 2021 – 2027 thematic areas:

1. "Mechatronics and microelectronics"
2. "Industries for a healthy living, bioeconomy and biotechnology"

### ***Kardjali district***

From the point of view of turnover, sustainable growth and profits, the economic profile of Kardjali district is shaped by the sectors of trade, processing industry and construction. Potential for innovative development in the processing industry is highlighted by the manufacturing of textile products, metal products, machinery and equipment, food and beverage products.

Other significant economic activities in the district are production of plastics, electrical equipment, including for the automotive industry and for the sector of repairs. Enterprises for the production of parts for the automotive industry, including an R&D center, operate on the territory of the district. A factory has been built for power supply systems for the extraction and storage of electricity –

innovative products that solve the global problem of electrification, and will be exported to five continents. The construction of industrial zone "Kardjali" is planned.

The mountainous and semi-mountainous relief of the district and the presence of pastures and meadows are suitable for the development of animal husbandry (cows for milk and meat, sheep breeding) and plant breeding (vegetables, fruits and technical crops). In agreement with the municipalities of the district, the regional structures of the employer organizations and the local stakeholders, the following thematic areas have been identified as priority thematic ones for intelligent specialization, according to ISSS 2021 – 2027:

1. "Mechatronics and microelectronics"
2. "Industries for a healthy living, bioeconomy and biotechnology"

### ***Haskovo district***

During the 2014 – 2020 programming period, a good basis for intelligent specialization in the field of mechatronics and clean technologies was created in Haskovo region. The general opinion of the employers' organizations and all interested parties in the district highlight the capacity of the district towards the development of the following thematic areas of ISSS 2021 – 2027:

1. "Mechatronics and microelectronics"
2. "Informatics and ICT"

## **5.4.2 National strategy for small and medium-sized enterprises 2021 – 2027**

The strategy sets out the policy framework for SMEs, with its strategic objectives based on the progress achieved to date, as well as the identified growth potential of SMEs, identified challenges and drivers for their development. The main factors for the competitiveness of SMEs are defined as the following:

- Access to markets
- Access to funding
- Use of ICT solutions and digitization of processes
- Availability of qualified personnel
- Efficient environmentally friendly use of resources

The overall objective of the Strategy is to support Bulgarian small and medium-sized enterprises through targeted actions in their efforts to be more competitive, digitized, sustainable and export-oriented, to produce goods and services with high added value.

The National Strategy for Small and Medium Enterprises 2021 – 2027 includes 6 areas of impact, each having specific strategic objectives to support SMEs on the way to making Bulgaria a more attractive place to start a small business, where companies strive and have rapid growth, while at the same time the country is an active participant in the Single European Market. Regarding Industry 4.0, the most relevant is Impact area 4 "Digitalization and skills", which foresees the implementation of 3 measures (out of a total of 6) and a set of actions related to finding an answer to the new challenges:

### ***Measure 4.1 Promoting the digitization of SMEs***

- Specific objective: Increasing the share of SMEs that introduce ICT technologies to increase their competitiveness and create management systems for new business models
- Specific activities:

- Introduction of digital technologies, software, e-commerce solutions, digital applications and implementation of appropriate cybersecurity and data security processes
- Support for SMEs to introduce ICT, such as customer relationship management (CRM) systems, enterprise resource planning (ERP) systems, information security systems, process digitization, cognitive technologies, specialized software packages, etc.
- Support for SMEs through the introduction of digital technologies and software products for automation and robotization of manufacturing processes, communication and distribution technologies, etc. in agriculture

***Measure 4.2 Support for the digital transformation of industrial SMEs***

- Specific objectives:
  - Introduction of new digital technologies and equipment in the manufacturing processes of industrial SMEs
  - Introduction of technologies and software leading to a reduction of the energy intensity of industrial SMEs
  - Implementation of modern ICT solutions and process management software
  - Encouraging the use of cyber security systems and data security solutions
- Specific activities:
  - Support for the digital transformation of SMEs in the industrial sectors of the economy by introducing new digital technologies and machines in production
  - Reducing the energy intensity of manufacturing SMEs by introducing technologies, software solutions and systems for managing production processes
  - Implementation of modern ICT solutions, cyber security systems and data storage solutions, etc.

***Measure 4.3 Support for acquiring digital skills***

- Specific objectives:
  - Increasing the share of SMEs that invest in training to form/develop the digital skills of their employees
- Specific activities:
  - Realisation of regular training needs assessments to accurately define target training groups and their specific needs (including needs for skills related to digitization)
  - Implementation of digital/online applications and analytical solutions in the process of monitoring and continuous assessment of training needs in all professional areas
  - Conducting trainings for SMEs to improve the formation of the necessary skills in the field of digitization, ICT, cyber security and in other areas that are specific to the activity of SMEs

Ultimately, the National Strategy for SMEs 2021 – 2027 is aimed at achieving the following goals:

- Increasing the number of SMEs and their competitiveness in high-tech and medium-to-high-tech industries and knowledge-intensive high-tech services
- Increasing the added value of SME products and services
- Support for hiring qualified human resources in SMEs
- Support for technological modernization and digitization of SMEs

- Encouraging SMEs to apply clean technologies, including circular economy, to increase resource and energy efficiency leading to sustainable growth

In addition to the national priority activities, the Strategy also includes aspects of regional policy. From the analysis of regional specialization, regional priority sectors at the district level have been determined. In such a way, the Strategy fulfills its goal of promoting sectors of regional importance, with a high concentration of enterprises, significant added value and high employment in favour of regional economic development. SMEs in these sectors will be encouraged to increase their competitiveness and achieve sustainable development.

The regional concentration of high-tech productions and services with intensive use of knowledge is extremely uneven with two clearly defined poles – Sofia city district, the absolute leader and the rest of the country, which lags behind in terms of the number of employed persons, total revenues and turnover per employee in high-tech activities. In this sense, the sectoral concentration of SMEs in the districts of Bulgaria shows that targeted and intensive interventions are needed to promote the development of SMEs in all other less developed regions of the country.

**Table 19: Regional specialization in the four districts of the cross-border region with Greece**

District	Regional specialization in high-tech manufacturing and in knowledge-intensive services	Regional specialization in other sectors of the manufacturing industry	Specialization in sectors outside the scope of the current strategy
<b>Blagoevgrad</b>	<ul style="list-style-type: none"> <li>• J62 Computer programming, consultancy and related activities</li> <li>• J63 Information service activities</li> <li>• M71 Architectural and engineering activities; technical testing and analysis</li> </ul>	<ul style="list-style-type: none"> <li>• C10 Manufacture of food products</li> <li>• C14 Manufacture of wearing apparel</li> <li>• C15 Manufacture of leather and related products</li> </ul>	<ul style="list-style-type: none"> <li>• F41 Construction of buildings</li> <li>• I55 Accommodation (hotels and similar accommodation)</li> <li>• Q86 Human health activities</li> </ul>
<b>Smolyan</b>	<ul style="list-style-type: none"> <li>• C20 Manufacture of chemicals and chemical products</li> <li>• C27 Manufacture of electrical equipment</li> <li>• C28 Manufacture of machinery and equipment n.e.c.</li> </ul>	<ul style="list-style-type: none"> <li>• C10 Manufacture of food products</li> <li>• C14 Manufacture of wearing apparel</li> <li>• C16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting mat</li> </ul>	<ul style="list-style-type: none"> <li>• F43 Specialised construction activities</li> <li>• I56 Food and beverage service activities (restaurants)</li> <li>• Q86 Human health activities</li> </ul>
<b>Kardjali</b>	<ul style="list-style-type: none"> <li>• C27 Manufacture of electrical equipment</li> <li>• C28 Manufacture of machinery and equipment n.e.c.</li> <li>• M71 Architectural and engineering activities; technical testing and</li> </ul>	<ul style="list-style-type: none"> <li>• C10 Manufacture of food products</li> <li>• C14 Manufacture of wearing apparel</li> <li>• C25 Manufacture of fabricated metal products, except machinery and</li> </ul>	<ul style="list-style-type: none"> <li>• F41 Construction of buildings</li> <li>• I56 Food and beverage service activities (restaurants)</li> <li>• Q86 Human health activities</li> </ul>

District	Regional specialization in high-tech manufacturing and in knowledge-intensive services	Regional specialization in other sectors of the manufacturing industry	Specialization in sectors outside the scope of the current strategy
	analysis	equipment	
<b>Haskovo</b>	<ul style="list-style-type: none"> <li>• C27 Manufacture of electrical equipment</li> <li>• C28 Manufacture of machinery and equipment n.e.c.</li> <li>• M71 Architectural and engineering activities; technical testing and analysis</li> </ul>	<ul style="list-style-type: none"> <li>• C10 Manufacture of food products</li> <li>• C14 Manufacture of wearing apparel</li> <li>• C25 Manufacture of fabricated metal products, except machinery and equipment</li> </ul>	<ul style="list-style-type: none"> <li>• F43 Specialised construction activities</li> <li>• I56 Food and beverage service activities (restaurants)</li> <li>• Q86 Human health activities</li> </ul>

Source: National Strategy for SMEs 2021 – 2027 e.

## 6 CONCLUSIONS

The EU has understood that providing multiple initiatives, incentives and specialized centers to push companies towards adopting new Industry 4.0 technologies, is an opportunity to maintain the advantage in an era when emerging economies are gaining a lot of ground in the global market. These technologies can be adopted to varying degrees by companies in any industry, although it is predicted that those in manufacturing, transportation and retailing will benefit the most from them. There have already been plenty of companies within the EU that adopted certain I4.0 technologies, according to their specific needs, and saw significant improvement.

When it comes to the local economies, Greece's most prominent economic sectors are those of service, industry and agriculture, something that is also reflected within the borders of the country's CBC sector. As for Bulgaria, its most prominent economic sectors are those of trade & motor repairs, transportation & storage, manufacturing, hotels & restaurants and professional, scientific & technical activities. When it comes to the Bulgarian CBC sector, it is noticeable that each region has its own distinct hierarchy of most prominent economic sectors. Notwithstanding, manufacturing and trade & motor repairs are mostly the most prominent in each region.

The EU has launched a variety of funding programs to incentivize European companies towards the adoption of I4.0 technologies. Each program has its own criteria of eligibility and usually focuses on different aspects of I4.0. However, one thing that all programs have in common is that they mainly focus on boosting SMEs throughout the continent. At the same time, Greece and Bulgaria have both launched their own initiatives in order to boost their local economies and help them cover the digitalization gap that exists between them and the rest of the EU.

## 7 REFERENCES

[1] (Source: Friedrich - Ebert - Stiftung – Industry 4.0 and European Innovation Policy - Big plans, small steps (2018). Retrieved from:

<https://library.fes.de/pdf-files/wiso/14455.pdf> ).

[2] (Source: McKinsey & Company - What are Industry 4.0, the Fourth Industrial Revolution, and 4IR? (2022) Retrieved from:

<https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-are-industry-4-0-the-fourth-industrial-revolution-and-4ir> ).

[3] (Source: European Parliament – Industry 4.0, Digitalisation for productivity and growth (2015). Retrieved from:

[https://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568337/EPRS\\_BRI\(2015\)568337\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568337/EPRS_BRI(2015)568337_EN.pdf) ).

[4] (Source: European Commission – ICT Innovation for Manufacturing SMEs: success stories (2018). Retrieved from:

<https://digital-strategy.ec.europa.eu/en/news/ict-innovation-manufacturing-smes-success-stories> ).

[5] (Source: STAM – Retrieved from:

<https://www.stamtech.com/> ).

[6] (DIAGNOSTIQA – Retrieved from:

<https://diagnostiqa.com/idi/> ).

[7] (Source: Enterprise Greece. (2023). Greek Economy. Retrieved from: <https://www.enterprisegreece.gov.gr/en/greece-today/why-greece/the-greek-economy> ).

[8] (Source: China – CEE Institute. (2022). Greece economy briefing: An overview of Greece's economy in 2022. Retrieved from: [https://china-cee.eu/wpcontent/uploads/2022/12/2022e12\\_Greece.pdf](https://china-cee.eu/wpcontent/uploads/2022/12/2022e12_Greece.pdf) ).

[9] (Source: ELSTAT. (2023). Retrieved from: <https://www.statistics.gr/el/statistics/-/publication/SEL12/->).

[10] (Source: Interreg Greece - Bulgaria. Retrieved from:

<https://www.greece-bulgaria.eu/> ).

[11] (Source: Hellenic Statistical Authority - Statistical Business Register, 2020. Retrieved from:

<https://www.statistics.gr/el/statistics/-/publication/SBR01/-> ).

[12] (Source: Photius. (1994). Greece THE SERVICE SECTOR. Retrieved from: [https://photius.com/countries/greece/economy/greece\\_economy\\_the\\_service\\_sector.html](https://photius.com/countries/greece/economy/greece_economy_the_service_sector.html) ).

[13] (Source: SME integration to Industry 4.0 - The objective of this partnership is to involve SMEs to the Industry 4.0 paradigm by increasing their absorption of specialised digital services. Retrieved from:

<https://s3platform.jrc.ec.europa.eu/sme-integration-to-industry-4.0> ).

[14] (Source: ELSTAT. (2022). Report on Total Workforce. Retrieved from: <https://www.statistics.gr/documents/20181/a48ad3c9-5f56-2ea8-013f-99f52eee2fa6>)

[15] (Source: ΕΤΑΙΡΙΚΟ ΣΥΜΦΩΝΟ ΠΕΡΙΦΕΡΕΙΑΚΗΣ ΑΝΑΠΤΥΞΗΣ (ΕΣΠΑ 2021-2027) Πόροι, Αρχιτεκτονική και Προγράμματα. Retrieved from:

[https://www.espa.gr/el/Documents/2127/Parousiasi\\_neou\\_ESPA\\_21-27.pdf](https://www.espa.gr/el/Documents/2127/Parousiasi_neou_ESPA_21-27.pdf) ).

[16] (Source: Digital Plan - Digital Transition Program 2021-2027. Retrieved from:

<https://www.digitalplan.gov.gr/dimosievma/102/programma-psifiakos-metaschimatismos-2021-2027> ).

[17] (Source: SEV. (2022). Special Report: Industry 4.0. Retrieved from: [https://www.sev.org.gr/wp-content/uploads/2022/05/2022-05-05\\_SR\\_Industry4.0\\_final.pdf](https://www.sev.org.gr/wp-content/uploads/2022/05/2022-05-05_SR_Industry4.0_final.pdf))

[18] (Source: European Union - NextGenerationEU. Retrieved from:

[https://next-generation-eu.europa.eu/recovery-and-resilience-facility\\_en#paragraph\\_116](https://next-generation-eu.europa.eu/recovery-and-resilience-facility_en#paragraph_116) ).

[19] (Source: Greece 2.0 - At a glance. Retrieved from:

<https://greece20.gov.gr/en/at-a-glance/> ).

[19] (Source: NSRF 2021-2027 - Action Packages for Digital Transformation of SMEs. Retrieved from:

<https://www.espa.gr/el/pages/ProclamationsFS.aspx?item=5660> ).

[20] (Source: European Commission - THE EU RESEARCH & INNOVATION PROGRAMME 2021 – 27 (2021). Retrieved from:

[https://research-and-innovation.ec.europa.eu/system/files/2022-06/ec\\_rtd\\_he-investing-to-shape-our-future\\_o.pdf](https://research-and-innovation.ec.europa.eu/system/files/2022-06/ec_rtd_he-investing-to-shape-our-future_o.pdf) ).

[21] (Source: European Commission – Research and Innovation – Cluster 4: Digital, Industry and Space. Retrieved from:

[https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/cluster-4-digital-industry-and-space\\_en](https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/cluster-4-digital-industry-and-space_en) ).

[22] (Source: European Commission – Horizon Europe Work Programme 2023 – 2024. Retrieved from:

[https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-7-digital-industry-and-space\\_horizon-2023-2024\\_en.pdf](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-7-digital-industry-and-space_horizon-2023-2024_en.pdf) ).

[23] (Source: PWC - "Digital Transformation of the Greek Industry" (2021). Retrieved from:

[http://eysed.gge.gov.gr/wp-content/uploads/2021/04/DG-Reform\\_Digital-Transformation\\_Deliverable-2\\_Final-Draft\\_01022021.pdf](http://eysed.gge.gov.gr/wp-content/uploads/2021/04/DG-Reform_Digital-Transformation_Deliverable-2_Final-Draft_01022021.pdf) ).

[24] (Source: European Investment Bank - InvestEU. Retrieved from:

<https://www.eib.org/en/products/mandates-partnerships/investeu/index.htm> ).

[25] (Source: InvestEU - Fostering research, innovation and digitalisation. Retrieved from: <https://advisory.eib.org/about/service/fostering-research-innovation-and-digitalisation.htm> ).

[26] (source: EIF - Guarantee products. Retrieved from: [https://www.eif.org/InvestEU/guarantee\\_products/index.htm](https://www.eif.org/InvestEU/guarantee_products/index.htm) ).

[27] (Source: EIF - The EIF and InvestEU. Retrieved from: <https://www.eif.org/InvestEU/index.htm> ).

[28] (Source: European Union - InvestEU Portal. Retrieved from: [https://investeu.europa.eu/investeu-programme/investeu-portal\\_en](https://investeu.europa.eu/investeu-programme/investeu-portal_en) ).

[29] (Source: European Union - InvestEU and a Europe Fit for the Digital Age. Retrieved from: [https://investeu.europa.eu/investeu-and-europe-fit-digital-age\\_en](https://investeu.europa.eu/investeu-and-europe-fit-digital-age_en) ).

[30] (Source: Your Europe - Access to EU Finance. Retrieved from: [https://europa.eu/youreurope/business/finance-funding/getting-funding/access-finance/search/en/financial-intermediaries?shs\\_term\\_node\\_tid\\_depth=723&field\\_type\\_of\\_finance\\_tid\\_i18n=All&field\\_investment\\_focus\\_tid\\_i18n%5B%5D=2395&field\\_max\\_amount\\_finance\\_euro\\_value=All&field\\_min\\_amount\\_finance\\_euro\\_value=All&field\\_company\\_category\\_tid\\_i18n=All&field\\_implementing\\_partner\\_tid\\_i18n=All&combine=&outermost=](https://europa.eu/youreurope/business/finance-funding/getting-funding/access-finance/search/en/financial-intermediaries?shs_term_node_tid_depth=723&field_type_of_finance_tid_i18n=All&field_investment_focus_tid_i18n%5B%5D=2395&field_max_amount_finance_euro_value=All&field_min_amount_finance_euro_value=All&field_company_category_tid_i18n=All&field_implementing_partner_tid_i18n=All&combine=&outermost=) ).

[31] (Source: European Commission - Digital Europe Programme. Retrieved from: [https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/digital-europe-programme\\_en](https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/digital-europe-programme_en) ).

[32] (Source: European Commission - Digital Europe Program (DIGITAL). Retrieved from: <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/programmes/digital> ).

[33] (Source: European Commission – Advanced Technologies for Industry (2021). Retrieved from: <https://ati.ec.europa.eu/sites/default/files/2021-06/Recommendations%20to%20improve%20SMEs%27%20access%20to%20TCs.pdf> )

[34] <https://futurium.ec.europa.eu/en/digital-compass/pages/about>

[35] ManuFUTURE Vision 2030 – Competitive, Sustainable and Resilient European Manufacturing, Report from ManuFUTURE High-level group, December 2018

[36] The Operational Program "Digital Transformation" 2021-2027 <https://bit.ly/3tSw9xl>

[37] Digital Transformation Bible 2020-2025 [https://digitalstrategy.gov.gr/en/principles\\_of\\_implementation](https://digitalstrategy.gov.gr/en/principles_of_implementation)

[38] Euratom Research and Training Programme [https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/euratom-research-and-training-programme\\_en](https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/euratom-research-and-training-programme_en)

[39] [Connecting Europe Facility \(CEF\) https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/connecting-europe-facility\\_en](https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/connecting-europe-facility_en)

[40] [Single Market Program https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/single-market-programme/overview\\_en](https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/single-market-programme/overview_en)

[41] [Union Anti-Fraud Programme \(UAFP\) https://anti-fraud.ec.europa.eu/policy/union-anti-fraud-programme-uafp\\_en](https://anti-fraud.ec.europa.eu/policy/union-anti-fraud-programme-uafp_en)

[42] [Regulation \(EU\) 2021/1058 of the European Parliament and of council of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund, Official Journal of the European Union, 30<sup>th</sup> of June 2021 L 231/60](#)

[43] [European Regional Development Fund https://ec.europa.eu/regional\\_policy/funding/erdf\\_en](https://ec.europa.eu/regional_policy/funding/erdf_en)

[44] [EU Policy framework on SMEs: state of play and challenges, European Committee of the Regions, Commission for Economic Policy, ECON, European Union, 2019, QG-02-19-559-EN-N; ISBN: 978-92-895-1019-6; doi:10.2863/612657](#)

[45] [Regional Implementation of the SBA, Guidebook Series, How to Support SME Policy form Structural Funds, European Commission , NB-BN-14-002-EN-C, ISBN 978-92-79-38087-7, 2014](#)

[46] [SME Policy Index, Eastern Partner Countries 2020, Assessing the implementation of the small business act for Europe, © OECD, ETF, European Union and EBRD 2020, ISBN 978-92-64-33010-8](#)

[47] [European Commission \(2010\), E-government action plan 2011-2015, COM\(2010\) 743 final.](#)

[48] An action plan to improve access to finance for SMEs, COM(2011) 870 final

[49] Regulation (EU) No 1301/2013 of the European Parliament and of the Council of 17 December 2013 on the European Regional Development Fund and on specific provisions concerning the Investment for growth and jobs goal and repealing Regulation (EC) No 1080/2006

[50] Regulation (EU) No 1304/2013 of the European Parliament and of the Council of 17 December 2013 on the European Social Fund and repealing Council Regulation (EC) No 1081/2006

[51] Regulation (EU) No 1300/2013 of the European Parliament and of the Council of 17 December 2013 on the Cohesion Fund and repealing Council Regulation (EC) No 1084/2006

[52] Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005

[53] Regulation (EU) No 1299/2013 of the European Parliament and of the Council of 17 December 2013 on specific provisions for the support from the European Regional Development Fund to the European territorial cooperation goal

[54] Regulation (EU) No EC 1303/2013 of the European Parliament and of the Council of 17 December 2013  
<https://eurlex.europa.eu/search.html?scope=EURLEX&text=EC+1303%2F2013&lang=en&type=quick&qid=1701169164442>

[55] Document 12008E107, Consolidated version of the Treaty on the Functioning of the European Union - PART THREE: UNION POLICIES AND INTERNAL ACTIONS - TITLE VII: COMMON RULES

ON COMPETITION, TAXATION AND APPROXIMATION OF LAWS - Chapter 1: Rules on competition - Section 2: Aids granted by States - Article 107 (ex Article 87 TEC)

[56] Directorate-general Competition (DG-COMP)

<https://www.industry4europe.eu/industryresources/directorate-general-competition-dg-comp/>

[57] European Commission (2012b), Entrepreneurship 2020 Action Plan, COM(2012) 795

[58] Regulation 2015/1017 of the European Parliament and of the Council on the European Fund for Strategic Investments, the European Investment Advisory Hub and the European Investment Project Portal and amending Regulations (EU) No 1291/2013 and (EU) No 1316/2013 — the European Fund for Strategic Investments

[59] European Union (2007), Treaty of Lisbon.

<https://www.europarl.europa.eu/factsheets/en/sheet/5/the-treaty-of-lisbon>

[60] COM/2018/375 final - 2018/0196 (COD), European Commission (2018d), Proposal for a Regulation of the European Parliament and of the Council laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, and the European Maritime and Fisheries Fund and financial rules for those and for the Asylum and Migration Fund, the Internal Security Fund and the Border Management and Visa Instrument, COM(2018) 375 final.

[61] European Commission (2018h), Proposal for a Regulation of the European Parliament and of the Council on the European Regional Development Fund and on the Cohesion Fund, COM(2018) 372 final

[62] National Smart Specialization Strategy 2021-2027, Hellas: Innovation Journey, Synopsis, June 2022, Hellenic Republic of Development and Investment

[63] Research & Innovation Strategy for Smart Specialization (RIS3) <https://gsri.gov.gr/en/research-innovation-strategy-for-smart-specialization-ris3/>

[64] Tolia, Yannis (2022) :Linking the “recovery and resilience plan” and smart specialization: The Greek case, JRC Working Papers on Territorial Modelling and Analysis, No. 09/2022, European Commission, Joint Research Centre (JRC), Seville

[65] Greece 2.0 National Recovery and Resilience Plan <https://greece20.gov.gr/en/>

[66] N. Komninos, A. Panori, C. Kakderi, A. Psaltoglou, A. Chatziparadeisis: Ecosystems and functioning EDP for S3 2021-2027 in Greece, Report to the European Commission, DG Regional and Urban Policy, Urenio Research & Intelspace Innovation Technologies, 2022

[67] Greece 2.0 National Recovery and Resilience Plan; Next Generation EU, May 2021

[68] Greece 2.0 National Recovery and Resilience Plan, Hellenic Republic Presentation , May 2021, [https://www.primeminister.gr/wp-content/uploads/2021/03/Greece-2\\_0-April-2021.pdf](https://www.primeminister.gr/wp-content/uploads/2021/03/Greece-2_0-April-2021.pdf)

[69] Metaxas, M. (2020), “RIS3 Monitoring System in Greece –Pilot Study”, <https://s3platform.jrc.ec.europa.eu/-/ris3-monitoring-system-in-greece-pilot-study?inheritRedirect=true&redirect=%2Fgreece>

[70] Smart Specialization in Greece: experiences and future opportunities, Dimitrios Pontikakis, JRC, B3 Territorial Development, European Semester – Greece 2020

