

Multiple Framework Contract for the Support to Structural Reforms in EU Member States

Lot 1: Support for the development and implementation of reforms

“Digital Transformation of the Greek Industry”

Deliverable 4: Report on Capacity Building for implementing and monitoring the Industry 4.0 Strategy

February 2021

This project is funded by the EU via the Structural Reform Support Programme and implemented in collaboration with PwC and the European Commission



This project is funded by the EU via the Structural Reform Support Programme and implemented in collaboration with PwC and the European Commission

Version control

History of the document

Version	Date	Author(s)	Changes	Description of changes
v.1	10.11.2020	PwC Accenture	Document created	First draft of the document
v.2	17.12.2020	PwC Accenture	Enhancements and additions to the Deliverable, based on the comments received by the General Secretariat and DG Reform	Final draft of the document

Contents

1	Introduction to Deliverable 4: Capacity Building Report.....	4
1.1	Purpose of the document.....	4
1.2	Setting the scene.....	4
1.3	Structure of the Document.....	5
2	Executive summary.....	6
3	Key points of the Operational plan – Link between the Operational plan and the Capacity Building Report.....	12
4	Implementation and monitoring of the Industry 4.0 strategy	14
4.1	Proposed governance model for the Greek Industry 4.0 strategy	15
4.1.1	European i4.0 Governance models: Best practices.....	15
4.1.2	Main issues and barriers identified within EU i4.0 Governance models.....	20
4.1.3	Key components for formulating an effective i4.0 Governance structure	21
4.1.4	The Greek i4.0 Governance structure	23
4.1.5	Strategic i4.0 implementation enablers	30
4.1.6	Indicative “Roadmap” for the set-up of the Industrial Transformation and Growth Body ..	32
4.2	Key performance indicators (KPIs): Key principles and considerations.....	34
4.2.1	General KPIs & KPIs directly linked to the strategic goals.....	35
4.2.2	KPIs focused on the Operational Plan.....	38
4.2.3	KPIs focused on the three (3) High Priority cases	45
4.3	Recommendations concerning the timeline, process and methodology for the review, evaluation and update of strategy on tactical intervals.....	50
4.3.1	Recommendations for the monitoring of Industry 4.0 Strategy’s implementation progress	50
4.3.2	Recommendations for the evaluation of the Industry 4.0 Strategy.....	53
4.3.3	Recommendations for the update of Industry 4.0 Strategy.....	59
5	Methodological approach for the implementation of other Priority cases within the Greek Industrial ecosystem.....	61
5.1	Introduction.....	61
5.1.1	Step 1: Identify potential groups/ clusters, from where priority cases could be elicited	62
5.1.2	Step 2: Apply a set of qualitative and quantitative criteria to surface the most important cases within each group.....	67
5.1.3	Step 3: Perform an As-Is analysis for the selected priority cases	73
5.1.4	Step 4: Consolidate and review international leading practices for the selected priority cases	73
5.1.5	Step 5: Design a set of interventions for each selected priority case	73

- This has been prepared in the context of the project “Digital Transformation of the Greek Industry”, for the purposes of the Deliverable 4 in accordance with the signed contract No SRSS/SC2019/034 Lot 1, Implementing framework contract procedure SRSS/P2017/FWC001 Lot 1.
- This Report has been prepared by PricewaterhouseCoopers Business Solutions S.A. (PwC) for the exclusive use of DG Reform and the main beneficiary of the project, it being the General Secretariat for Industry, and should not be relied upon by any third party for any purpose. The authors do not assume and hereby disclaim any liability to any party for any loss or damage howsoever arising from the use of this Report or of the information contained herein by any person other than the DG Reform.
- PwC does not assume any audit responsibility, nor substitutes the appointed audit bodies, based on the National Audit Rules by an auditor.
- PwC is not liable for any use of the Deliverables for audit, accounting, tax, financial, legal, etc. purposes by third parties (e.g. public authorities, audit bodies, etc.).
- The product of this work is limited to supportive services offered to the Contracting Authority.
- The relevant Authorities are solely responsible for the final decisions made. PwC does not take decisions on matters that fall within the responsibility of the Administration or official bodies or executives of the Contracting Authority.
- For the implementation of the project, data and other relevant information were collected through interviews with stakeholders as discussed and agreed with the study’s beneficiary. The list of interviewees was agreed with DG Reform and PwC is not responsible for the statements the interviews and their accuracy and these have been taken as accurate and true without further verification.
- PwC bears no responsibility for the processing of the information and data that was never submitted or was submitted incorrectly or belatedly.
- The current study is valid in its entirety. The legal review, interviews with stakeholders, data analysis wherever applicable, as well as the conclusions of the study that are presented in this document are indissociable from one another and PwC bears no responsibility for any potential fragmented use, which can lead to misinterpretations.

1 Introduction to Deliverable 4: Capacity Building Report

1.1 Purpose of the document

This report was prepared in the context of the project “Digital Transformation of the Greek Industry” funded by the EU via the Structural Reform Support Programme. This present document constitutes the first draft of the fourth Deliverable of the project, titled “Deliverable 4: Report on Capacity Building for implementing and monitoring the i4.0 Strategy”.

It was shaped based on the directions provided by the General Secretariat for Industry and Workshop 5 (and was conducted on the 15th of October) which laid the foundations of the Capacity Building report, after finalizing the proposed Industry 4.0 Operational plan with the General Secretary for Industry. The participants of the workshop were selected stakeholders of the Greek industrial environment, namely the General Secretary for Environment and Energy, the Hellenic Federation of Enterprises (SEV), the Federation of Industries of Greece (SVE), the Federation of Hellenic ICT Enterprises (SEPE), the Hellenic Production, the Hellenic Recovery Recycling Cooperation and the Aluminium Association of Greece.

The current deliverable has been shaped following a series of technical meetings with the General Secretariat for Industry’s project team (including the General Secretary) and DG Reform.

1.2 Setting the scene

The focus areas of the deliverable are the design of a governance mechanism for the effective management and monitoring of the Greek i4.0 strategy operationalization which is complemented by a management structure for the follow up of the project, and the setting up of a monitoring process for the documentation and periodical evaluation of the operationalization progress along with a methodology for the review, evaluation and update of the strategy.

Deliverable 4 seeks to provide the management and monitoring related measures to ensure the necessary system is in place to carry out the implementation of the i4.0 strategy and operational plan effectively. Additionally, the Capacity Building report presents a methodological guide that could be used to select and implement additional high priority cases, that have not been selected in this first version of the Industry 4.0 strategy.

Based on the above, the report outlines the governance model of the i4.0 strategy. The main principles surrounding the governance model are the close collaboration between public and private stakeholders, an approach which has also been evident throughout the “Digital Transformation of the Greek Industry” project, the utilization of an i4.0 digital platform and the Smart Manufacturing Technologies Competence Center, as well as the establishment of an implementation body responsible for the operationalization of each of the six strategic pillars and high priority cases.

The report also provides a list of Key Performance Indicators related to the strategy, including general economic/industrial and digital indicators as well pillar and high priority case specific indicators per initiative, which aim to facilitate the documentation and monitoring of the strategy’s implementation to ensure targets are met.

Finally, the deliverable gives a detailed analysis of the proposed monitoring and evaluation framework for the implementation of the i4.0 Strategy. This includes vertical and horizontal monitoring activities, an evaluation and performance management system aiming to evaluate the outcome and impact of the

implemented Industry 4.0 initiatives along with the use of the relevant performance dashboard. It also provides recommendations for the update of the Industry 4.0 Strategy, which include the comprehensive revision of the i4.0 vision and its strategic goals.

1.3 Structure of the Document

The report is structured in the following way:

- **Chapter 2** provides a brief overview of this document’s contents, serving as an executive summary.
- **Chapter 3** presents the key takeaways of Deliverable 3 with regards to the strategy’s Operational plan, making the link between the operational plan and the capacity building report.
- **Chapter 4** presents the governance structure for the Greek Industry 4.0 strategy, paired with a set of Key Performance Indicators for a high-level monitoring of the strategy’s impact, the initiatives proposed within the strategy’s six execution pillars as well as the high priority cases. Moreover, this chapter includes recommendations concerning the timeline, process and methodology for the review, evaluation and update of strategy on tactical intervals.
- **Chapter 5** presents the methodological approach for the implementation of other Priority cases within the Greek Industrial ecosystem.

2 Executive summary

The link between the Operational plan and the Capacity Building Report

Having designed the proposed initiatives for the implementation of the Industry 4.0 strategy through its Operational plan, the Capacity Building report seeks to provide an elaborate Governance structure and a detailed monitoring and evaluation mechanism.

More specifically, the capacity building report complements the i4.0 strategy by defining several prerequisites for the successful implementation of the Operational plan including the following:

- The key governance structure, and the governance bodies responsible for the implementation of the operational plan along with their composition and role.
- General Key Performance Indicators (KPIs) and KPIs linked to specific strategic initiatives of the operational plan to monitor its implementation progress.
- The monitoring and evaluation framework for the effective operationalization of the i4.0 strategy.

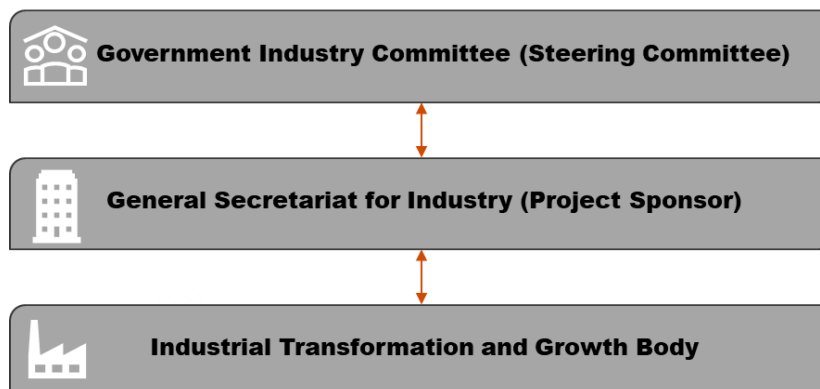
The Greek i4.0 Governance Structure

To design an effective and tailored to the Greek needs Governance structure, best practices of i4.0 governance models across European countries that have pursued i4.0 transformational programmes have been reviewed. The countries of focus were Portugal, Germany and France, as these were the countries that were identified (together with the General Secretariat for Industry's project team) as the most relevant "case studies" for Greece.

Following the analysis of the case studies, we have identified three key takeaways that were incorporated as "design principles" to the Greek i4.0 Governance structure proposed. These are:

1. Collaboration between public and private stakeholders following the triple helix model
2. Setting up an Industry 4.0 Platform is key
3. A solid implementation body for the proposed strategic initiatives is critical

Based on the above, the Governance structure of the Industry 4.0 strategy consists of the following key stakeholders:



In more detail, a few key details are presented for each of the aforementioned bodies and stakeholders:

Government Industry Committee (Steering Committee)

The newly founded Government Industry Committee (founded on the 18th of August 2020, through the respective Government Gazette, A', Issue 158) will represent the Industry 4.0 Steering Committee for the strategy. It will constitute of six key ministries and will have the overarching role of the Industrial strategy of the country.

More specifically, the Government Industry Committee (Steering Committee) will perform regular meetings in order to:

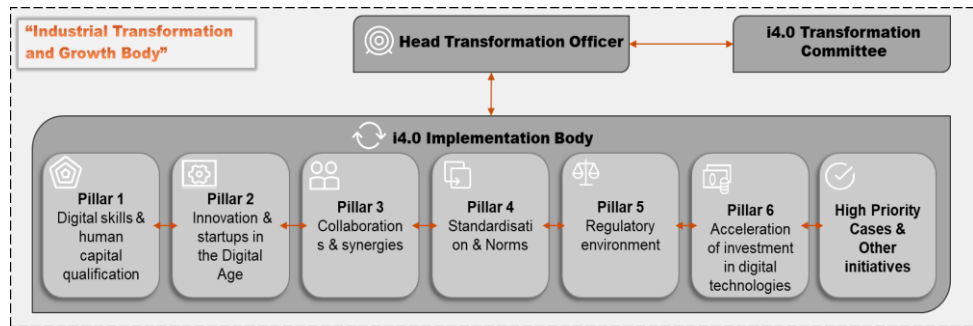
- Endorse and sponsor the operationalization of the national Industry 4.0 vision and strategy for Greece.
- Promote, prioritize and ensure alignment between strategic initiatives pursued at a Ministry level in order to ensure their complementarity with the proposed Industry 4.0 strategy and their smooth implementation within the Greek ecosystem.
- Decide on appropriate funding mechanisms and approve government budget allocation for the operationalization of the national i4.0 strategy.
- Address overarching challenges and resolve issues escalated from the Industry 4.0 Transformation Committee, ensuring the latter's empowerment.
- Oversee the overall progress against strategic objectives and monitor value realization across the Greek industry and economy.

General Secretariat for Industry (Project Sponsor)

The General Secretariat for Industry will constitute the project sponsor of the Industry 4.0 strategy. It will be responsible to provide strategic directions regarding the planning and the implementation of the initiatives of the i4.0 strategy and operational plan to the Industrial Transformation and Growth Body, which will act as its implementation “arm” for the digital transformation of the Greek Industry.

Overall, the General Secretariat for Industry will be responsible to support the Government Industry Committee with the smooth implementation of the strategy, creating a uniform culture of industrial transformation and “leap” towards the digital future of the sector.

Industrial Transformation and Growth Body



The Industrial Transformation and Growth Body will include the following:

1. Head Transformation Officer & Industry 4.0 Transformation Committee

The Head Transformation Officer, who will essentially be the “architect” of the whole transformational journey within the Greek industrial ecosystem. Moreover, it will consist of the Implementation Body leaders who will essentially represent the leading implementation officers, for all initiatives and actions pursued by the Industry 4.0 Implementation Body collectively. With regard to that, their role will be to ensure that they organise the work and effort necessary, give directions to and in general assist with potential bottlenecks the “on-the-ground” implementation body members in order to ensure that all initiatives are pursued according to the plan.

The Industry 4.0 Transformation Committee will consist of the Industry 4.0 implementation body’s leaders, collaborating closely and at all times with the Head Transformation Officer regarding the timely and effective implementation of the pursued initiatives. Together they will be responsible for the following:

- Be accountable for the development and operationalization of the proposed Industry 4.0 strategy, in close collaboration with industrial federations and local stakeholders.
- Establish collaborative structures and mechanisms for the implementation of the i4.0 initiatives.
- Liaise with and coordinate the work of “on-the-ground” implementation body members.
- Liaise and coordinate with i4.0 transformation programs and initiatives at an EU level.
- Specify, identify and mobilise the necessary funding and resources for the i4.0 strategy operationalization.
- Ensure the on-time and on-budget operationalization of the national Industry 4.0 strategy.
- Escalate issues to the General Secretariat for Industry (project sponsor) and coordinate Governance meetings.
- Prepare and publish periodic reports on the progress of the operationalization.
- Lead Industry 4.0 public awareness initiatives responsible for the implementation of the i4.0 strategic initiatives.

2. Industry 4.0 Implementation body

The Industry 4.0 Implementation Body will comprise of experts originating from the Public and Private sector. Indicatively they could be technical advisors or employees of industrial corporates that have long been involved in the Greek industrial sector, and fully understand its needs, landscape and key players as well as the tools and courses of action necessary in order to assist it drastically and effectively. It will be responsible for the following:

- Move forward all the proposed initiatives of the proposed Industry 4.0 strategy and operational plan,
- Identify, contact and actively engage strategic allies from the private sector in this major transformation journey.
- Prepare, communicate and assist the industrial ecosystem to embrace the proposed Industry 4.0 strategy and initiatives through targeted actions and dissemination events
- Engage with relevant bodies from the EU industrial landscape, so much with regard to enterprises that can become strategic allies in such a journey as well as relevant committees pursuing similar Industry 4.0 strategies.
- Escalate issues to the Industry 4.0 Transformation Committee.

*Proposed set of KPIs
for the monitoring of
the Operational Plan's
and High Priority
Cases' initiatives*

The Governance structure for the proposed Industry 4.0 strategy shall be heavily supported by two key strategic implementation enablers, as these will be analysed in the following lines:

- The Industry 4.0 Platform for Greece (Initiative 3.4)
- The Smart Manufacturing Technologies (SMT) Competence Centre (Initiative 7.2)

As they have been identified through the Operational plan, these two initiatives consist critical tools for the implementation of the strategy in a smooth and efficient manner. They are essentially expected to drive the transformational journey since the early days of the “kick-off” of the strategy and therefore their timely implementation is critical towards the overall venture’s success.

For the monitoring of the proposed Industry 4.0 strategy, this report contains also a set of indicative KPIs. These KPIs are split between Industrial and Economic indicators as well as specific KPIs for each of the proposed initiatives of the six strategic pillars and the three High priority cases.

To serve their purpose and assist significantly in the smooth implementation of the proposed Industry 4.0 strategy, KPIs should be selected based on the “S.M.A.R.T.(E.R.)” criteria. Specifically, each KPI should be:

- **Specific:** It should be clear what the KPI measures. There must be one commonly accepted definition of the indicator and each individual user must interpret it the same way to ensure consistent data collection and entry.
- **Measurable:** The KPI should be measurable to define a standard, which could be quantity, time or investment. Where applicable, accurate quantifications should take place in order to produce numerical data, for example by introducing rating scales to facilitate statistical analysis.
- **Achievable:** Striving to obtain “impossible-to-deliver” KPIs creates unnecessary administrative burden, discourages users and hinders the entire monitoring process and initiative’s progress. It is crucial that the KPI is achievable, that is available, obtainable and realistic, provided that the available resources and time are appropriately utilised.
- **Relevant:** The KPI must provide further insight into the progress of the strategic initiative and the implementation of the strategy. It must, therefore, inform the process.
- **Time-bound:** It is important to specify the time frame in which the KPI should be achieved, therefore its value should be stated in time.
- **Evaluated:** As the strategy changes and evolves overtime, it is important to evaluate whether the KPI provides the right measurements and strategically aligns with its respective strategic initiatives

Recommendations concerning the timeline, process and methodology for the review, evaluation and update of strategy on tactical intervals

Methodological approach for the implementation of other Priority cases within the Greek Industrial ecosystem

- **Revised:** Occasional evaluations indicate the necessity for revision of the KPI.

Complementary to the above, and since the strategy needs to be reviewed, evaluated and updated on a tactical basis, the timeline and process have been laid out in order to ensure that the whole initiative moves towards the planned direction. The monitoring and evaluation framework for Industry 4.0 strategy shall include three different sets of activities:

- **Monitoring activities:** Activities focused on the monitoring the progress of the implementation of the Industry 4.0 initiatives (as these have been defined within the Operational Plan in Deliverable 3), will highlight critical activities, milestones and interdependencies amongst the initiatives and will surface potential risks and issues that need to be addressed, to ensure the on-time and on-budget completion of Industry 4.0 initiatives
- **Evaluation activities:** Activities focused on the evaluation of the outcome and impact stemming from the implementation of an Industry 4.0 initiative/ strategic pillar. In more detail, evaluation activities aim to ascertain results (output, outcome, impact) and assess the effectiveness, efficiency, relevance and sustainability of a specific intervention, provide findings, conclusions and recommendations with respect to a specific intervention in order to draw lessons for future design and implementation.
- **Updating activities:** Activities focused on updating the actual content of the Industry 4.0 strategy and on adding new initiatives within the Industry 4.0 Operational plan.

Throughout the strategy, there will arise the need to select new or update existing priority cases that are more relevant at that specific point in time for the ecosystem and identify targeted interventions to be suggested under each focus area selected. The steps to effectively do so are the following:

- **Step 1:** Identify potential groups/ clusters, from where priority cases could be elicited
- **Step 2:** Apply a set of qualitative and quantitative criteria to surface the most important cases within each group
- **Step 3:** Perform an As-Is analysis for the selected priority cases
- **Step 4:** Consolidate and review international leading practices for the selected priority cases
- **Step 5:** Design a set of interventions for each selected priority case

3 Key points of the Operational plan – Link between the Operational plan and the Capacity Building Report

Deliverable 3 of the “Digital Transformation of the Greek Industry” project presents the Operational plan that will essentially act as the implementation vehicle of the proposed i4.0 strategy, acting as a step-by-step guidance for stakeholders that will be called to collaborate within the Greek industrial ecosystem to design and implement the proposed strategic initiatives. To achieve the abovementioned, the i4.0 strategy will be implemented through six discrete strategic pillars, which are briefly outlined below:

1. **Digital skills & human capital qualifications**, which aims at the provision of the current and future Greek industrial workforce with the appropriate digital knowledge and skills.
2. **Innovation & start-up supporting mechanisms in the Digital Age**, which focuses on the following:
 - the enhancement and promotion of innovation across the Greek Industry
 - the targeted mechanisms for the support of the booming start-up ecosystem in Greece
 - the incentives that will foster investment in innovation and applied R&D within the Greek industrial enterprises to contribute to the solution of industrial and societal problems (i.e. circular economy and industrial symbiosis).
3. **Collaboration & Synergies**, which focuses on the development of a collaborative industrial ecosystem, where Industry stakeholders shall cooperate and utilise each other’s expertise in order to achieve greater goals.
4. **Standardisation & Norms**, which emphasises at setting key ICT standardisation priorities within the industrial ecosystem to help ensure that the implemented Industry 4.0 technologies, systems and services retain the ability to connect and interoperate with each other, boosting innovation, and keeping the Greek ICT market open, competitive and interconnected with the rest of the Europe.
5. **Regulatory Environment**, which emphasises on improvements of the Greek regulatory environment, primarily in the areas of cybersecurity, data protection, free flow of data and Artificial Intelligence.
6. **Acceleration of investment in digital technologies**, which targets at creating the much needed financial incentivisation for Greek enterprises in order to invest and leverage Industry 4.0 technologies and applications.

In addition to the six main strategic pillars, three High Priority Cases have been identified and developed which are briefly outlined below:

1. **Smart Manufacturing technologies**, which pertains to the technology-driven approach that utilizes the Internet-connected machinery to monitor the production process, with the goal to identify opportunities for automating operations and use data analytics to improve manufacturing performance, realize operational efficiencies, reduce costs and improve flexibility and capacity.
2. **The Structural Materials Value Chain**, which focuses on materials whose primary purpose is to transmit or support a force and pose a promising area for investments and growth within the Greek industrial ecosystem.

3. The Circular Economy, which aims at harvesting the enormous opportunities offered by i4.0 to enable circular economy, in which end of life products are reused, remanufactured and recycled.

Each strategic pillar and High Priority Case is accompanied by its own set of relevant strategic initiatives, which aim to achieve its pursued goal.

Having set the Industry 4.0 Operational plan, the need for an elaborate Governance structure and Strategy and Operational plan monitoring and evaluation mechanism is prevalent. Apart from providing a detailed methodological guide to select and implement additional high priority cases, additional to the ones presented in the Operational plan in deliverable 3, it presents the measures for the successful operationalization of the strategy in relation to the i4.0 strategy's governance model and the monitoring process for the documentation and periodical evaluation of the operationalization progress. More specifically, the capacity building report seeks to complement the i4.0 strategy by defining several prerequisites for the successful implementation of the Operational plan including the following:

- The key governance structure, and the governance bodies responsible for the implementation of the operational plan along with their composition and role.
- General Key Performance Indicators (KPIs) and KPIs linked to specific strategic initiatives of the operational plan to monitor its implementation progress.
- The monitoring and evaluation framework for the effective operationalization of the i4.0 strategy.

The recommendations made and outlined in the following chapters of the Deliverable have been developed based on best practices that have been successfully identified in other Industry 4.0 strategies across Europe, always tailored to the needs and particularities of the Greek case.

4 Implementation and monitoring of the Industry 4.0 strategy

As it has already been pointed out, it is key that the whole digital transformation journey of the Greek industry is closely and actively monitored by a dedicated agency/ body within the industrial ecosystem. This agency/ body should possess a greater operational capacity than the General Secretariat for Industry, actively uniting and engaging all key stakeholders and actors within the industrial environment.

This stems from the fact that this whole initiative is expected to be a rather demanding, time-consuming and highly technical effort, which will require the full-time devotion and utmost engagement of the responsible body(ies) at all levels: from implementation of the proposed initiatives, to their active and continuous monitoring, the overview and monitoring and eventually the re-design of certain aspects of the proposed Industry 4.0 strategy and operational plan in the future.

In the following lines, a brief overview of similar governance mechanisms (presented as EU best practices) currently operating within the European industrial ecosystem is provided, showcasing their purpose and the different bodies they consist of.

Ultimately, and based on these best practices, the proposal of the respective governance mechanism for the Greek industrial ecosystem is presenting, tailored to the current needs of the Greek industry and always taking into account the many and different key actors of the ecosystem that will assist to drive the whole “digital transformation of the Greek industry” initiative forward successfully.

4.1 Proposed governance model for the Greek Industry 4.0 strategy

Same as for the design of the proposed Industry 4.0 strategy for Greece, we have collectively reviewed and compared best practices of i4.0 governance models across European countries that have pursued i4.0 transformational programmes within the recent years.

More specifically, we focused on Portugal, Germany and France, as these were the countries that were identified (together with the General Secretariat for Industry’s project team) as the most relevant “case studies” for Greece. In the following lines we provide a brief overview of these governance mechanisms for these three countries, concluding with the “key components” for designing an effective governance model/ mechanism for the Greek Industry 4.0 strategy.

4.1.1 European i4.0 Governance models: Best practices

Portugal – Industria 4.0

The Portuguese i4.0 programme, Industria 4.0, aims at defining a governance model which ensures “the articulation and integration of efforts and resilience in the face of political cycles”¹. **At the heart of the programme is “Plataforma Portugal i4.0”, an i4.0 platform** developed to support the coordination and implementation of the strategy, in response to the rapid digital evolution.

The Portuguese government mandated the management of the platform to COTEC Portugal, a private body, through a public-private partnership including a cooperation protocol signed between the Ministry of Economy and COTEC.

The creation of the i4.0 platform includes the establishment of a governance structure, comprised of five main governance bodies. These are formed by central agents of the fourth industrial revolution ecosystem in Portugal, including public institutions, private enterprises and associative institutions.

Each governance body is guided by the strategy’s internal functioning model and a set of associated responsibilities which are briefly presented below:

Government Body	Description/Composition	Main Responsibilities
i4.0 Managing Entity	<ul style="list-style-type: none"> COTEC Portugal (Portuguese Business Association for Innovation) 	<ul style="list-style-type: none"> i4.0 programme promotion and dissemination of knowledge i4.0 programme mobilisation and operational articulation including development of communication/cooperation tools i4.0 digital platform creation, results monitoring and evaluation Generated knowledge repository storage and sharing
Government Council	<ul style="list-style-type: none"> Ministry of Economy Ministry of Science, Technology and Higher Education 	<ul style="list-style-type: none"> Public policy guidelines definition Institutional sponsorship and articulation with public bodies Public policy-related measures validation

¹ https://cotecportugal.pt/wp-content/uploads/2020/09/COTEC_BrochuraMadrid2019_V07-1.pdf

	<ul style="list-style-type: none"> Ministry of Infrastructures and Planning Ministry of Education Ministry of Labour 	
Steering Committee	<ul style="list-style-type: none"> Public institutions Private sector enterprises Associative institutions 	<ul style="list-style-type: none"> Monitoring Orientation Measure validation Advice on different topics
Community of Experts	<ul style="list-style-type: none"> Companies Employees Associations Science and political actors 	<ul style="list-style-type: none"> Participation and discussion in working groups Measure development and implementation Technical assistance
Working Groups and Different Entities	<ul style="list-style-type: none"> Companies Employees Associations Science and political actors 	<ul style="list-style-type: none"> i4.0 related topics discussion and debate Measure deployment and implementation

With regards to the programme’s financing model, it is worth noting that 85% of the investment will be covered by EU funds, while the rest 15% will come from the private entities of the Steering Committee. Up to now, however, no mechanisms have been developed to ensure private funding commitments, and this has been identified by the European Commission as a potential barrier.²

Germany – Plattform Industrie 4.0

Germany’s i4.0 programme, **Plattform Industrie 4.0**, is publicly backed and aims at securing and expanding the country’s leading position in the manufacturing industry. The programme’s governance structure is developed around three key purposes (Governance, Expertise and Implementation) and is comprised of nine main governance bodies. Each governance body is formed by key agents of the fourth industrial revolution in Germany and is assigned a set of associated responsibilities as indicated in the table below.

Governance Body	Description/Composition	Main Responsibilities
Chair	<ul style="list-style-type: none"> Chaired by Federal Ministers of Economic Development and Energy (BMWi) and the Federal Minister of Education and Research (BMBF) Representatives of commerce, trade unions, science 	<ul style="list-style-type: none"> i4.0 programme Political Support
Secretariat	<ul style="list-style-type: none"> Operated by IFOK GmbH (Institute for Organisational Communication) and VDI Technologiezentrum 	<ul style="list-style-type: none"> i4.0 activities organisation and coordination Information sharing about progress made Central contact point for business, media and politics

² https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_Ind%C3%BAstria%204.pdf

	<ul style="list-style-type: none"> Supported by the Federal Ministry for Economic Affairs and Energy 	
Steering Body	<ul style="list-style-type: none"> Chaired by companies Business representatives Chairs of working groups BMW, BMBF Representatives of associations (BDI, BITKOM, VDMA, ZVEI) 	<ul style="list-style-type: none"> Specialist technical work coordination and steering Input sharing for International Cooperation
International Cooperation	<ul style="list-style-type: none"> Intergovernmental cooperations with Italy, France, Netherlands, China and others³ 	<ul style="list-style-type: none"> i4.0 trendsetting questions discussion International digital transformation debate
Working Groups	<ul style="list-style-type: none"> Experts from business associations, works council, academia 6 dedicated working groups for each i4.0 strategic pillar 	<ul style="list-style-type: none"> i4.0 pre-competitive concepts, solutions, and recommendations development
Research Council	<ul style="list-style-type: none"> Chaired by science and business representatives Representative of science and industry 	<ul style="list-style-type: none"> Independent advisor of the Plattform, working groups and German federal ministries
Industry 4.0 Transfer-Network	<ul style="list-style-type: none"> Federal states representatives Midsized 4.0 Centres of Competence Sector-specific associations (BITKOM, VDMA, ZVEI) DIHK and Chambers of Commerce and Industry (IHKs) BMBF, BMW, LNI Fraunhofer Gesellschaft Labs Network Industrie 4.0 e.V.⁴ 	<ul style="list-style-type: none"> Ideas/opinions exchange between transfer protagonists Synergies identification Resource combination in appropriate measures to further support the midsized sector
Labs Network Industrie 4.0 e.V.	<ul style="list-style-type: none"> Plattform Industrie 4.0 companies and associations 	<ul style="list-style-type: none"> Company support in the initiation of Industrie 4.0 projects Results pooling from test-beds and forwarding to relevant competitive structures
Standardisation Council Industrie 4.0	<ul style="list-style-type: none"> Industry representatives nominated by BITKOM VDMA and ZVEI 	<ul style="list-style-type: none"> Standardisation coordination and regulation work in the field of Industrie 4.0 in Germany and beyond

³ <https://www.plattform-i40.de/PI40/Navigation/EN/ThePlattform/Structure-Organization/InternationalCooperation/international-cooperation.html>

⁴ <https://www.plattform-i40.de/PI40/Navigation/EN/ThePlattform/Structure-Organization/TransferSMEs/transfer-smes.html>

- DIN and DKE representatives
- Research institution and university representatives

Germany’s funding model combines public funding, private financing and in-kind contributions, with a ratio of 2:1-5:1 between private to public investments.

France – Industrie du Futur

France’s i4.0 programme, Industrie du Futur, is initiated and guided by the government, but it is mainly implemented by the private sector, and more specifically by the **Industry of the Future Alliance**. The Alliance consists of 32⁵ members including professional organisations, business and local authorities as well as scientific and academic institutions, central to the digital transformation of France. Its aim is to modernise and transform France’s industry by engaging all enterprises on the road of transforming their processes and organisations via the use of new digital technologies. The governance structure of Industrie du Futur consists of 6 governance bodies, key to its implementation, which are driven by a set of associated responsibilities as indicated below:

Governance body	Description/Composition	Responsibilities
Managing Entity	<ul style="list-style-type: none"> • Industry of the Future Alliance 	<ul style="list-style-type: none"> • Organisation and coordination of initiatives, projects and actions towards the digital transformation of France • Representation of French interests in European initiatives
Directorate General for Enterprises	<ul style="list-style-type: none"> • Part of the Ministry of Economy and Finance 	<ul style="list-style-type: none"> • Coordination of government action related to i4.0 objectives • Providing of the secretariat for the Steering Committee
Steering Committee	<ul style="list-style-type: none"> • Chaired by the Minister of Economy and Finance 	<ul style="list-style-type: none"> • Ensuring engagement of all stakeholders
Local Authorities	<ul style="list-style-type: none"> • French Regions, Regional Councils 	<ul style="list-style-type: none"> • Regional steering and roll-out e.g. through platforms and by supporting SMEs on the ground • Assistance in greater policy alignment between the national and the regional level⁶
Working Groups	<ul style="list-style-type: none"> • Industry of the Future Alliance members • Open working groups 	<ul style="list-style-type: none"> • Implementation of initiatives based on strategic pillars
Project Leaders	<ul style="list-style-type: none"> • Business and Industry Leaders • A group of project leaders is responsible 	<ul style="list-style-type: none"> • Lead and coordination in achieving specific goals based on priority markets

⁵ Latest data of November 2020

⁶ https://ec.europa.eu/futurium/en/system/files/ged/fr_country_analysis.pdf

for each of the 9 priority
markets

France combines private and public financing for the implementation of Industrie du Futur. It is worth noting that France’s funding model relies on private investments, given that all public financial tools are conditioned on private financing⁷.

⁷ https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_Industrie%20du%20Futur%20v1.pdf

4.1.2 Main issues and barriers identified within EU i4.0 Governance models

Adding to the above analysis of the three best practices studied within the EU industrial landscape, we have further identified a few issues and barriers within the respective i4.0 governance frameworks of Portugal, Germany and France. These issues are quite important to highlight since they should be considered and avoided in the context of designing the Greek i4.0 Governance structure.

Portugal – Industria 4.0

As previously mentioned, the financing model of the Portuguese i4.0 programme, Industria 4.0, relies by 85% on EU funds, while the rest 15% is planned to come from the private entities of the Steering Committee. This constitutes an issue since no mechanisms have been developed to ensure private funding commitments, making the governance mechanism directly related to public/ EU funding in the long term.

This suggests that i4.0 governance structures should involve relevant instruments and methods to ensure the respective financing both from public and private sources and ensure the sustainability of the governance mechanism in the long term.

Germany – Plattform Industrie 4.0

One of the key issues that arose during the implementation of Germany's i4.0 programme was the competition among German industrial stakeholders. More specifically, due to the different goals between companies, trade unions and industrial groups, the influence of the platform in the wider manufacturing environment was initially negatively impacted.

As a result, the government assumed an active role in developing the platform and enlarged the group to improve coordination, collaboration and uptake. Furthermore, toward that goal, it aimed to successfully integrate new digital processes and adapt work organization between the involved parties, ensuring all stakeholder interests and goals were heard and taken into account.

From the above, it can be concluded that important issues may arise due to conflicting goals and interests between industrial stakeholders and thus the country's public sector should play a key role in dealing with such predicaments.

France – Industrie du Futur

The initial phase of the French i4.0 programme was launched by the French government in September 2013 and followed the New Industrial France (NFI) strategy. NFI was characterised by a lack of a common structure and network to facilitate collaboration, coordination and dialogue between industry and digital technology stakeholders from the public and private sectors.

This barrier induced the launch of Industrie du Futur (IdF) (as presented in section 4.1.1), a more targeted strategy, which includes the Industry of the Future Alliance and focuses on the digital transformation implementation needs the NFI predecessor failed to provide for.

Another related barrier that France was faced with in implementing its i4.0 programme, concerns the gap between the requirements of industry 4.0 and the digital skills qualifications. To counter this problem, great focus was placed on forging the missing links between social partners and making training and skill sets core components of the strategy.

Lastly, Industrie du Futur has also encountered problems in relation to the monitoring and evaluation under the programme. More specifically, the monitoring process involves monthly input delivery from the programme’s stakeholders, which has proven difficult due to the complexity and wideness of digital transformation.

This suggests that the i4.0 governance structures should strongly support the monitoring process by providing clear and concise key performance indicators and maintaining close communication between stakeholders and dedicated i4.0 executives to encourage and assist them.

4.1.3 Key components for formulating an effective i4.0 Governance structure

With regard to the key governance Industry 4.0 bodies analysed above, these three countries present similarities but also many differences in their approach, mainly due to varying objectives and strategy implementation approaches, as they have been analysed in “Deliverable 1: Report on the Current Situation – digitisation in Greek Industry” and international trends (for more information, please refer to Chapter 7.3).

In the above context, key components were identified, which inform the development of an effective government model for Greece, including the organisation of a governance structure and the mechanisms by which governance is implemented. The key takeaways are briefly presented below:

1. **Collaboration between public and private stakeholders following the triple helix model**

A solid governance model underlines the importance of collaboration and synergies between key agents of the i4.0 ecosystem, including the public sector, industrial stakeholders, academia and research institutions, and facilitates and promotes their establishment. This collaboration is pursued in the lines of the very effective and widely embraced “triple helix collaboration” model, which has been pursued across many EU countries that have pursued and successfully implemented their respective Industry 4.0 strategies and transformation initiatives. Based on this model, the public sector, the private sector as well as academia and research institutions collaborate closely and on an ongoing basis in order to set the foundations for the digital transformation of the industrial ecosystem of the country.

It is only logical that achieving the digital transformation of a country’s industry requires the creation of an ecosystem where every actor/ stakeholder contributes resources, strengths and effort in order to generate higher added value as an inseparable piece of the industrial puzzle.

2. **Setting up an Industry 4.0 Platform is key**

A digital i4.0 platform responsible for the coordination and implementation of the strategy, can prove extremely beneficial, provided that the right governance model and institutions are at its centre.

Such a platform shall attract increasing numbers of businesses and other stakeholders, foster cooperation and synergies between key i4.0 agents and forge the missing links between digital technologies, enterprises and talent. It shall promote strategic initiatives and lines of action as well as effectively monitor and evaluate their results, while acting as an information and knowledge repository.

Furthermore, the incorporation of an i4.0 digital platform as one of the “Key i4.0 transformation enablers” sends out a message to the public that the government is leading by example in a digitally evolving world.

3. A solid implementation body for the proposed strategic initiatives is critical

One common component of all the governance models studied is the creation of a solid implementation body responsible for the development and implementation of initiatives, solutions and recommendations necessary for the achievement of all outlined strategic objectives.

This is essential for the implementation of all initiatives promoted within the strategy, making certain that an engaged team of experts will monitor closely and ensure their smooth implementation in the set timelines. Also, this body is responsible for ensuring that all input, expertise and knowledge within the key players of the industrial ecosystem is pursued, by uniting them through the designed initiatives in order to drive change and achieve digital transformation in the industrial ecosystem.

At the same time, this body is actively promoting accountability for the implementation of actions, enabling agents to monitor their own progress and eliminating barriers along the way. Lastly, it seeks to strengthen the infrastructure for collaboration, filling gaps between institutions, enterprises and other important stakeholders, resulting in the overall efficient collaboration which is expected to lead to the desired results and set targets.

4.1.4 The Greek i4.0 Governance structure

By taking into consideration the key components identified for the design of solid governance structure for an i4.0 strategy as well as the “practices-to-avoid” that have been outlined above, the current chapter presents the proposed Greek governance model that will be responsible to monitor and implement the desired changes within the Greek industrial ecosystem in the following years, as presented below:

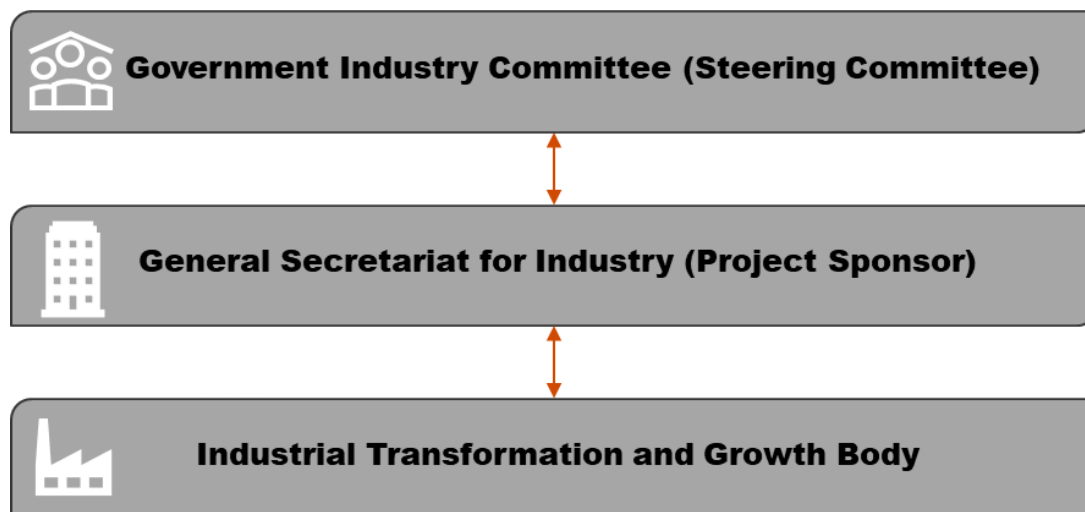


Figure 1: Governance structure for the implementation of the Greek i4.0 strategy and operational plan

All three stakeholders within the above Governance structure are analysed in the following lines.

4.1.4.1 The Government Industry Committee (Steering Committee)

A common variable among all the Industry 4.0 Governance structures studied was that for the successful implementation of the proposed i4.0 strategy, the active engagement of the country’s public sector is imperative.

The newly founded Government Industry Committee (founded on the 18th of August 2020, through the respective Government Gazette, A’, Issue 158) will represent the Industry 4.0 Steering Committee for the strategy. It will constitute of the following six key ministries and will have the overarching role of the Industrial strategy of the country (including the Industry 4.0 Strategy), taking into account the European initiatives towards that direction, as well as global and national industrial trends, tailoring them to the Greek ecosystem, its needs as well as the wider economic and social growth of the country.

The key stakeholders that make up the Steering Committee are the following:

- Minister of Development and Investments (President of the Steering Committee)
- Minister of Finance
- Minister of Environment and Energy
- Minister of Education and Religious Affairs
- Minister of Labour and Social Affairs
- Minister of Digital Governance

In order to ensure that the implementation of the proposed Industry 4.0 strategy will be successful, it will seek to closely collaborate with the General Secretariat for Industry and the Greek private industrial sector and research institutions/ academia through the Industrial Transformation and Growth Body.

More specifically, the Industry 4.0 Steering Committee will perform regular meetings in order to:

1. Endorse and sponsor the operationalization of the national Industry 4.0 vision and strategy for Greece.
2. Promote, prioritize and ensure alignment between strategic initiatives pursued at a Ministry level in order to ensure their complementarity with the proposed Industry 4.0 strategy and their smooth implementation within the Greek ecosystem.
3. Decide on appropriate funding mechanisms and approve government budget allocation for the operationalization of the national i4.0 strategy.
4. Address overarching challenges and resolve issues escalated from the General Secretariat for Industry, ensuring the latter's empowerment.
5. Oversee the overall progress against strategic objectives and monitor value realization across the Greek industry and economy.

All in all, this Steering Committee seeks to embrace collaborations among Ministries as well as the holistic embracement of cross-Ministry initiatives (such as the proposed Industry 4.0 strategy) in order to derive greater value for the Greek economy, acting as a “model-Committee” for similar initiatives to be pursued within the Greek ecosystem in the following years.

4.1.4.1.1 The General Secretariat for Industry (Project Sponsor)

The General Secretariat for Industry essentially constitutes the project sponsor of the Industry 4.0 strategy, and therefore its role towards the initiative's success is critical.

To that purpose, the General Secretariat for Industry will be responsible to provide strategic directions regarding the planning and the implementation of the initiatives of the i4.0 strategy and operational plan to the Industrial Transformation and Growth Body, which will act as its implementation “arm” for the digital transformation of the Greek Industry. (to be analysed in more detail below).

The General Secretariat for Industry will be responsible to support the Government Industry Committee with the smooth implementation of the strategy, creating a uniform culture of industrial transformation and “leap” towards the digital future of the sector. In line with the above, the General Secretariat will also examine relevant issues that demand adjustments of the regulatory and legal framework, promoting the respective reforms, as “the” stakeholder responsible to drive forward industrial change, uniting under that purpose the country's public sector and private sector, as well as industrial and other key stakeholders within the ecosystem.

With regard to that, it is also essential that the General Secretariat for Industry (and consequently the Industrial Transformation and Growth Body) cooperates with key stakeholders within the Greek industrial landscape. Toward that end goal, the General Secretariat will be called to closely collaborate with other stakeholders within the Greek public sector (relevant Ministries and General Secretariats), industrial Federations and Industrial employees' committees as well as research and innovation centres and academia. In that respect, two such significant collaborations have already been established through the respective memorandums between the General Secretariat for Industry and the Ministry of Digital Governance as well as the National Documentation Centre.

4.1.4.2 *Industrial Transformation and Growth Body*

For the successful implementation of the proposed Industry 4.0 strategy, it is essential that it is orchestrated in a synchronised and well-planned manner by a respective body that will have deep knowledge of the Greek industrial landscape and its needs. This body will be called to implement all the proposed initiatives of the strategy's Operational plan in a tight timeframe, leading to immediate and measurable results for the industrial ecosystem of Greece.

To that purpose, it is proposed that the “**Industrial Transformation and Growth Body**” is founded, through a cooperation memorandum signed with the General Secretariat for Industry. It is essential to note that the Body will pursue the holistic digital transformation of Greek industrial enterprises, through implementing the initiatives of the operational plan and engaging all relevant stakeholders of the ecosystem (businesses, research institutions and academia stakeholders as well as key members of the Greek public sector).

It is also critical to mention that the proposed Industry 4.0 strategy essentially represents the first step of a series of linked initiatives that will be designed and implemented in the short and medium term (such as, among others, the revised Smart Specialisation Strategy, the Digital Strategy and the Industrial Strategy of Greece). Due to the aforementioned, it could be the case that the Industrial Transformation and Growth Body be responsible for the implementation of these linked initiatives, in an effort to achieve operational effectiveness and efficiency, acting as a central implementation and monitoring mechanism within the Greek ecosystem. The above set as a prerequisite the smooth and close collaboration of the Body with other key stakeholders of the Greek ecosystem, such as the newly founded Government Industry Committee (which for the Governance structure of the i4.0 strategy will act as the Steering Committee, to be analysed below in more detail) as well as the Hellenic Development Bank.

The “**Industrial Transformation and Growth Body**” will essentially represent the competent body that will be called to implement the proposed Industry 4.0 strategy for Greece as well as the initiatives proposed through its Operational plan. It will represent a “Transformation Do-er” within the industrial ecosystem, ensuring change and digital transformation are pursued by all enterprises and relevant stakeholders within the Industrial ecosystem.

It shall consist of approximately 15-20 officers (including the head transformation officer as well as implementation body leaders), as they will be described below. The indicated size of the Industrial Transformation and Growth Body stems from the fact that it needs to assemble a tight and dedicated team that will pursue to assist with the parallel implementation of the many proposed initiatives. At the same time, it will be able to reach out to the Greek private sector so as to collaborate with high-calibre experts on an ad-hoc basis always according to the task at hand.

In order to fulfill its purpose, it is essential that the Body consists of highly competent experts (for further analysis regarding their competencies refer to the following lines). Currently there exists a lack of targeted services with regard to the support of enterprises and their digital transformation journey within the market, making the composure of the Industrial Transformation and Growth Body's staffing even more critical, taking into account the complex governance and implementation needs for the digital transformation of the Greek industry.

As already analysed, the Industrial Transformation and Growth Body, once it will have successfully initiated the implementation of the Industry 4.0 Strategy for the country, could potentially undertake the implementation and monitoring of related initiatives within the Greek ecosystem. Such initiatives could be

the implementation/ facilitation of the New NSRF 2021-2027 for Greece, the revitalized Strategy for Smart Specialisation, the Digital Strategy, the Industrial Strategy and the National Growth Programme for Greece.

To that purpose, there exist a number of sources where the Industrial Transformation and Growth Body could revert to in order to secure funding towards its operation and financial support. Such sources could indicatively be the following:

- The new NSRF 2021-2027 for Greece,
- The National Recovery and Resilience Plan for Greece,
- The Public Investments Programme, or
- The Operational Programme “Competitiveness, Entrepreneurship and Innovation” (EPAnEK) (as it currently stands or through its respective extension in the new NSRF, with regard to the goal of “creating a new production model that will lead to development and will strengthen the competitiveness of the Greek economy by leveraging private financing”).

To ensure however its longevity and viability as a crucial stakeholder within the Greek ecosystem, it could be the case that in the medium and long term, an approach similar to other EU countries’ governance bodies is pursued. The Body could allow enterprises to get enrolled as members to a wider group of enterprises and stakeholders, which, in the lines of the pursued initiatives could participate in working groups and open discussions in order to shape the future of the respective areas of the Greek economy (be it the Greek industrial or other sectors/ areas of interest, for which initiatives are pursued and implemented). On that note, they could contribute with a fixed monthly or yearly fee, in order for their “voice” to be heard and actively contribute in the design of the “next day for the Greek Industry”, while at the same time these fees would be used to sustain the growth and smooth operation of the Industrial Transformation and Growth Body.

It is proposed that the Body essentially represents a legal person governed by private law, that will be established through a collaboration memorandum with the General Secretariat for Industry. This is due to the fact that, as already mentioned within this chapter, it has been deemed necessary by the General Secretariat that the responsible body to undertake this significant transformation initiative should possess a greater operational capacity than the General Secretariat for Industry, actively uniting and engaging all key stakeholders and actors within the industrial environment. To that purpose, the Industrial Transformation and Growth Body shall consist of the following groups/ roles, which are further analysed in the following lines:

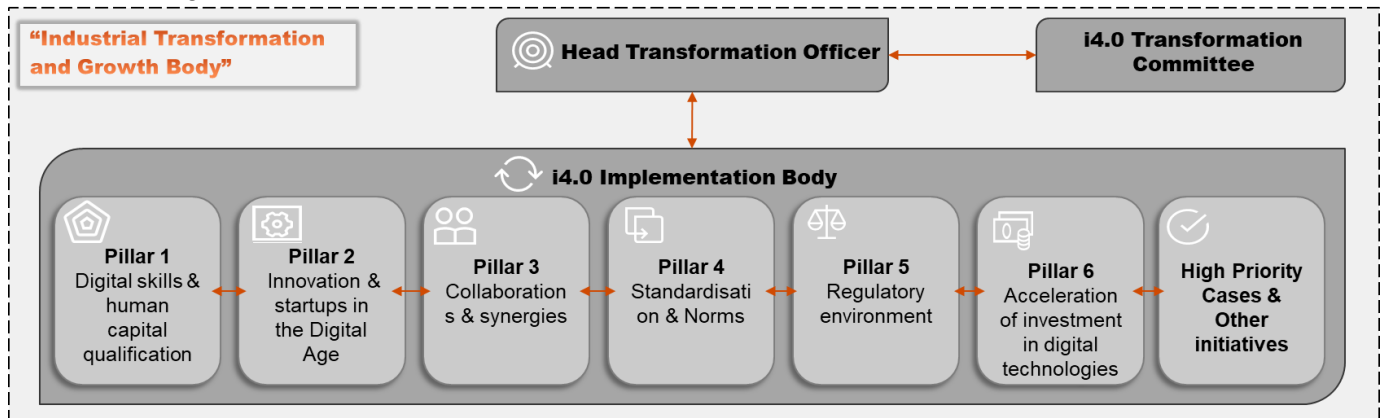


Figure 2: The internal structure of the Industrial Transformation and Growth Body

Head Transformation Officer

The Head Transformation Officer will essentially be the “**architect**” of the whole transformational journey within the Greek industrial ecosystem. He/ she will have the ultimate overview of the whole transformational effort, guiding the members of the Implementation body (through the implementation body leaders) with regard to their actions in order to ensure operational success for the whole initiative.

To this end, it is recommended that the head transformation officer is an individual with a proven track record with regard to his/her involvement in the industrial sector, covering most (if not all) of the following competency requirements:

- Solid understanding of the needs of the industrial ecosystem, through a long track-record in the industrial sector
- Managing partners and stakeholders that will be crucial for the implementation of the digital transformation journey of the ecosystem;
- Solid knowledge of the Industry 4.0 technologies and applications Greek industrial enterprises can make use of to transform;
- Experience with financing mechanisms and support programmes within the Greek ecosystem;
- Highly experienced in management of simultaneously running and interlinked projects;
- Solid understanding of the industrial regulatory environment and its limitations;
- Familiar with previous operational programmes within the Greek ecosystem (i.e. previous NSRF programmes and mechanisms).

The following constitutes an indicative list of the Head Transformation Officer’s responsibilities:

- Managing the day-to-day operations by prioritizing tasks for the Implementation Body leaders, performing quality reviews of their outputs.
- Ensuring that all initiatives of the strategy and activities are carried out as planned.
- Reporting on all significant issues related to the project and proceeding with the formulation of recommendations to the General Secretariat for Industry and the government Industry Committee (Steering Committee) for decision-making purposes.
- Ensuring proactive stakeholder management by creating direct channels of communication with the identified stakeholders that have the greatest influence on the project.
- Coordinating efficiently the resources of the Industrial Transformation and Growth body, identifying early on relevant needs of human resources and expertise in order to reach out to the market in due time;
- Reviewing the entire project progress and reporting their respective recommendations to the General Secretariat for Industry for the strategy’s implementation, through the establishment of a solid communication channel.

The i4.0 Transformation Committee

It will consist of the implementation body's leaders, who will essentially represent the leading implementation officers, for all initiatives and actions pursued by the Industry 4.0 Implementation Body collectively. With regard to that, their role will be to ensure that they organise the work and effort necessary, give directions to and in general assist with potential bottlenecks the "on-the-ground" implementation body members in order to ensure that all initiatives are pursued according to the plan.

This group of individuals will directly report to the Head Transformation Officer, formulating corrective actions and new implementation plans and schedules where deemed necessary, ensuring at the same time synergies across all initiatives pursued within the Strategy's context. To that purpose, they need to have similar technical and other skills and competencies to the Head Transformation Officer, since they will be called to realise a similar set of activities, but within smaller and fragmented teams.

All in all, the responsibilities of the Industry 4.0 Transformation Committee comprise of the following:

1. Be accountable for the development and operationalization of the proposed Industry 4.0 strategy, in close collaboration with industrial federations and local stakeholders.
2. Establish collaborative structures and mechanisms for the implementation of the i4.0 initiatives.
3. Liaise with and coordinate the work of "on-the-ground" implementation body members.
4. Liaise and coordinate with i4.0 transformation programs and initiatives at an EU level.
5. Specify, identify and mobilise the necessary funding and resources for the i4.0 strategy operationalization.
6. Ensure the on-time and on-budget operationalization of the national Industry 4.0 strategy.
7. Escalate issues to the Steering Committee and Project Sponsor and coordinate Governance meetings.
8. Prepare and publish periodic reports on the progress of the operationalization.
9. Lead Industry 4.0 public awareness initiatives responsible for the implementation of the i4.0 strategic initiatives.

Industry 4.0 Implementation Body

The Industry 4.0 Implementation Body will comprise of experts originating from the Greek public and private sector. Indicatively they could be technical advisors or employees of industrial corporates that have long been involved in the Greek industrial sector, and fully understand its needs, landscape and key players as well as the tools and courses of action necessary in order to assist it drastically and effectively. Moreover, and in order to ensure adequate operational capacity, this group of experts should be supported by selected individuals from the private sector, ensuring that their respective knowledge on programmes' mechanisms, similar previously pursued initiatives and also their knowledge one public sector's landscape is transferred into this holistic digital transformation effort of the Greek industry.

With regard to this group's competencies and areas of experience, they will have to be competent in most (if not all) of the following areas:

- Long experience in industrial digital transformation programmes, fulling understanding the operational needs of an industrial enterprise, its link into the ecosystem and the type of financial and other support mechanisms that will suffice to its needs.
- Active engagement in previous operational programmes within the Greek ecosystem (i.e. previous NSRF programmes and mechanisms), either from the supply side (public sector) or the demand side (industrial enterprises). This is essential since it will allow to identify

- early on in the process potential bottlenecks or hurdles within the pursued initiatives, allowing for better programming and planning and therefore smoother implementation.
- Solid understanding of the initiatives pursued throughout the Industry 4.0 strategy and operational plan. Having a complete overview of the components of each initiative is crucial since it will allow these experts to directly “pull the right strings”, such as:
 - Seek for targeted services from the market toward that end in due time
 - Contact the right stakeholders within the ecosystem to push an initiative forward or
 - Help it mature in a more effective way (saving both time and costs in the process).
 - Ability to comprehend all technical, financial, regulatory or “industrial-specific” aspects of each initiative. This will allow them to facilitate the implementation of the initiatives as planned and efficiently.
 - They also need to fully understand what the Industry 4.0 strategy seeks to accomplish and the means to do so.
 - Experience in reporting and monitoring of transformational programmes will be really valuable since they will communicate the complete overview of the strategy’s implementation against the set plan to the higher levels of authority, first within the Industrial Transformation and Growth Body (i.e. to the Head Transformation Officer and the i4.0 Transformation Committee). These in turn, utilising the correct and timely information provided by the Industry 4.0 Implementation body members will in turn effectively raise on time potential issues to the General Secretariat for Industry or the Government Industry Committee.

Having said the above, the responsibilities and day to day actions of this group are briefly outlined below:

1. **Move forward all the proposed initiatives of the proposed Industry 4.0 strategy and operational plan**, ensuring that they are implemented within the defined timelines, directly being exploited by industrial enterprises and key stakeholders of the ecosystem.

That being said, they will be responsible to assist with “maturing” and implementing all proposed as well as future (to-be designed) initiatives in order to be rolled out within the set timelines. In the lines of the above they will be responsible to issue call for tenders, promote industrial research and innovation projects in close collaboration with research partners as well as liaise with the key stakeholders from the public sector in order to identify and utilise relevant funding sources in order to assist the enterprises of the ecosystem.

Also, it is critical to point out that they will be responsible to orchestrate the implementation effort for the initiatives across all six (6) of the proposed strategy’s pillars and high priority cases, ensuring complementarities, parallel implementation and synergies where relevant (for example the adoption of smart manufacturing technologies by industrial enterprises paired with the respective upskilling and reskilling programmes, pursuing a holistic transformation for both businesses and their human capital).

2. **Identify, contact and actively engage strategic allies from the private sector in this major transformation journey**. Such allies could be large technology provider groups of enterprises as well as technology integrators, ensuring that they will actively provide their systems, expertise and knowledge on the industrial digital world, becoming a significant driver for change within the Greek industrial ecosystem.
3. **Prepare, communicate and assist the industrial ecosystem to embrace the proposed Industry 4.0 strategy and initiatives through targeted actions and dissemination events** that will not only

serve a “for information” purpose but also actively engage enterprises in order to take the first step towards their industrial transformation journey.

4. **Engage with relevant bodies from the EU industrial landscape, so much with regard to enterprises that can become strategic allies in such a journey as well as relevant committees pursuing similar Industry 4.0 strategies.** This will seek to achieve cooperation and synergies in an international level with bodies/ enterprises that are ahead of the curve and can significantly impact the efforts within the Greek ecosystem.

5. Escalate issues to the Industry 4.0 Transformation Committee.

4.1.5 Strategic i4.0 implementation enablers

The Governance structure for the proposed Industry 4.0 strategy shall be heavily supported by two key strategic implementation enablers, as these will be analysed in the following lines:

- **The Industry 4.0 Platform for Greece** (Initiative 3.4)
- **The Smart Manufacturing Technologies (SMT) Competence Centre** (Initiative 7.2)

As they have been identified through the Operational plan, these two initiatives consist critical tools for the implementation of the strategy in a smooth and efficient manner. They are essentially expected to drive the transformational journey since the early days of the “kick-off” of the strategy and therefore their timely implementation is critical towards the overall venture’s success.



[The Industry 4.0 Platform for Greece](#)

The Industry 4.0 platform will enclose all the necessary information regarding the proposed i4.0 strategy and will act as an umbrella that will embrace all the initiatives & supporting mechanisms that will be promoted and pursued by the Industrial Transformation and Growth Body.

The platform will in fact materialize the memorandum signed between the General Secretariat for Industry and the Ministry of Digital Governance in 2019 and will seek to act as the "single source of truth" for information, awareness, networking and promotion of Greek companies on topics related to "Industry 4.0".

In more detail, it is suggested that it includes the following:

1. Greece's Industry 4.0 vision, goals, defined strategy & operational plan (as part of this engagement), in order inform all businesses within the Greek industrial ecosystem to take action and become part of this major initiative
2. Educational material on Industry 4.0, its key benefits and the key I4.0 technologies
3. Information & update on implementation of relevant Industry 4.0 initiatives
4. Information and online access to available supporting mechanisms, services & regulatory frameworks that could benefit the digital transformation of the Greek Industry
5. Information, update, newsroom on the “Industry 4.0 Awareness” initiatives

More importantly and complementary to the above, the platform represents a critical tool since it will also serve as a “working and implementation” digital space for the Industry 4.0 implementation agents. That being said, they will be able to monitor the progress and performed actions of the pursued initiatives through the monitoring of relevant KPIs and data, as well as next steps that need to be performed in the near future to ensure that the whole industrial digital transformation venture is progressing as planned.

The results of the work conducted “on-the-ground” will be uploaded in the platform to ensure that all critical stakeholders are informed of the latest developments within the ecosystem, allowing for synergies and complementarities of actions along the way.

At a higher level, the platform will allow for the holistic review of the strategy and its proposed initiatives in the future, allowing for corrective actions within a reasonable timeline in order to ensure efforts are moving towards the right direction and all setback and bottlenecks are dealt with in due time.



The Smart Manufacturing Technologies Competence Centre

The Greek Smart Manufacturing Technologies Competence Center⁸ shall act as the bridge between manufacturing and industrial SMEs and midcaps with large enterprises of the ICT and Manufacturing sectors (digital providers and integrators) as well as with academic and research institutions. It is therefore only logical that the Industrial Transformation and Growth Body utilises this initiative to the maximum as a key driver for digitalisation and change of the current status quo within the Industrial ecosystem.

It is expected to become the epicenter of digital transformation within the Greek industrial ecosystem, essentially being the space where industrial innovation and digital transformation for enterprises as well as upskilling and reskilling of the industrial human capital will be performed on an ongoing basis.

It shall therefore provide the resources, space and facilities to SMEs, midcaps and larger enterprises to experiment with the development of Smart Manufacturing solutions, as well as with the associated digital processes and new business models under realistic conditions. In more detail, the Competence Center will enable industrial actors to innovate, build differentiated smart manufacturing solutions and applications. Indicatively, it is expected that the Competence Center provide the following services (non-exhaustively), to support its clients:

1. **Visioning & strategy development:** Support new start-ups/ SMEs to assess their current Industry 4.0 maturity and design their Industry 4.0 strategy
2. **Collaborative R&D:** Provide support for the design and implementation of R&D projects on smart manufacturing; develop new smart manufacturing concepts, design and develop proof of concepts
3. **Testing and validation:** Provide technical and specialized services for design, testing & validation of new solutions including product demonstration & product qualification
4. **Technical support on scale up:** Provide support for solutions’ technology concept development, proof of concept, prototyping & small series production
5. **Skills & education:** provide digital upskilling & reskilling training (i.e. workshops, seminars, courses, etc.) to the center’s customers, tailored to their digital maturity level & their business area; offer technological infrastructure for educational purposes
6. **Community building:** Support the creation of a collaborative, innovation-driven ecosystem, instigate awareness, act as the broker to bring in contact enterprises, etc.

⁸ For more information, please refer to Initiative 7.2 of the Operational Plan within Deliverable 3

In addition to the aforementioned, the Competence Center can also act as an ecosystem accelerator for start-ups, active in the “smart manufacturing” field.

4.1.6 Indicative “Roadmap” for the set-up of the Industrial Transformation and Growth Body

Since the “timing” parameter for the implementation of the Industry 4.0 strategy is crucial, swift actions need to be taken by the Greek Authorities in the short term. In order to facilitate the smooth establishment and operation of the Industrial Transformation and Growth Body, it is critical that the Ministry of Development and Investments and more specifically the General Secretariat for Industry take the necessary legal actions and possibly amend existing laws or introduce new legal provisions in order to set the foundations within the ecosystem for the establishment of the Body.

By doing so, it is expected that rolling out the Body will be done within a predefined framework, which should lay out all the key details of its operation, avoiding potential bottlenecks that will further delay the process and obstruct the effective implementation of the Industry 4.0 strategy.

Below, a high-level roadmap is presented, as far as the immediate next steps on the side of the Greek authorities are considered.

Step 1 (~2 months): Establishment of the Industrial Transformation and Growth Body, by the General Secretariat for Industry, acting as its operational arm within the wider ecosystem.

Within the official establishment document the following shall be fully outlined:

- The legal status of the Body and its fit and purpose within the Greek ecosystem.
- Its governance structure and composition of staff (experts), including the relevant roles and responsibilities as well as the required skills and competencies.
- The funding mechanism for the setup and first steps of operation for the Body as well as the remuneration mechanism for its staff.

Step 2 (~1 month): Establish the respective memorandum for the co-operation between the General Secretariat for Industry and the Body.

In that context, the following (indicatively and non-exclusively) need to be described in full detail, since this memorandum will govern the relationship and the collaboration between the two parties in the long term:

- Duration, scope, amendment and termination of the co-operation
- Co-operation mechanism between the General Secretariat for Industry and the Body, including outline of the general responsibilities between the two parties
- Representation of the two parties
- Confidentiality clauses
- Lines of communication and information/ guidance exchange in the context of the cooperation
- Frequency of reporting and receipt of guidance and directions for the i4.0 strategy’s implementation.

Step 3 (~2 months): Staffing of the Industrial Transformation and Growth Body

It is essential that once the memorandum of co-operation is signed between the General Secretariat for Industry and the Body, the staffing process is rapidly initiated and concluded.

Given that a definition of the relevant profiles and roles needed within the Body will have already been provisioned, the General Secretariat is expected to facilitate and engage actively in the selection process for the staff of the Body. Thus, it will ensure that the most qualified experts from the public and private sector will become part of the Body, strengthening its operational capabilities to the desired levels.

Step 4 (~1,5 month): Identify and equip the premises of the Body & Deploy the Industrial Transformation and Growth Body

The final step of the roadmap is to identify and equip the premises that are going to be the headquarters of the Industrial Transformation and Growth Body.

It is crucial that the premises are equipped with high performance computers as well as stable and fast internet connection, allowing the staff to facilitate the implementation of the initiatives through the Industry 4.0 platform that is going to be designed in the short term, acting as the central implementation and monitoring tool for the Industry 4.0 strategy.

Furthermore, it would be ideal if the premises were located near the General Secretariat for Industry, allowing for direct collaborations and often working meetings in the context of the initiatives' maturing and implementation.

All in all, the above process needs to be followed rigorously by the General Secretariat for Industry, since the Industrial Transformation and Growth Body needs to be established in due time in order to assist with the implementation of the strategy within the Greek industrial ecosystem.

4.2 Key performance indicators (KPIs): Key principles and considerations

Once the Industrial Transformation and Growth Body has been set up and effectively begins to implement the digital transformation journey of the Greek industry, it shall need a set of Key Performance Indicators (KPIs).

These shall effectively assist in the monitoring of the strategy as a whole, as well as with the monitoring each respective initiative, adequately measuring their key outputs in order to intervene with corrective actions when and where needed. To that purpose, the current chapter presents the rationale and the methodology for setting and selecting KPIs for the Industry 4.0 strategy and initiatives.

Below we present the key principles and considerations in selecting KPIs, by applying the “S.M.A.R.T.(E.R.)” criteria, which facilitate decision makers in deciding which indicators belong to the performance management methodology. In addition, we provide an indicative list of KPIs for each strategic initiative, under each strategic pillar and high priority case, as well as general economic monitoring indicators related to the i4.0 strategy as a whole.

As already discussed, KPIs should be selected based on the “S.M.A.R.T.(E.R.)” criteria. Specifically, each KPI should be:

- **Specific:** It should be clear what the KPI measures. There must be one commonly accepted definition of the indicator and each individual user must interpret it the same way to ensure consistent data collection and entry.
- **Measurable:** The KPI should be measurable to define a standard, which could be quantity, time or investment. Where applicable, accurate quantifications should take place in order to produce numerical data, for example by introducing rating scales to facilitate statistical analysis.
- **Achievable:** Striving to obtain “impossible-to-deliver” KPIs creates unnecessary administrative burden, discourages users and hinders the entire monitoring process and initiative’s progress. It is crucial that the KPI is achievable, that is available, obtainable and realistic, provided that the available resources and time are appropriately utilised.
- **Relevant:** The KPI must provide further insight into the progress of the strategic initiative and the implementation of the strategy. It must, therefore, inform the process.
- **Time-bound:** It is important to specify the time frame in which the KPI should be achieved, therefore its value should be stated in time.

The S.M.A.R.T. methodology is complemented by two additional criteria, which make KPIs “S.M.A.R.T.E.R.”. This essentially means that each KPI should also be:

- **Evaluated:** As the strategy changes and evolves overtime, it is important to evaluate whether the KPI provides the right measurements and strategically aligns with its respective strategic initiatives
- **Revised:** Occasional evaluations indicate the necessity for revision of the KPI.

On top of the aforementioned, below we present some key considerations which should be taken into account before the finalisation of the KPIs proposed:

- KPIs should be proportionate and efforts should be directed to those aspects of the system that are most important.
- Existing data and existing indicators should be used where possible.
- Whenever available, baseline indicators should be included for each strategic initiative.

Furthermore, for each KPI there should be a clear reference to the data source and collection mechanism (existing databases within the Greek industrial ecosystem/ public sector, reporting by public institutions, survey, ex ante and ex post evaluation) and the appropriate timing (collection of data during or after the implementation of the measure, at a later stage, through external evaluation). To that purpose, it is significant to pursue and identify the best possible mechanisms for the selection of the necessary data and, whenever possible, the use of existing sources.

4.2.1 General KPIs & KPIs directly linked to the strategic goals

The following lists (Chapters 4.2.1 - 4.2.3) aim at providing a basis for further development of the dynamic monitoring process of Greece’s i4.0 strategy implementation and as such they are not meant to be exhaustive or exclusive of other KPIs that could be applicable. However, and as mentioned within the lists, all evaluations have to be performed against the set targets that shall be identified by the Industrial Transformation and Growth Body and the Governance model’s Industry 4.0 Steering Committee.

Economic/ Industrial indicators

Economic/ Industrial Indicator	Description
Industry GVA (and Δ in Industry GVA) as % of total GVA	Industry Gross Value Added is the net output of Industry after adding up all outputs and subtracting intermediate inputs. Industry Gross Value Added as % of total Gross Value Added is the Industry Gross Value added as a share of the total Gross Value Added of the country.
Industry employment (and Δ in industry employment) as % of total employment	Industry Employment is defined as persons of working age who were engaged in any industrial activity to produce goods or provide services for pay or profit, whether at work during the reference period or not at work due to temporary absence from a job, or to working-time arrangement. Industry employment as % of total employment measures Industry employment as a share of the total employment of the country.
Gross Capital Formation	Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.
Industry GVA per employee	Industry GVA per employee measures the gross value added per industry employee.
Exports of high technology products as % of total exports	Measures the share of exports of all high technology products in total exports. High technology products are defined according to SITC Rev.4 as the sum of the following products: Aerospace, Computers-office machines, Electronics-telecommunications, Pharmacy, Scientific instruments, Electrical machinery, Chemistry, Non-electrical machinery, Armament.

Imports of industrial goods and services as % of GDP	Imports of goods and services as % of GDP represent Imports of goods and services as a share of the country's Gross Domestic Product.
Exports of industrial goods and services as % of GDP	Exports of goods and services as % of GDP represent Exports of goods and services as a share of the country's Gross Domestic Product.
Industrial New Orders	The new orders index shows changes in demand for domestic products and imports. It measures the trend in orders received by industrial producers from domestic and non-domestic customers.
Industrial Production Index	Industrial production is an indicator of the business cycle for industrial output and activity. The index measures changes in the volume of output of different industrial activities and industry as a whole at monthly intervals. It reflects price-adjusted changes in industrial output.
Manufacturing Production Index	Manufacturing production is an indicator of the business cycle for industrial output and activity. The index measures changes in the volume of output of different manufacturing activities and manufacturing as a whole at monthly intervals. It reflects price-adjusted changes in manufacturing output.
Industry Labor Cost Index	The quarterly Industry Labour Cost Index shows the short-term development of the total hourly costs incurred by the industrial employers of maintaining their employees.
Environmental Industrial Footprint Index	In an effort to measure the environmental footprint of the Greek Industry, the following sub-KPIs are proposed. They aim to define how “green” and environmental-friendly the Industrial ecosystem is through the concept of Industrial Symbiosis and all initiatives and KPIs proposed within High Priority Case 3: 1) Reduction in the waste generated from industrial operations 2) Ratio of recycled materials used in raw material through waste exchanges, 3) Reduction in the amount of industrial waste landfilled, and 4) Reduction in the cost of waste treatment and disposal borne by industry.

Adding to the above general KPIs, the following KPIs have been selected as more “Industry 4.0 specific” and seek to measure the successful realisation of the Industry 4.0 strategy and operational plan, aiming to fulfil the strategic goals set, as they have been identified in the context of Deliverable 2.

They directly match one-to-one the strategic goals that will be pursued through the digital transformation of the Greek industry initiative, allowing for a direct overview of the progress made regarding the strategic goals set.

Strategic Goal	Relevant Industry 4.0 KPI
1. Increase the Greek Industry’s overall digital maturity	<ul style="list-style-type: none"> • Readiness for Future of Production (FOP) Index, published by the World Economic Forum, (WEF) • DESI Index, Sub-dimension 4: Integration of Digital Technology European Commission, Digital Transformation Scoreboard, https://ec.europa.eu/growth/tools-databases/dem/monitor/scoreboard
2. Digitally upskill and reskill the human workforce in the Greek industry	<ul style="list-style-type: none"> • DESI Index, Sub-dimension 2: Human Capital • Human Capital Index, World Bank
3. Enhance the Greek Industry’s applied R&D, innovation and production capabilities	<ul style="list-style-type: none"> • European Innovation Scoreboard (EC), https://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en • Global Innovation Index, World Intellectual Property Organization (WIPO)
4. Support the Greek Industry to transition into the zero-carbon and low environmental footprint economy	<ul style="list-style-type: none"> • EU Circular material use rate, % of total material use • Regulatory Indicators for Sustainable Energy (RISE), World Bank • Sustainable Development Goals (with emphasis on those relevant to energy), United Nations
5. Develop a collaborative industrial ecosystem to accelerate the digitization and scale up of the Greek SMEs and mid-caps	<ul style="list-style-type: none"> • Operation indicators already captured in some of the initiatives
6. Enhance the internationalization and extroversion of the Greek Industry and strengthen its active participation in global, European and regional value chains	<ul style="list-style-type: none"> • Operation indicators already captured in some of the initiatives
7. Increase the Greek Industry’s potential to meet personalized needs and imminently respond to emergencies and crises (flexible processing)	<ul style="list-style-type: none"> • Employment in high- and medium-high technology manufacturing sectors and knowledge-intensive service sectors, Eurostat
8. The enhancement of internationalization of the Greek Industry and its active participation in EU ecosystems	<ul style="list-style-type: none"> • Add High-tech exports, Eurostat • # of enterprises participating in EU innovation hubs
9. Increase the overall contribution of Greek industry to the Greek economy	<ul style="list-style-type: none"> • Global Competitiveness Index, World Economic Forum

4.2.2 KPIs focused on the Operational Plan

Pillar 1: Initiatives	Proposed KPIs
1.1: Develop an Industry 4.0 reskilling & certification programme for the Greek Industry Workforce	<ul style="list-style-type: none"> • Number of applications and registrations for the programme • Graduation rate of participants • Number of certifications awarded • Number of training sessions held • Student satisfaction (based on follow-up surveys) • Supervisor report and feedback • Overall amount invested in initiative against the budgeted investment at that specific point in time
1.2: Develop a dedicated Industry 4.0 apprenticeship programme for STEM undergraduates & graduates	<ul style="list-style-type: none"> • Number of apprenticeship programme requests • Number of apprenticeships approved/started • Number of apprenticeships completed against the number of approvals granted • Participant satisfaction (private enterprises and students, based on follow-up surveys) • Supervisor report and feedback • Overall amount invested in initiative against the budgeted investment at that specific point in time
1.3: Develop Postgraduate conversion programmes in Smart Manufacturing Technologies	<ul style="list-style-type: none"> • Number of postgraduate programmes introduced • Number of related modules introduced or percent (%) of i4.0 curriculum covered by a member state’s similar course • Number of apprenticeships developed as part of the postgraduate program • Student/ participants’ satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
1.4: “Back to I4.0 School” - Incentivize Greek enterprises to support employees to participate in I4.0/ Smart Manufacturing postgraduate convention programmes	<ul style="list-style-type: none"> • Number of Back to I4.0 School applications submitted and registrations • Graduation rate of participants and number of postgraduate degrees awarded • Average amount invested per student • Participant satisfaction (students and enterprises, based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
1.5: Revamp of the STEM departments’ & Technical/ VET (Vocational Education Training) bodies’ educational curricula to reflect current needs across Industry 4.0	<ul style="list-style-type: none"> • Number of horizontal skilling/upskilling courses introduced • Number of advanced courses introduced • Number of related modules introduced or percent (%) of i4.0 curriculum covered by a member state’s similar programme • Average number of horizontal skilling/upskilling courses completed per student • Average number of advanced courses completed per student • Student satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys)

	<ul style="list-style-type: none"> • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>1.6: Introduce an Industry 4.0 Fellowship programme for PhD, Post-PhD Students and researchers</p>	<ul style="list-style-type: none"> • Number of Fellowship programme applications and registrations • Completion rate of the programme • Number of Fellowship programme graduates hired by respective private enterprises against number of total Fellowship programme graduates • Participant satisfaction (students and private enterprises, based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>1.7: Incentivise Greek mid-level and senior workforce working abroad on I4.0 areas to repatriate</p>	<ul style="list-style-type: none"> • Number of Greek mid-level/senior professionals repatriated • Number of Greek mid-level/senior professionals hired for i4.0 positions • Participant satisfaction (repatriated professionals, (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time

Pillar 2 Initiative	Proposed KPIs
<p>2.1: Introduce an "Industry 4.0 labs/testbeds" funding scheme</p>	<ul style="list-style-type: none"> • Number of Industry 4.0 test labs/testbeds established • Number of experiments/tests performed by enterprises • Number of technical/business solutions developed • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative and funding absorption rate by participating enterprises against the budgeted amount/investment
<p>2.2: Support the setup of a dedicated competence centre for Artificial Intelligence & Big Data Analytics for the Greek Industry</p>	<ul style="list-style-type: none"> • Number of visits to the Competence Center from industrial enterprises that seek to capitalise on the provided services • Number of Competence centre-hosted events (workshops, seminars, courses) • Number of i4.0 projects supported against the scheduled projects/programmes at a specific point in time • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>2.3: Introduce the "GovTech Programme for Manufacturing SMEs/start-ups"</p>	<ul style="list-style-type: none"> • Number of problems submitted by the Public Sector • Number of challenges selected and procured • Number of suppliers to work on each challenge • Number of prototypes selected for full-scale implementation • Number of full-scale solutions implemented • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative

<p>2.4: Introduce a program to prepare and educate future Smart Industrial & Manufacturing entrepreneurs</p>	<ul style="list-style-type: none"> • Number of applications and participants registered • Number of certifications awarded • Programme completion rate • Number of start-ups applying for the “Industry 4.0 funding scheme for start-ups” upon completion (Initiative 6.2) • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>2.5: Introduce the "Adopt an Industry 4.0 start-up" programme</p>	<ul style="list-style-type: none"> • Number of participating enterprises (other than startups) and number of startups supported • Number of successful programme completions and programme completion rate • Participant satisfaction (enterprises and startups) (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>2.6: Introduce an Industrial Strategy Challenge Fund to enhance innovation & collaboration across the Greek Industry</p>	<ul style="list-style-type: none"> • Number of industrial challenges defined • Number of calls for tender published • Number of participants and successful participants per tender • Overall number of participations and number of participants per initiative against the planned/ desired participations • Number of challenge specific solutions developed • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time

Pillar 3 Initiative	Proposed KPIs
<p>3.1: Introduce the "Idea Agora" Pitch Programme</p>	<ul style="list-style-type: none"> • Number of problems/challenges shared • Number of enterprises registered on the platform • Number of proposals submitted • Number of competitions held and successfully completed • Number of contracts signed for full-scale solution development • Number of full-scale solution implementations • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>3.2: Introduce an Industry 4.0 Awareness Programme</p>	<ul style="list-style-type: none"> • Number of presentations/workshops/networking/matchmaking events/Open Door days held • Number of participants (per event category) • Number of participants employed in i4.0 jobs after graduation and/or number of students pursuing further studies in i4.0 disciplines • Engagement with 4.0 platform (Website engagement metrics) • Participant satisfaction (based on follow-up surveys)

	<ul style="list-style-type: none"> • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>3.3: Evaluate and set up of Industry 4.0 value chain Innovation Districts</p>	<ul style="list-style-type: none"> • Number of events/conferences/workshops/trainings/incubations sessions held • Number of event participants • Number of Innovation activities supported/delivered • Number of R&D projects supported • Number of technical/business solutions developed • Number of events/conferences held • Number of workshops/training and incubation sessions organized • Number of new entrants • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>3.4: Develop a dedicated Industry 4.0 platform for Greece</p>	<ul style="list-style-type: none"> • Website/portal engagement metrics such as conversion rate, awareness level, average time on page etc. applied to the i4.0 strategy • Visitor/user/subscriber satisfaction • Supervisor report and feedback • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>3.5: Design a national portal for Industrial patents</p>	<ul style="list-style-type: none"> • Website/portal engagement metrics such as conversion rate (number of patent registrations), awareness level, average time on page etc. applied to the i4.0 strategy patent related goals • Visitor/user/subscriber satisfaction (based on surveys) • Number of times the portal was identified by patent applicants as a communication channel in surveys (“how did you hear about this” type questions) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>3.6: Introduce a "scale up and internationalization" programme for Greek Industrial SMEs/ start-ups</p>	<ul style="list-style-type: none"> • Number of SMEs/startups supported • Number of enterprises achieved internationalisation through the expansion of their operations/ products in foreign markets and value chains • Number of consulting/training/implementation events held • Average funding per SME/ startups • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative and funding absorption rate by participating enterprises against the budgeted amount/investment

Pillar 4 Initiative	Proposed KPIs
4.1: Introduce a Greek Industrial Standardisation Committee	<ul style="list-style-type: none"> • Number of European/international standards introduced • Number of industrial enterprises that have effectively adopted newly introduced European/international standards • Number of industrial enterprises supported in successfully developing new industrial standards • Number of new industrial standards developed by enterprises • Number of standardisation collaborations established with EU member states (e.g. Germany, France, Italy) • Supervisor report and feedback (based on follow-up surveys) • Number of newly developed industrial standards that enterprises have capitalised upon in international/ foreign markets • Overall amount invested in initiative against the budgeted investment at that specific point in time
4.2: Develop the Greek Industry 4.0 standardization framework	<ul style="list-style-type: none"> • Number of focus groups/interviews/surveys to infer the as-is state of play against the desired/ planned number (Step 1) • Number of industrial enterprises participating in focus groups/interviews/surveys against the desired/ planned number (Step 1) • Number of collaborations established with technical experts/standardisation organizations (Step 2) • Number of short-term and mid-term targets established (Step 3) • Completion rate of steps (1,2,3) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
4.3: Awareness campaign on standardisation within the Greek industrial landscape	<ul style="list-style-type: none"> • Number of workshops held against the desired/ planned number • Number of Federations that have informed members about standardisation • Metrics relevant to the official advertising campaign such as awareness metrics (e.g. reach, impressions) and conversion metrics (e.g. number of subscriptions) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
4.4: Enhance the accreditation of enterprises on industrial standards	<ul style="list-style-type: none"> • Number of times services around standardisation (e.g. trainings, customized solutions, diagnostic and support plans) were offered to companies • Number of companies that have received relevant certification • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative and funding absorption/ utilisation rate by participating enterprises against the budgeted amount/investment

Pillar 5 Initiative	Proposed KPIs
5.1: Strengthen the Cybersecurity framework of Greece with regards to Industry 4.0	<ul style="list-style-type: none"> • Number of Greek entities participating in Cybersecurity Competence Network and Center initiatives (e.g. surveys, community building activities) • Number of Greek entities participating in the open forum-platform set up by the Ministry of Digital Governance • Engagement metrics for open-forum platform • Metrics relevant to the awareness campaign such as awareness metrics (e.g. reach, impressions) and conversion metrics (e.g. subscriptions) • Number of companies that have received cyber-security certification against the number of desired/ planned certifications • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
5.2: Enhance the Greek industrial ecosystem with regards to intellectual property	<ul style="list-style-type: none"> • Number (or percent (%)) of new EU/member state policies (IP and 4.0 technology related) adopted in the Greek IP framework • Number of patent filings in the field of i4.0 technologies (e.g. AI) • Supervisor report and feedback (based on follow-up surveys)
5.3: Reinforce the free flow of non-personal data within the Greek Industrial Sector	<ul style="list-style-type: none"> • Number of laws of the European Regulation for the Free Flow of Non-Personal Data developed for the Greek industrial ecosystem (Step 1) • Number of specific measures on data governance, access and reuse of data set (Step 2) • Number of publicly held databases developed (Step 2) • Number of enterprises supported in developing relevant infrastructures, data sharing tools, architecture and governance mechanisms (Step 2) • Completion rate of steps against the foreseen timetable/ implementation timeline (1,2,3) • Supervisor report and feedback (based on follow-up surveys)
5.4: Green Industry 4.0 initiative	<ul style="list-style-type: none"> • Number (or percent (%)) of new EU sustainable product policies and legislative initiatives adopted • Number of targeted inspections/market surveillance actions • Supervisor report and feedback (based on follow-up surveys)

Pillar 6 Initiative	Proposed KPIs
6.1: Accelerated depreciation scheme	<ul style="list-style-type: none"> • Number of beneficiaries/ applicants for the scheme against the number of successful applications that resulted in financial/ funding support • Average amount invested in i4.0 technologies per company • Overall amount invested in i4.0 technologies by all companies • Beneficiary satisfaction (enterprises) • Supervisor report and feedback

	<ul style="list-style-type: none"> Overall amount invested in initiative and funding absorption/ utilisation rate by participating enterprises against the budgeted amount/investment
<p>6.2: Acceleration of investments (funding scheme) for Industry 4.0 startups</p>	<ul style="list-style-type: none"> Number of beneficiaries/ applicants (startups) for the scheme against the number of successful applications that resulted in financial/ funding support Average funding amount received by startups Overall amount of funding received by startups Beneficiary satisfaction (startups) (based on follow-up surveys) Supervisor report and feedback (based on follow-up surveys) Overall amount invested in initiative and funding absorption/ utilisation rate by participating enterprises against the budgeted amount/investment
<p>6.3: Acceleration of investments (funding scheme) for Industry 4.0 SMEs & Mid-Caps</p>	<ul style="list-style-type: none"> Number of beneficiaries/ applicants (SMEs/ mid-caps) for the scheme against the number of successful applications that resulted in financial/ funding support Average funding amount received by enterprises Overall amount of funding received by enterprises Beneficiary satisfaction (based on follow-up surveys) Supervisor report and feedback (based on follow-up surveys) Overall amount invested in initiative and funding absorption/ utilisation rate by participating enterprises against the budgeted amount/investment
<p>6.4: Acceleration of investments (funding scheme) for large scale industrial enterprises to become “game changers” for the Greek industry</p>	<ul style="list-style-type: none"> Number of beneficiaries/ applicants (large scale industrial enterprises) for the scheme against the number of successful applications that resulted in financial/ funding support Number of successful collaborations/ partnerships pursued through the funding scheme Number of successfully submitted digital transformation plans against the desired/ foreseen number of digital transformation plans Beneficiary satisfaction (large scale enterprises) (based on follow-up surveys) Supervisor report and feedback (based on follow-up surveys) Overall amount invested in initiative and funding absorption/ utilisation rate by participating enterprises against the budgeted amount/investment
<p>6.5: Introduce "Sector-deals" with regards to Industry 4.0 applications for companies that are part of specific Industry sectors</p>	<ul style="list-style-type: none"> Number of beneficiary SMEs, scaleups and Mid-Caps Average amount of funding received by enterprises Overall amount of funding received by enterprises Beneficiary satisfaction (based on follow-up surveys) Supervisor report and feedback (based on follow-up surveys) Overall amount invested in initiative and funding absorption/ utilisation rate by participating enterprises against the budgeted amount/investment
<p>6.6: Standardisation Vouchers for enterprises of the Greek Industry</p>	<ul style="list-style-type: none"> Number of standardisation vouchers granted/Number of initiatives beneficiaries against desired/ foreseen beneficiaries Number of beneficiaries further investing (including size of investment) in standardisation after receiving standardisation voucher

	<ul style="list-style-type: none"> • Beneficiary satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative and funding absorption/ utilisation rate by participating enterprises against the budgeted amount/investment
--	--

4.2.3 KPIs focused on the three (3) High Priority cases

High Priority Case 1 Initiative	Proposed KPIs
<p>7.1: Design a training curriculum and an online digital platform for the reskilling & up-skilling of the Greek Manufacturing SMEs and midcaps on Smart Manufacturing Technologies</p>	<ul style="list-style-type: none"> • Number of Smart Manufacturing modules/programmes introduced • Digital Platform metrics related to awareness, engagement and conversion • Number of certifications awarded against the foreseen number of certifications • Number of times learning material was updated throughout the courses’ lifetime • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time • Number of businesses and employees accredited throughout the reskilling and upskilling programme against set target of accreditations • Number of follow-up assessments undertaken by industrial employees against set number of assessments • Assessment average scoring against target score
<p>7.2: Support the Setup of a Smart Manufacturing Competence Center</p>	<ul style="list-style-type: none"> • Number of visits to the Competence Center by interested participants and range of services sought after the most • Number of Competence centre-hosted events (workshops, seminars, courses) against foreseen/desired number of events • Number of i4.0 projects supported against foreseen/desired number of projects • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>7.3: Introduce a Smart Manufacturing Challenge Programme to develop innovative solutions for a modern, more productive, environmentally sustainable Greek Manufacturing</p>	<ul style="list-style-type: none"> • Number of Smart Manufacturing industrial challenges defined and successfully completed (per field of focus) • Number of calls for tender published and number of applicants/ participants per tender • Overall number of participations and number of participants per initiative against set targets • Number of challenge specific solutions developed against foreseen/desired number of solutions and challenges • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time

<p>7.4: Set up a Smart Manufacturing Industrial Park</p>	<ul style="list-style-type: none"> • Number of memberships established against desired/ planned memberships at that specific point in time (industrial enterprises, academic institutions, research institutions) • Number of collaborative R&D projects implemented/Number of collaborative R&D solutions developed against desired/ set targets • Number of events/conferences/workshop/incubation sessions held • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>7.5: Smart Manufacturing Technologies within the Greek Industry 4.0 Standardisation Framework</p>	<ul style="list-style-type: none"> • Similar KPIs to initiative 4.2, applied to Additive Manufacturing, Big Data Analytics, Machine to Machine (M2M) and 5G • Number of focus groups/interviews/surveys to infer the as-is state of play (Step 1) • Number of industrial enterprises participating in focus groups/interviews/surveys (Step 1) • Number of collaborations established with technical experts/standardisation organizations (Step 2) • Number of short-term and mid-term targets established (Step 3) • Completion rate of steps (1,2,3) against planned completion rate • Number of accredited companies (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>7.6: Enhancement of the Patents’ Framework with regard to Smart Manufacturing Technologies</p>	<ul style="list-style-type: none"> • Number of Patent Pools established against set target of patent pools • Number of Standard Essential Patents (SEPs) established against set target of SEPs • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time

High Priority Case 2 Initiative	Proposed KPIs
<p>8.1: Develop a dedicated Industry 4.0 reskilling curriculum & certification programme for the Greek “Structural Materials” Workforce</p>	<ul style="list-style-type: none"> • Number of certifications awarded to trainees • Number of training sessions held against set target of trainings • Graduation rate of participants • Student satisfaction (based on follow-up surveys) • Number of related modules introduced or percent (%) of EU member state’s curriculum from similar programme covered • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>8.2: Develop a “Structural Materials apprenticeship” programme for STEM</p>	<ul style="list-style-type: none"> • Number of applications against desired number of applications • Number of “matches” made • Number of apprenticeship slots provided

<p>graduates & deploy a “matchmaking” platform</p>	<ul style="list-style-type: none"> • Number of matchmakings achieved against set targets for the matchmaking • Number of reports uploaded to the matchmaking platform, against set target of reports • Enhancement/ corrective actions taken to enhance the apprenticeships’ programme based on the feedback received from the reports • Enterprise satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>8.3: Support the setup of a Structural Materials Test lab</p>	<ul style="list-style-type: none"> • Number of visits to the Test lab by interested participants and range of services sought after the most • Number of projects supported and successfully concluded against set targets • Number of technical/business solutions developed • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>8.4: Introduce a “Structural Materials” Sector Deal</p>	<ul style="list-style-type: none"> • Number of beneficiary SMEs, scaleups and Mid-Caps supported throughout the sector deal scheme, against the set target of beneficiaries • Average amount of funding received by enterprises against set targets • Overall amount of funding received by enterprises against total set targets • Beneficiary satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative and funding absorption/ utilisation rate by participating enterprises against the budgeted amount/investment

<p>High Priority Case 3 Initiative</p>	<p>Proposed KPIs</p>
<p>9.1: Develop an online reskilling & up-skilling programme on Circular Economy & Industry 4.0 enabling technologies</p>	<ul style="list-style-type: none"> • Number of related modules introduced or percent (%) of EU member state’s curriculum from similar programme covered • Number of certifications awarded to trainees against set graduation targets • Number of training sessions held against planned/ desired trainings • Graduation rate of participants • Digital Platform metrics related to awareness, engagement and conversion • Student satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time

<p>9.2: Support the Setup of an Industrial Symbiosis Competence Center</p>	<ul style="list-style-type: none"> • Number of visits to the Competence Center by interested participants and range of services sought after the most • Number of Competence center-hosted events (workshops, seminars, courses) against set targets of planned events • Number of i4.0 projects successfully supported • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time • Number of memberships against desired number of memberships • Quantity of secondary raw materials sold/bought against set targets • Engagement with Marketplace website (Website engagement metrics) • User/member satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>9.3: Introduce a Green Innovation Challenge Fund to enhance innovation and collaboration for Green Economy & Industrial Symbiosis</p>	<ul style="list-style-type: none"> • Number of grants issued and absorption/ utilisation rate by industrial enterprises • Number of challenge specific i4.0 solutions developed against set targets • Participant satisfaction (based on follow-up surveys) • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative against the budgeted investment at that specific point in time
<p>9.4: Support the setup of an Industrial Symbiosis Eco-Industrial Park</p>	<ul style="list-style-type: none"> • Number of enterprises participating/relocating • Number of local collaborative partnerships established • Industrial Symbiosis metrics such as Increase/ Decrease in Total Air (GHG) emissions and Increase/ Decrease in Total water Consumption per partnership or per enterprises • Supervisor report and feedback (based on follow-up surveys) • Overall amount invested in initiative (based on follow-up surveys)
<p>9.5: Develop the national standards for the Circular Economy and Industry</p>	<ul style="list-style-type: none"> • Number of relevant European/international standards introduced • Number of industrial enterprises that have adopted newly introduced European/international standards against set targets at that specific point in time • Number of standardisation collaborations established with EU member states • Supervisor report and feedback (based on follow-up surveys)
<p>9.6: Regulatory reforms for a Circular Economy and Industry</p>	<ul style="list-style-type: none"> • Number of relevant regulatory changes/reforms made • Completion rate (Actions 1,2,3,4) against scheduled completion • Supervisor report and feedback (based on follow-up surveys)
<p>9.7: Financial incentives to promote the Circular Economy and Industry</p>	<ul style="list-style-type: none"> • Number of grants issued and absorption/ utilisation rate by participating enterprises against the budgeted amount/investment • Number of financial loans with preferential interests/ significant grace period provided and absorption/ utilisation rate by participating enterprises against the budgeted amount/investment • Average amount of loans per beneficiary

	<ul style="list-style-type: none">• Number of companies assisted with regard to “Circular transformation vision” plans against set targets• Number of companies assisted with regard to incremental circular improvements against set targets• Supervisor report and feedback (based on follow-up surveys)• Overall amount invested in initiative against the budgeted investment at that specific point in time
--	---

4.3 Recommendations concerning the timeline, process and methodology for the review, evaluation and update of strategy on tactical intervals

The effective operationalization of the national Industry 4.0 Strategy requires the continuous monitoring and evaluation of its Operational plan's implementation. In more detail, the introduction of a monitoring and evaluation framework for the implementation of Industry 4.0 strategy shall:

- **inform** about what the Industry 4.0 strategy has achieved thus far and whether implementation is on track and shall make this information available to decision makers.
- **clarify** the logic of intervention of the Industry 4.0 strategy and make it comprehensible to the broader public.
- **support** the constructive involvement and participation of Industry 4.0 stakeholders through transparent communication and promote trust building.

As such, the monitoring and evaluation framework for Industry 4.0 strategy shall include three different sets of activities:

- **Monitoring activities:** Activities focused on the monitoring the progress of the implementation of the Industry 4.0 initiatives (as these have been defined within the Operational Plan in Deliverable 3), will highlight critical activities, milestones and interdependencies amongst the initiatives and will surface potential risks and issues that need to be addressed, to ensure the on-time and on-budget completion of Industry 4.0 initiatives
- **Evaluation activities:** Activities focused on the evaluation of the outcome and impact stemming from the implementation of an Industry 4.0 initiative/ strategic pillar. In more detail, evaluation activities aim to ascertain results (output, outcome, impact) and assess the effectiveness, efficiency, relevance and sustainability of a specific intervention, provide findings, conclusions and recommendations with respect to a specific intervention in order to draw lessons for future design and implementation.
- **Updating activities:** Activities focused on updating the actual content of the Industry 4.0 strategy and on adding new initiatives within the Industry 4.0 Operational plan.

Below we analyse in more detail, the activities included under the monitoring and evaluation framework and we suggest a relevant timeline and approach for each set of activities included.

4.3.1 Recommendations for the monitoring of Industry 4.0 Strategy's implementation progress

The introduction of a monitoring mechanism will ensure that the implementation progress of the Industry 4.0 Operational plan is closely managed and supervised on two levels:

- Vertically, within each Strategic pillar (i.e. Pillar 1: Digital Skills & Human Capital Qualifications, Pillar 2: Innovation & startups in the Digital Age, etc.). This aims at monitoring in greater detail the progress of interventions described across each strategic pillar of the Operational Plan.
- Horizontally, across all pillars to ensure the alignment of cross-pillar initiatives and to provide an overall monitor of the end-to-end implementation of the Operational Plan.

The operationalization of these two levels will be accomplished in different timelines.

4.3.1.1 Vertical Monitoring of Strategic Pillars

The Industry 4.0 Implementation Body (as described under the Governance Model), shall be responsible for developing a detailed action plan and closely monitor the implementation of I4.0 initiatives and actions in their area of focus (strategic pillar). As such, the Implementation Body is suggested to prepare a progress report for the initiatives included in the strategic pillar of their focus every month.

The progress report will indicatively include the following pieces of information:

- Executive Summary for the entire Strategic Pillar X that shall include:
 - Overall Progress Status & Percentage of Completion (%)
 - A brief summary of the overall progress achieved in Strategic Pillar X
 - Key milestones achieved with regards to Strategic Pillar X
 - Key milestones in delay with regards to Strategic Pillar X
 - Key risks/ issues and respective mitigation actions identified
 - Next steps/ actions to be implemented within the next period
- Detailed Analysis of progress per initiative for Strategic Pillar X
 - Key milestones achieved with regards to each initiative
 - Key milestones in delay with regards to each initiative
 - Key risks/ issues and respective mitigation actions identified per initiative
 - Next steps/ actions to be implemented in the next period per initiative

This report shall be prepared every month by the Industry 4.0 Implementation Body that will be responsible for all initiatives and submitted for review and discussion to the Implementation Body leaders. An alignment meeting with the Implementation Body stakeholders shall take place upon the publication of the progress report, chaired by the Head Transformation Officer, where an update on the overall progress of the initiatives will be discussed, the key risks and issues regarding the delivery of initiatives will be identified and relevant mitigation actions will be agreed upon.

4.3.1.2 Horizontal Monitoring across all Industry 4.0 strategic pillars

On top of the vertical alignment and monitoring within the Industry 4.0 Implementation Body, a horizontal monitoring shall be undertaken to ensure the efficient and successful progress of the implementation for the end-to-end Industry 4.0 Operational Plan (including the High Priority Cases and other relevant digital transformation initiatives). The end-to-end monitoring of the Operational Plan shall be performed by the Industry 4.0 Transformation Committee that will be responsible to establish the appropriate collaborative structures and mechanisms for the implementation of the i4.0 initiatives and liaise with and coordinate the work of the different actors within the Industry 4.0 implementation body.

To achieve the horizontal monitoring, it is suggested that the Industry 4.0 Transformation Committee establishes a rigorous process that shall run every two months and will ensure the monitoring of the implementation of the Industry 4.0 Operational plan throughout its entire lifecycle (initiating, planning, executing, closing). In more detail, during this process:

- The Industry 4.0 Implementation Body consolidate the group's data with regards to the progress of their work, prepare the relevant status reports and highlight the risks, issues and corrective actions for the next level of review.

- The Industry 4.0 Transformation Committee should define and maintain performance metrics, create a consolidated dashboard for all initiatives and communicate this to the Industry 4.0 Head Transformation Officer.
- The Industry 4.0 Head Transformation Officer should review a consolidated dashboard using all provided Status Reports. This report should address information required for initiatives' management.
- The Industry 4.0 Head Transformation Officer will perform an alignment meeting with Implementation Body's leaders to discuss overall progress, identify potential risks and issues and potentially escalate unsolved issues to the Industry 4.0 Steering Committee.
- A steering committee meeting can take place every six months, where the Government Industry Committee shall oversee the overall progress of the implementation of the Industry 4.0 Operational Plan against strategic objectives, shall monitor value realization and shall address overarching challenges and resolve issues escalated from the Industry 4.0 Head Transformation Officer.
- Finally, once per year the Industry 4.0 Head Transformation Officer, supported by the Transformation Committee shall submit to the Steering Committee an Industry 4.0 Strategy progress report. This report shall incorporate the overall progress of the Industry 4.0 Operational plan, the status of key initiatives, milestones achieved thus far, as well as clarify potential causes for delays in initiatives' implementation. An executive summary of this annual report could also be published to the wider public through the Industry 4.0 platform to ensure transparency on the Industry 4.0 implementation progress.

4.3.1.3 Enablers for Monitoring Activities

The Monitoring process requires the design and implementation of a set of enablers, in order to ensure its effective operationalization. Namely:

- **IT System for the effective monitoring of the Industry 4.0 Operational plan:** The monitoring of all initiatives included in the Industry 4.0 Operational plan shall be facilitated by the design and set up of a dedicated IT platform. This platform shall enable the Industry 4.0 Transformation Committee and the Industry 4.0 Implementation Body to:
 - Insert the agreed initiatives in the platform and capture the planned timeline, critical milestones and key activities for their implementation
 - Time track the initiatives inserted and monitor their percentage of completion
 - Highlight the critical path per initiative, identify and closely monitor initiatives' milestones and dependencies
 - Produce progress update reports
 - Monitor process and progress indicators per initiative incorporated
- **Monitoring Processes:** It is suggested that both the horizontal and vertical monitoring activities shall be accompanied by detailed processes that will define the key activities to be undertaken, the timeframe in which these activities shall be undertaken and the roles that shall undertake these activities. An indicative process has been presented above.
- **Reporting:** The report templates that shall be used for the monitoring of each strategic pillar as well as for the end-to-end monitoring of the Industry 4.0 Operational plan shall be designed and commonly agreed by the involved stakeholders. It should be noted that the report templates shall also be accompanied by a glossary of terms and by a set of guidelines that will support the users

during the reporting process. Special emphasis shall be placed on the design of the annual progress report that will be published to the wider public, in terms of the information to be presented and its level of analysis. The annual report shall be concise but at the same time include all major achievements and provide a transparency to the wider public on the progress of the Industry 4.0 strategy's implementation.

4.3.2 Recommendations for the evaluation of the Industry 4.0 Strategy

While monitoring activities capture if the strategy is actually doing what it was set out to do according to the planned logic of the defined interventions and initiatives, evaluation activities provide an ex-post validation of the intervention logic by assessing how and why the implemented initiatives have actually had the desired effects. Monitoring does not substitute for evaluation; it rather complements it.

In fact, one of the main reasons for the failure of different strategies throughout the years has been the lack of connection between their identified initiatives and interventions and a set of performance monitoring indicators, as well as the lack of measurable targets per indicator. Given the above, the implementation of the proposed Industry 4.0 Strategy shall be accompanied by the introduction of an evaluation and performance management system, which will link the Industry 4.0 strategic pillars and their respective initiatives with a set of indicators and which will set measurable targets per indicator during the initiation of Industry 4.0 Operational plan's implementation.

A selection of suggested performance indicators per Industry 4.0 initiative and for the strategy as a whole have been presented in detail in paragraph 4.2. This section will focus on the process and timing for designing and updating the relevant performance dashboard in order to evaluate the outcome and impact of the implemented Industry 4.0 initiatives.

This performance dashboard shall be used as the key communication tool that shall distil the logic behind the Industry 4.0 interventions and make their outcome comprehensible to the upper echelons of the Government and to the broader public. The first performance dashboard shall be produced at the end of the second year of implementation of the Industry 4.0 Strategy by the Industry 4.0 Transformation Committee. To achieve this, the following activities shall be performed:

4.3.2.1 *Setup of the Industry 4.0 evaluation mechanism*

The evaluation of the Industry 4.0 strategy shall be performed through the setup of an evaluation mechanism that will provide the necessary guidelines for the performance of the Industry 4.0 Strategy evaluation. The evaluation mechanism will include the following sub-areas:

Set up of the logical framework for the evaluation and select the relevant performance indicators

The first step in setting up the evaluation mechanism is the definition of the logical framework for the evaluation and select the appropriate indicators. The performance dashboard presented above shall be used as the baseline for this. The logical framework of the evaluation shall help the stakeholders to scope the evaluation. In fact, stakeholders shall take the time to understand the interventions implemented and identify the questions that need to be answered. The set of indicators that can be used to answer these questions will result in an evaluation that is more likely to be of genuine use.

There are many mapping tools that can be used to help explore the intervention and how it is expected to work, often described as the ‘programme theory’. One commonly used is the “logical framework”.

As a methodology, the “logical framework” is a systematic, visual approach to designing, executing and assessing interventions which encourages users to consider the relationships between available resources, planned activities, and desired changes or results. At its core it presents the logical flow of causal outcomes between achievement of an initiative’s activity targets, and the delivery of intended results. “Logical Frameworks”, to this end, enable planners to establish a hierarchy of objective or result statements – i.e. a development pathway – which articulate their best understanding of how change can be achieved.

At minimum, four central categories, arranged horizontally by column, or vertically by rows, contain information on the **initiative’s Goal, Purpose, Activities, and Output**.

- **Goal:** Here, an overall initiative goal - the broader issue (i.e. at the national or sectoral level) that the initiative seeks to contribute to- is defined. (i.e. “Digitally upskill and reskill the human workforce in the Greek industry “)
- **Purpose:** The initiative’s central purpose or outcome - a localised result that the intervention seeks to achieve in support of the above goal – is next identified. This statement should clarify what will be changed, and who will benefit (i.e.: “Enhance the digital skills of existing industrial workforce with an emphasis on the Smart Manufacturing Technologies”)
- **Project outputs:** Listed here are those observable, measurable change, and tangible products/services to be delivered by the initiative, which serve to achieve the above goal and purpose. (i.e.: “Demonstrably increased number of industrial employees that have enrolled and attended the Industry 4.0 upskilling certification programmes in 2021”)
- **Activities:** Finally, supporting activities - the main tasks that need to be completed in order for the output to be achieved – are defined. (i.e. “Government to design and launch a dedicated Industry 4.0 reskilling programme, in collaboration with Industry Federations, academia and private sector stakeholders to digitally upskill & reskill the existing workforce of the Greek Industry (with specific emphasis given to Greek SMEs)”.)

Each of these central components are, in turn, accompanied by at least four rows (if arranged vertically) or columns (if horizontally) displaying the following supporting information:

- A **Narrative Summary** describing the event.
- **Indicators** which will be measured to indicate if the events taking place have been achieved – these can be sourced by the performance dashboard indicated above
- **Means of Verification** (or “verification sources”) – the location of those sources of data required of the above indicators.
- A list of **critical risks and Assumptions** (“hypotheses”) – those external factors which the evaluators believe may positively or negatively influence the events described by the narrative summary, including any external phenomena beyond the project/programme manager’s control. Only those concerns or anticipated opportunities which can actually be substantiated should be included.
- Additionally, **baseline date, measurable milestones** in the progress of an event, and/or **target year/date/ value** are also commonly included.

More specifically, the performance target values shall define the desired level of performance to be achieved within a specified time frame for each indicator. The following points shall be taken into consideration during the decision of the performance target values:

- **Baseline Values:** When applicable, setting target values requires identifying the current condition, that is baseline information against which success can be tracked. This way, it is possible to establish a baseline value or starting point, based on which the desired level of improvement can be measured. It is important that baseline values are clearly defined and understood. For example, if we were aiming to implement a strategic initiative meant to, among others, increase the number of patents issued per year, it would be advisable to identify the number of patents issued in previous years. The baseline value could be the number of patents issued last year or the average number of patents issued in the last three years, based on which a realistic target value can be set for the future.
- **Available Funding and Resource levels:** The availability of funding and resources allocated to each strategic initiative (i.e. financial, human or physical resources) for a specified time period consists a crucial factor for setting realistic and achievable performance target values. It is also worth noting that availability of funding and resources may change overtime and thus it is important to monitor change in order to identify whether adjustments to the target values should be made.
- **Political Concerns:** It is important to acknowledge that setting performance target values is part of the political process and, therefore success or failure in meeting these targets is associated with a set of potential political ramifications. For this reason, careful consideration should be placed in setting target values, to ensure they are achievable and realistic. Furthermore, performance target values could be stated as a range instead of a single numerical value to ensure they are not too firm. At the same time, it is counterproductive to set target values that are too modest and easy to achieve, in order to rule out the possibility of failure.

Upon the definition of the logical framework and the respective indicators, the stakeholders shall focus on the primary data collection, data access and data linking.

Data collection, data access and data storage

The indicators suggested and agreed upon through the “logical framework” will consist the information unit of focus for evaluation analyses performed by the Industry 4.0 Transformation Committee. To achieve this, the next important step in the evaluation mechanism is to define the primary data required, design the data collection process and assess who can provide the primary data as well as potential data access constraints in place.

In fact, data collection is an essential component of any evaluation and needs to be planned in advance. It is important to note that baseline data – data collected before the intervention – will need to be collected early. Without appropriate planning of data collection or data access an evaluation may be impossible, severely limited, or unnecessarily expensive. If the data collection is poorly designed, this may result in inaccurate data being collected and false inferences being drawn from the evaluation.

The first part of this step aims to identify what primary data is required to be collected. To achieve this the following question shall be answered:

- What type of data will be required to calculate each identified indicator?
- Who or what can provide the data?
- Are there any issues with accessing or collecting the data? (i.e. data sensitivities, availability of necessary samples, etc.)
- What section of the population of interest should data be collected from?

With regards to the type of data that could be collected for the evaluation, the following primary data could be considered:

- Stakeholder perceptions/attitudes towards the intervention/behavioral change
- Financial data relating to the initiative’s expenditure
- Process data to assess whether the intervention has been implemented as intended
- Data to track the outcomes and impact of an intervention

With regards to the data sources, these could be:

- **Third party sources of processed data:** These are Public Authorities and other organizations which calculate and monitor specific indicators or primary data that can be directly transferrable for the Industry 4.0 Transformation Committee’s purposes without any additional processing. These can be combined with the Committee’s own processing for reporting purposes but also to allow the Committee’s to act as a centralized data repository which can contribute to the resolution of the currently fragmented Industry 4.0 related data environment.
- **Primary data sources:** These can be Public Authorities and other organizations that collect primary data directly from organizations such as tax authorities or the commercial registry. These organizations are expected to provide unprocessed data in a predefined format and in specific intervals as defined by the corresponding data definitions.

To start with and in order to avoid unnecessary complexities, the Industry 4.0 Transformation Committee is suggested to primarily select for the evaluation of the Industry 4.0 Strategy 3rd party indicators that are collected and calculated by worldwide organizations, such as the Eurostat, the World Bank and the OECD. At the same time, it can also start defining additional indicators, whose calculation nevertheless will require

data to be collected and monitored by the stakeholders responsible for implementing the Industry 4.0 initiatives.

Moving forward, the Industry 4.0 Transformation Committee shall also define:

- **Who will have responsibility for gathering the primary data** – It is suggested that the Industry 4.0 Transformation Committee shall create a taskforce that will be responsible for running the end-to-end evaluation mechanism; that is from the collection, consolidation and cleansing of the primary data, the calculation of the respective indicators, their respective interpretation, to the production of the final evaluation reports.
- **When will the data be gathered** – The Industry 4.0 Transformation Committee shall identify how often primary data should be gathered. This could be done on a quarterly basis, in order for the taskforce to collect enough data points for the indicators that they shall monitor, before the first evaluation report is prepared (it is suggested that this will take place by the end of the second year of the Industry 4.0 Strategy implementation).
- **How will the data be gathered and stored** – Another topic that should be defined by the Industry 4.0 Transformation Committee is the format that the primary data to be collected should have, as well as the IT system in which this shall be stored. In order to avoid multiple, offline “versions of truth” (i.e. excel-based spreadsheets) a Data Warehouse shall be designed and implemented. The Data Warehouse will collect, aggregate and cleanse the primary data required for the calculation of the identified indicators. In addition, data protection protocols need to be identified, in order to meet security and data sharing requirements. Likewise, ethical considerations with regards to primary data collection need to be taken into account (i.e. informed consent, GDPR, etc.).

4.3.2.2 Production of the Industry 4.0 Performance Dashboard

At the end of the 2nd year the first Industry 4.0 performance dashboard is suggested to be published. The performance dashboard shall visually depict the impact identified on the selected indicators and their progress achieved between the baseline year and the current year of reference.

The Industry 4.0 dashboard shall offer a bird’s eye view of the end-to-end Industry 4.0 strategy performance (through the monitoring and displaying of the impact indicators defined per strategic pillar). At the same time, it shall drill down to the performance of detailed initiatives through the monitoring of their respective indicators. The Industry 4.0 performance dashboard could be incorporated in the Industry 4.0 platform, the main digital platform suggested to be developed to support the coordination and implementation of the Industry 4.0 strategy.

To produce the Industry 4.0 performance dashboard, the following steps shall be undertaken:

- The evaluation “taskforce” within the Industry 4.0 Transformation Committee shall as a first step consolidate the required primary data. If the respective IT system (i.e. Data Warehouse) is in place, this will be a fairly straight-forward task, since all the data collection, aggregation and cleansing procedures shall have been established during the previous step, the “setup of the Industry 4.0 evaluation mechanism”.
- Having collected the primary data, the evaluation “taskforce” shall review the consolidated data, calculate the associated indicators, validate them and check for potential data discrepancies,

inconsistencies, etc. The captured indicators should define how data should be validated and how related values should be calculated. The evaluation “taskforce” should document and assign activities necessary to correct any identified, inaccurate data.

- Upon the correction and validation of all primary data and the respective calculated indicators, the evaluation “taskforce” shall produce the respective performance dashboard and shall perform a qualitative evaluation of the Industry 4.0 Strategy impact recorded thus far. The qualitative evaluation shall be recorded on an accompanying memo. The memo and the performance dashboard shall be then provided to the Head Transformation officer for their review.
- The Head Transformation officer, with the assistance of the evaluation “taskforce”, shall be responsible for overseeing the overall impact of the Industry 4.0 Strategy implementation. As such, the Head Transformation officer should review the consolidated performance dashboard, as well as the accompanying memo to understand what has been achieved thus far, how this is depicted to the selected indicators and ensure the quality of the analysis and the correct interpretation of the evidence. The Head Transformation officer supported by the evaluation “taskforce” shall also ensure that the evaluation meets its objectives and responds appropriately to emerging issues.
- Finally, the performance dashboard shall be communicated and presented to the Government Industry Committee (Steering Committee) for final review and discussion of key achievements or changing conditions that may lead to a divergence for the projected indicators’ values.
- After the completion of all the above steps, a simplified and user-friendly version of this performance dashboard shall also be published to the wider public.

4.3.2.3 *Enablers for Evaluation Activities*

The evaluation mechanism requires the design and implementation of a set of enablers, in order to ensure its effective operationalization. Namely:

- **IT System for the effective evaluation of the Industry 4.0 Operational plan:** As already explained, data can be stored in many different formats, such as in a database, dataset, spread sheet or data warehouse. In order to ensure the data consolidation on a central point, that will also ensure the appropriate data access to involved stakeholders – those able to read, write, store and change data – the design and setup of a data warehouse has been suggested. This data warehouse shall be interconnected with the monitoring IT system (as described in a previous paragraph), in order to link the selected indicators with the relevant Industry 4.0 initiatives and strategic pillars. At the same time, this data warehouse shall be connected with the reporting tool that will be implemented for the design and production of interactive evaluation reports, as this will source the information that will be depicted in the latter.
- **Data Governance Processes:** It is suggested that the setup of the industry 4.0 evaluation mechanism shall be accompanied by detailed data governance processes that will define clear data ownership and stewardship and will introduce structured data policies, with regards to how the Industry 4.0 Transformation Committee will define the specific criteria behind data definition, creation, usage and if required storage.
- **Reporting Tool:** Finally, focus shall be given on the tool to be selected for the design and production of the interactive evaluation reports. It is important to mention that there is no tool that can do everything. Some tools specialise on visualisation, others come with a large number of

functions and there are others that will be the "work horse" for evaluation analyses. The final selection of the reporting tool shall also take into account the set of end-users of each tool (i.e. different tools will be proposed for statisticians and for businesspeople).

4.3.3 Recommendations for the update of Industry 4.0 Strategy

The Industry 4.0 Strategy shall not consist a static but rather a dynamic document that will provide a robust strategic vision but at the same time will remain flexible to reflect potential changes in political priorities and Industry developments. To ensure this flexibility, we propose the introduction of an annual review and update of the Industry 4.0 Operational Plan (through its enrichment with new initiatives), while a comprehensive revision of the Industry 4.0 vision and its strategic goals may occur every four years or so, or when special circumstances dictate so.

The annual update process of the i4.0 Operational plan could indicatively include the following steps:

- At a specific time interval, identified and indicated by the Industry 4.0 Transformation Committee, members of the Industry 4.0 Implementation body will be eligible to submit new proposals for the introduction of additional initiatives or the substitution of existing with new ones. The initiatives submitted shall incorporate the following information:

Topic	Brief explanation
Title of the initiative	Refers to the name of the initiative, capturing the essence of its content.
Pillar	Refers to the execution pillar of the proposed Industry 4.0 Strategy the initiative belongs in.
Link with strategic goals	Reflects how each respective initiative is linked directly linked with one or more strategic goals as proposed in the lines of the Industry 4.0 strategy. It can also incorporate an ex-ante evaluation of the impact that this initiative will be expected to have on the Greek Industry & economy.
Description of the initiative	Provides the rationale behind the need for each initiative within each priority case, presenting the link between the "As-is" study and the proposed Industry 4.0 strategy. It also provides more specific details with regards to the focus of the initiative, elaborating on how it should be implemented within the Industrial ecosystem.
Stakeholders	Presents the key stakeholders involved with regards to the design as well as the implementation of the respective initiative.
Key beneficiaries (Target group)	Refers to the Group of individuals/ firms/ entities or other parties of the Greek industrial ecosystem that will ultimately benefit from the implementation of the respective initiative.
Potential funding sources	Refers to the sources the initiative can draw funding from (national or European sources) in order to be implemented.

Indicative Budget	Refers to an indicative budgeting range (regarding the initiatives such a budget is applicable for) covering their funding needs within the Operational plan’s period.
Dependencies with other initiatives	Reflects how each respective initiative is linked/ interrelated with other initiatives within the same or the rest of the priority cases and execution pillars of the Operational plan
Timeline of implementation	Refers to the timing of implementation for each respective initiative, seeking to place it within a discrete period of the Operational plan, categorising it as “Immediate” (1-2 years) – “short-medium term”(2-5 years) or “mid-long term”(5-7 years). It refers to amount of time required for its design and implementation.
Feasibility and Necessity of the initiative	Refers to the scoring of the respective initiative, after the meetings conducted with stakeholders for the development of the Operational Plan. The scoring examines the “feasibility” of the initiative, indicating the degree of readiness to implement it as well as the “necessity” of the initiative, indicating the need for the initiative within the Greek industrial ecosystem.

- The Industry 4.0 Implementation Body shall consolidate all propositions and perform an initial screening in order to keep a specific number of those (as per the Industry 4.0 Transformation Committee’s guidelines), that will be promoted to the next round.
- The Industry 4.0 Transformation Committee shall consolidate all proposals from all members of the i4.0 Implementation body and shall implement a prioritization process for the initiatives’ evaluation. The prioritization process shall be transparent and shall introduce clear and commonly agreed criteria for the initiatives’ ordering. Indicative criteria could be:
 - The expected feasibility and necessity of the initiative, as this will be indicated in the initiative’s description.
 - The expected impact (if possible, to measure) from the implementation of the suggested initiative.
 - The political priority that the Industry 4.0 Governance Structure places to each specific Industry 4.0 strategic pillar (this dimension can support the prioritization amongst initiatives of different pillars)
- In addition, in a case of substitution of an initiative, a thorough justification shall be provided on the reasons on why this has happened and why the substitute initiative consists a better alternative for achieving the same strategic goal.
- Upon the finalization of the list with the new initiatives to be incorporated in the revamped Operational plan, this list together with the accompanied justification shall be provided to the Steering Committee for their final review, comments and approval. A dedicated Steering Committee meeting shall be organized for this.

5 Methodological approach for the implementation of other Priority cases within the Greek Industrial ecosystem

5.1 Introduction

Deliverable 3 presented exhaustively the detailed Operational plan for the proposed Greek Industry 4.0 vision and strategy. The Operational plan incorporated a set of horizontal initiatives, organized under six discrete pillars that aims to act as the implementation vehicle for the Industry 4.0 strategy, setting out the initiatives and priorities within the Industrial ecosystem of Greece, the will be implemented through the collaboration of key stakeholders from the Greek Public and Private sector, research institutions, academia and other relevant stakeholders.

Moreover, Deliverable 3 included the analysis and a set of proposed targeted interventions for three “High priority cases”; that is three Industry 4.0-related focus areas, of higher importance for the Greek Industry and Manufacturing. These priority cases were the outcome of an analysis performed by the Contractor’s team, through the use of multiple qualitative and quantitative criteria. The final selection of the three most important cases was made by the General Secretariat for Industry, based on the cases’ political sensitivity and importance. The three High Priority Cases, were the following:

- **High Priority Case 1:** Smart Manufacturing Technologies
- **High Priority Case 2:** The Structural Materials Value Chain
- **High Priority Case 3:** The Circular Economy

As the Industry 4.0 strategy and its operational plan consist a dynamic document that shall be continuously monitored, evaluated and enriched with new initiatives, the selection of High priority cases is likely to also change in the years to come. As such, we present below a high-level methodological guide that could be used by the Industry 4.0 stakeholders to select and implement additional high priority cases, that have not been selected in this first version of the Industry 4.0 strategy.

The methodological approach will consist of a set of steps that will guide the stakeholder from selection of the appropriate focus areas to the way they shall identify the targeted interventions to be suggested under each focus area selected. In more detail, the following steps shall be undertaken:

- **Step 1:** Identify potential groups/ clusters, from where priority cases could be elicited
- **Step 2:** Apply a set of qualitative and quantitative criteria to surface the most important cases within each group
- **Step 3:** Perform an As-Is analysis for the selected priority cases
- **Step 4:** Consolidate and review international leading practices for the selected priority cases
- **Step 5:** Design a set of interventions for each selected priority case

5.1.1 Step 1: Identify potential groups/ clusters, from where priority cases could be elicited

First step in our methodology consists the identification and selection of potential groups/ clusters that the stakeholders aim to further focus on, in order to elicit priority cases. These groups can significantly differ according to political priorities and different areas that the Industry 4.0 stakeholders would like to explore in greater detail. Indicative clusters, also selected and analysed by different countries are presented below:

5.1.1.1 Group of organizations

A first cluster that is usually further explored in the group of Industrial and manufacturing organizations. The segmentation of organizations can be performed using multiple criteria. The most common is the size of the organizations, the digital maturity of the organizations, as well as the type of organizations regarding the “supply” and “demand” of Industry 4.0 solutions.

Size of organizations

One of the most common methods to segment organizations, is according to their size. In fact, according to the European Commission, small and medium-sized enterprises (SMEs) are defined in the EU recommendation 2003/361.⁹ The main factors determining whether an enterprise is an SME are:

- staff headcount
- either turnover or balance sheet total

Company category	Staff headcount	Turnover	or	Balance sheet total
Large	>250	> € 50 m		> € 43 m
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

As per our As-Is findings, under Deliverable 1 & 2, the Greek Industrial organizations of different sizes indicate different Industry 4.0 maturity and are positioned at different levels with regards to their Industry 4.0 transformation journey, with micro and small SMEs indicating a much lower maturity and adoption of Industry 4.0 technologies.

Digital maturity of organizations

Another approach for segmenting the group of Industrial organizations is according to their digital maturity and their adoption rate of Industry 4.0 technologies. This segmentation would surface three different groups of organizations:

- Industrial/ Manufacturing organizations that demonstrate limited knowledge/ low maturity regarding Industry 4.0: This group includes a significant number of Greek organizations with limited Industry 4.0 awareness that are yet to realize the benefits from adopting relevant Industry 4.0 solutions. As also indicated above, this group usually contains Industrial SMEs and midcaps.
- Industrial/ Manufacturing organizations with some knowledge/ moderate maturity regarding Industry 4.0: This group consists of organizations of various sizes that have started to implement

⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32003H0361>

some Industry 4.0 initiatives, nevertheless they are yet to define a holistic Industry 4.0 strategy for their organization, or they cannot easily justify return on investment, mitigate risk and start disrupting.

- Industrial/ Manufacturing organizations with increased knowledge/ high maturity regarding Industry 4.0: These organizations shall act as the Industry 4.0 “champions” for the Greek Industry and undertake a leading role to increase Industry’s awareness and adoption of Industry 4.0 technologies.

It shall be mentioned that the segmentation of organizations according to their digital maturity is much more complex than their segmentation according to their size, mainly due to the lack of hard data for this. In fact, limited evidence is available for the digital maturity of different Greek Industrial & manufacturing sectors, since the majority of the existing studies evaluate digital maturity at a national and not at an industry level.

Segmentation of organizations regarding the “supply” and “demand” of Industry 4.0 solutions

Another approach for segmenting the pool of industrial organizations is based on whether these are Industry 4.0 solution “producers” or Industry 4.0 solution “consumers”. In other words, if these organizations consist the traditional industrial organizations that aim to adopt Industry 4.0 solutions to improve their efficiencies and increase their revenue streams (therefore increase the Industry 4.0 demand) or whether these are ICT organizations that aim to develop new, innovative Industry 4.0 solutions (therefore enhance the Industry 4.0 supply side).

These three different segmentations of the Industrial organizations can be also combined in order to produce more granular organization segments. For example, in the future Industry 4.0 stakeholders may wish to focus on targeted initiatives and interventions for Greek Industrial SMES, with limited digital maturity that need to implement Industry 4.0 solutions to increase their efficiencies (therefore they belong to the Industry 4.0 demand side).

5.1.1.2 Sectors of Economic Activity

A second cluster that could be further analysed for the elicitation of priority cases is the Greek Industrial sectors of economic activity. These are the following:

B. Mining and quarrying

C. Manufacturing

CA Manufacture of food products, beverages and tobacco products

CB Manufacture of textiles, apparel, leather and related products

CC Manufacture of wood and paper products, and printing

CD Manufacture of coke, and refined petroleum products

CE Manufacture of chemicals and chemical products

CF Manufacture of pharmaceuticals, medicinal chemical and botanical products

CG Manufacture of rubber and plastics products, and other non-metallic mineral products

CH Manufacture of basic metals and fabricated metal products, except machinery and equipment

CI Manufacture of computer, electronic and optical products

CJ Manufacture of electrical equipment

CK Manufacture of machinery and equipment n.e.c.

CL Manufacture of transport equipment

- CM Other manufacturing, and repair and installation of machinery and equipment
- D. Electricity, gas, steam and air-conditioning supply
- E. Water supply; sewerage, waste management and remediation activities
- F. Construction
- H. Transportation and storage

The analysis of the Greek Industrial sectors and sub-sectors, with a set of quantitative criteria that will be presented below, will surface the key sectors/ sub-sectors, where Greece demonstrates a competitive advantage or strength. These sectors/ sub-sectors, that will be further enhanced and accelerate their growth through the implementation of Industry 4.0 initiatives, can consist potential candidates for high priority cases.

It should be mentioned at this point that, as explained in Deliverable 1, Industry 4.0 breaks down siloed sectors of economic activities, blurs industries’ boundaries and emerges the digitisation of cross-sectoral value chains. As such, the identification of sectors that demonstrate a competitive advantage for Greece, shall not lead to the design of sectoral, vertical Industry 4.0 strategies and operational plans. On the contrary, these sectors shall be used as the basis for the identification of cross-sectoral value chains, where Greece could implement targeted interventions for accelerating their digitization, create an emerging industrial ecosystem and improve their productivity and strength. Key example for this is the 2nd high priority case that was selected within Deliverable 3: Structural Materials. Our analysis indicated that the Greek Metals sub-sector is an area of high strategic importance and competitive advantage for Greece. Using the Metals sub-sector as our baseline, we expanded the perimeter (following the relevant suggestion from the General Secretariat for Industry) of the priority case to include the adjacent sub-sectors of structural material (i.e. concrete, composites, masonry, timber, etc.) and focused on the cross-sectoral value chain “Structural Material” to investigate targeted Industry 4.0 interventions.

5.1.1.3 Technological domains

A third cluster for pilot areas and targeted interventions is the Industry 4.0 technological groups. The total set of Industry 4.0 technology trends, as these were presented in Deliverable 1, have been grouped into seven discrete groups according to their relevance, interdependency & common ground for implementation. These are presented below:

Groups	I4.0 technologies included	Rationale for Grouping
Group 1 AI & Big Data Analytics	<ul style="list-style-type: none"> • Cloud • Artificial Intelligence • Big Data • Internet of Things • 5G 	<ul style="list-style-type: none"> • Artificial Intelligence and Data Science are the two major technologies of the future. At the core of AI sits big data. Data is captured through the network of interconnected sensors that communicate via standard protocols (Internet of Things) and is stored in the Cloud. The speed of communication between the sensors and other IoT devices is defined and accelerated by the introduction of 5G networks

Groups	I4.0 technologies included	Rationale for Grouping
Group 2 Smart Manufacturing Technologies	<ul style="list-style-type: none"> • Cloud • Big Data • Electronic Components & Systems • Machine-to-Machine (M2M) • Manufacturing Execution Systems (MES) • Simulation • Supervisory Control and Data Acquisition Systems (SCADA) • Distributed Intelligence • Additive Manufacturing 	<ul style="list-style-type: none"> • This grouping includes all Industry 4.0 technologies & trends that permeate the manufacturing industry and enable the fusion of physical and virtual worlds through cyber-physical systems (CPS), which mark the advent of the fourth stage of industrial production • When implemented, these Industry 4.0 technologies enable the digital transformation and automation of production lines, the direct communication between devices using any communications channel, including wired and wireless and to the prototyping and production of customized, individual goods
Group 3 Robotics	<ul style="list-style-type: none"> • Industrial Robots/ Robots 	<ul style="list-style-type: none"> • Sits at the intersection between AI and Smart Manufacturing Technologies; Refers to automatically controlled, reprogrammable, multipurpose manipulators programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications
Group 4 Cybersecurity	<ul style="list-style-type: none"> • Cybersecurity • Blockchain 	<ul style="list-style-type: none"> • Refers to the security of equipment and products, which are connected through the internet or amongst themselves and create a fully interconnected industrial networked environment. Blockchain is the major Industry 4.0 technology that ensures transparency & enhanced security
Group 5 Photonics	<ul style="list-style-type: none"> • Photonics, Automation, Sensors & Applications 	<ul style="list-style-type: none"> • Photonics, optical fiber transmission systems and their applications refer to backbone network infrastructure and move communications into the terabit era by dramatically increasing data capacity and data transmission speeds, while simultaneously reducing the networks' carbon footprint and the overall cost per bit • Although supporting the development of smart manufacturing applications, they act as enablers for these and cannot be grouped into a single group
Group 6 New Material	<ul style="list-style-type: none"> • New Materials (e.g. Graphene, composites, PVD, CVD) 	<ul style="list-style-type: none"> • The development of new materials and nanostructures (e.g. graphene, composites, PVD, CVD), enable the creation of new components with useful traits such as, durability, shape retention, lightweight, thermo-electric efficiency and re-usability
Group 7 HPC	<ul style="list-style-type: none"> • High Performance Computing 	<ul style="list-style-type: none"> • High-performance computing (HPC) is the use of parallel processing for running advanced application programs efficiently, reliably and quickly. The term applies especially to systems that function above a teraflop or 10¹² floating-point operations per second

The high priority case 1, presented in Deliverable 3, focused on the Smart Manufacturing Technologies, due to their structural importance for the Industry 4.0 era and their high degree of adoption across every Industry’s sector and function. As a next step, Industry 4.0 stakeholders may wish to further exploit:

- Additional Technology domain groups (i.e. AI & Big Data Analytics)
- Focus on a specific technology/ subset of technologies within the “Smart Manufacturing Technologies” group

5.1.1.4 Wider Industry 4.0 Themes

The final cluster for further investigation could refer to wider Industry 4.0 themes, or socio-political themes which are adjacent to Industry 4.0. These themes may consist global and EU imperatives or emerging trends that may impose an opportunity or a threat for Greece and for which the country should identify and implement targeted initiatives.

Key example under this cluster consists the “Circular Economy” theme (high priority case 3 in Deliverable 3) that gains increasing attention worldwide as a means to reduce dependency on primary materials and energy, while at the same time becoming an economically viable alternative to the linear economy.

5.1.2 Step 2: Apply a set of qualitative and quantitative criteria to surface the most important cases within each group

The second step in the suggested methodology is to define and apply a set of qualitative and quantitative criteria to surface the candidate cases within each group/ cluster presented above. These criteria will consist the “industry” or “technology-specific” lenses that will surface potential pilot areas of targeted interventions. For the analysis of each group/ cluster a different set of lenses can be used. Below we present some indicative “lenses” that could be used for each group/ cluster presented.

The implementation of this set of “lenses” will surface a list of primary candidates to be selected and analysed as high priority cases. Nevertheless, the implementation of these “lenses” can only take us thus far. This shortlist of candidates shall be then reviewed by the Governmental leadership and the final high priority cases shall be selected based on their political priorities and vision of Industry 4.0.

5.1.2.1 Group of organizations

In order to identify select group of organizations, where we could further focus our attention and propose targeted interventions, Industry 4.0 stakeholder could use a set of lenses to the total set of the Greek Industry sectors and Manufacturing sub-sectors. These “lenses” can be applied both horizontally, to understand the overall break down of all Greek Industrial and Manufacturing organizations, and within each sector and sub-sector, to investigate the vertical structure and segmentation of organizations. These indicative lenses, are presented in the table below:

Selected Lens	Definition	Reason for Selection	Data Source
Number of Enterprises (per size of organization)	The number of enterprises that are classified as micro, small, medium-sized and large.	Indicates the importance of each group of organizations to the overall economy/ within each sector.	Eurostat
Number of persons employed (per size of organization)	The number people engaged in productive activities across the different group of organizations.	Indicates the political importance and sensitivity of each group of organizations	Eurostat
Value Added by Organizations (per size of organization)	Gross value added is the value of output less the value of intermediate consumption for a specific group of organizations; it is a measure of the contribution to GDP made by an individual group of organizations	Indicates the contribution and significance of each group of organizations to the overall economy	Eurostat
Turnover (per size of organization)	Turnover is used to understand how quickly a company collects cash from accounts receivable or how fast the company sells its products/ inventory. Turnover is a synonym for an organization’s total revenues.	Indicates the size and the strength of each group of organizations	Eurostat
Number of Technology-Intensive Organizations	Number of Industrial & Manufacturing enterprises within, which are involved in the production of:	Indicates the steps that organizations across sectors has taken towards Industry 4.0 and the introduction of	Eurostat

	<ul style="list-style-type: none"> • High-technology products (i.e. pharmaceuticals, computers, electronics, etc.) • Medium-high-technology products (i.e. chemicals, electrical equipment, etc.) • Medium-low-technology products (i.e. coke, rubber, non-metallic mineral products, etc.) • Low-technology products (i.e. food, beverages, tobacco, etc.) 	innovative Industry 4.0 technologies for the design of high value-adding products.	
--	---	--	--

5.1.2.2 Sectors of economic activity

In order to identify select areas of economic activity, where the Industry 4.0 stakeholders could further focus their attention and propose targeted interventions, a set of 6 lenses can be applied to the total set of the Greek Industry sectors and Manufacturing sub-sectors. These lenses are selected in order to holistically review all aspects of the economic sectors within the perimeter of our analysis. These indicative lenses, are presented in the table below:

Selected Lens	Definition	Reason for Selection	Data Source
Gross Value Added (GVA)	Gross value added is the value of output less the value of intermediate consumption for a specific sector/ sub-sector; it is a measure of the contribution to GDP made by an individual sector/sub-sector	Indicates the contribution and significance of each sector/sub-sector to the overall economy	Eurostat
Industrial Production Index	An economic indicator measuring real output in the manufacturing, mining, electric and gas industries, relative to a base year (2015)	Indicates the volume of production of each sector/ sub-sector and the sector's efficiency	Eurostat/ Stochasis
Turnover	Turnover is used to understand how quickly a company collects cash from accounts receivable or how fast the company sells its products/ inventory. Turnover is a synonym for an organization's total revenues	Indicates the size and the strength of each sector/sub-sector	Eurostat
Exports	Goods and services that are produced in one country and sold to buyers in another. Exports, along with imports, make up international trade.	Indicates the competitiveness of each sector/sub-sector	Eurostat
Employment	The number people engaged in productive activities in an economy. The concept includes both employees and the self-employed.	Indicates the political importance and sensitivity of each sector/sub-sector	Eurostat
Investment in Technology & Innovation	Composite index that indicates the investment that a sector/sub-sector performs on the following dimensions: - Computing & Communication Equipment - Computer Software & Databases & R&D	Indicates the steps that each sector/sub-sector has taken towards Industry 4.0	EU Klems

5.1.2.3 Technological domains

With regards to specific technological groups that could consist pilot areas for targeted interventions, we reviewed the total set of Industry 4.0 technology trends, as these were presented in Deliverable 1, the Industry 4.0 stakeholders could evaluate whether Greece demonstrates relative strengths or weaknesses in any of these, as well as which of these (as primary candidates) could potentially accelerate the digitalisation of the Greek Industry. This activity was also performed in Deliverable 3, as presented below.

It should be mentioned here that currently there is no hard data available to indicate the effect that the implementation of a technology domain can have on the Greek Industry or on specific group of organizations. To achieve this, a macro-economic analysis should be performed that would evaluate through relevant forecasting models how would the implementation of a specific Industry 4.0 technology affect for the Greek economy and Greek GDP. This ex-ante evaluation of the financial benefits of a technology implementation has been performed thus far to a limited extent. Examples of this can be found in:

- Accenture & the Hellenic Federation of Enterprises report “Digital Greece: The path for Growth”, where analysis indicated that Greece’s digitization can potentially lead to a 4,9 billion – 7,6 billion Euros GDP uplift by 2021.¹⁰
- Accenture & Microsoft report “With an AI to the Future”, where analysis revealed that AI has the potential to lead to a cumulative \$195 billion GDP uplift over a 15-year period (from 2020 to 2035).¹¹

Groups	I4.0 technologies included	Rationale for Grouping	Greece’s performance across these
Group 1 AI & Big Data Analytics	<ul style="list-style-type: none"> • Cloud • Artificial Intelligence • Big Data • Internet of Things • 5G 	<ul style="list-style-type: none"> • Artificial Intelligence and Data Science are the two major technologies of the future. At the core of AI sits big data. Data is captured through the network of interconnected sensors that communicate via standard protocols (Internet of Things) and is stored in the Cloud. The speed of communication between the sensors and other IoT devices is defined and accelerated by the introduction of 5G networks 	<ul style="list-style-type: none"> • Contrary to all other technology groups, Greece demonstrates a particularly strong performance across this set of Industry 4.0 technologies • Greek companies already exploit the potential of Big Data Analytics. This is evidenced by the fact that 13% of Greek enterprises (compared with 12% of the EU) invest in the collection and Big Data analytics¹² • 1 out of 3 respondents of the Industry 4.0 survey cited that their organisations have already adopted big data & analytics capabilities, while an approximately equally

¹⁰ <https://www.slideshare.net/accenture/digital-greece-the-path-to-growth>

¹¹ <https://www.accenture.com/gr-en/insights/digital/greece-an-ai-future>

¹² Eurostat, Big data analysis, http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_eb_bd&lang=en

Groups	I4.0 technologies included	Rationale for Grouping	Greece’s performance across these
			percentage is planning to do so in the next five years ¹³
Group 2 Smart Manufacturing Technologies	<ul style="list-style-type: none"> • Cloud • Big Data • Electronic Components & Systems • Machine-to-Machine (M2M) • Manufacturing Execution Systems (MES) • Simulation • Supervisory Control and Data Acquisition Systems (SCADA) • Distributed Intelligence • Additive Manufacturing 	<ul style="list-style-type: none"> • This grouping includes all Industry 4.0 technologies & trends that permeate the manufacturing industry and enable the fusion of physical and virtual worlds through cyber-physical systems (CPS), which mark the advent of the fourth stage of industrial production • When implemented, these Industry 4.0 technologies enable the digital transformation and automation of production lines, the direct communication between devices using any communications channel, including wired and wireless and to the prototyping and production of customized, individual goods 	<ul style="list-style-type: none"> • Greece appears to lag behind with regards to the adoption of some of the key technologies that consist the group • According to Eurostat, In Greece, enterprises show low rates of adoption regarding Cloud, with only 13% of enterprises making use of the technology, half the EU average¹⁴ • In addition, with regards to additive manufacturing, only 2% of the Greek enterprises used 3D printing capabilities in 2018¹⁵ • Finally, our Industry 4.0 survey indicated that less than 1 out of 4 interviewed enterprises have already implemented SCADA, MES, ECS and Simulation capabilities¹⁶
Group 3 Robotics	<ul style="list-style-type: none"> • Industrial Robots/ Robots 	<ul style="list-style-type: none"> • Sits at the intersection between AI and Smart Manufacturing Technologies; Refers to automatically controlled, reprogrammable, multipurpose manipulators programmable in three or more axes, which can be 	<ul style="list-style-type: none"> • According to Eurostat, just 2% of Greece’s enterprises used industrial robot technology in 2018, demonstrating the country’s

¹³ The performed analysis and the respective conclusions were based on data recorded through the “Industry 4.0” survey ran by the Ministry of Development, PwC and Accenture, with 152 Greek executives across the following sectors: B. Mining & Quarring, C: Manufacturing, E: Water supply; sewage, waste management and remediation activities, F: Constuction, H: Transportation, J: Information & Communication, which was launched on November 2019 and closed in February 2020.

¹⁴ Eurostat, Cloud computing services, https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_cicce_use&lang=en

¹⁵ Eurostat, 3D printing and robotics, <https://data.europa.eu/euodp/data/dataset/yzsEuBlwUUXizsj3hSOdQ>

¹⁶ The performed analysis and the respective conclusions were based on data recorded through the “Industry 4.0” survey ran by the Ministry of Development, PwC and Accenture, with 152 Greek executives across the following sectors: B. Mining & Quarring, C: Manufacturing, E: Water supply; sewage, waste management and remediation activities, F: Constuction, H: Transportation, J: Information & Communication, which was launched on November 2019 and closed in February 2020.

Groups	14.0 technologies included	Rationale for Grouping	Greece’s performance across these
		either fixed in place or mobile for use in industrial automation applications	slow rate of adoption in terms of industrial robotics ¹⁷
Group 4 Cybersecurity	<ul style="list-style-type: none"> • Cybersecurity • Blockchain 	<ul style="list-style-type: none"> • Refers to the security of equipment and products, which are connected through the internet or amongst themselves and create a fully interconnected industrial networked environment. Blockchain is the major Industry 4.0 technology that ensures transparency & enhanced security 	<ul style="list-style-type: none"> • According to the Global Cybersecurity Index (GCI) from ITU, Greece holds the 77th position across 175 countries worldwide, with regards to its cybersecurity capabilities, much lower than the other EU countries (i.e. UK is 1st, France 3rd, Estonia 5th, etc.)¹⁸
Group 5 Photonics	<ul style="list-style-type: none"> • Photonics, Automation, Sensors & Applications 	<ul style="list-style-type: none"> • Photonics, optical fiber transmission systems and their applications refer to backbone network infrastructure and move communications into the terabit era by dramatically increasing data capacity and data transmission speeds, while simultaneously reducing the networks’ carbon footprint and the overall cost per bit • Although supporting the development of smart manufacturing applications, they act as enablers for these and cannot be grouped into a single group 	<ul style="list-style-type: none"> • No hard data is provided for Greece across this Industry 4.0 technology • Our Industry 4.0 survey indicated that less than 10% of our sample claimed to already implement photonics and their applications in their organizations – limited use of this technology¹⁹
Group 6 New Material	<ul style="list-style-type: none"> • New Materials (e.g. Graphene, composites, PVD, CVD) 	<ul style="list-style-type: none"> • The development of new materials and nanostructures (e.g. graphene, composites, PVD, CVD), enable the creation of new components with useful traits such as, durability, shape retention, lightweight, thermo-electric efficiency and re-usability 	<ul style="list-style-type: none"> • No hard data is provided for Greece across this Industry 4.0 technology • Our Industry 4.0 survey indicated that 12% of our sample claimed to deal with the production/ use of new materials in their production

¹⁷ Eurostat, 3D printing and robotics, https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_eb_p3d&lang=en

¹⁸ ITU, Global Cybersecurity Index, https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-GCI.01-2018-PDF-E.pdf

¹⁹ The performed analysis and the respective conclusions were based on data recorded through the “Industry 4.0” survey ran by the Ministry of Development, PwC and Accenture, with 152 Greek executives across the following sectors: B. Mining & Quarring, C: Manufacturing, E: Water supply; sewage, waste management and remediation activities, F: Constuction, H: Transportation, J: Information & Communication, which was launched on November 2019 and closed in February 2020.

Groups	I4.0 technologies included	Rationale for Grouping	Greece’s performance across these
			lines – limited use of this technology ²⁰
Group 7 HPC	<ul style="list-style-type: none"> High Performance Computing 	<ul style="list-style-type: none"> High-performance computing (HPC) is the use of parallel processing for running advanced application programs efficiently, reliably and quickly. The term applies especially to systems that function above a teraflop or 1012 floating-point operations per second 	<ul style="list-style-type: none"> No information is provided for Greece across this Industry 4.0 technology This is an advanced I4.0 technology, specialized and used by particular segments of the industry Our Industry 4.0 survey indicated that only 6% of our sample claimed to currently use HPC capabilities – limited use of this technology²¹

5.1.2.4 Wider Industry 4.0 themes

Finally, turning our focus to wider Industry 4.0 themes that may have a significant impact in the Greek Industry and the Greek economy, through future targeted interventions, a set of qualitative and quantitative criteria can be used to identify their importance. Namely these could be:

- Global studies and surveys indicating the importance of the theme (i.e. WEF’s report for Circular Economy “Towards the circular economy: Accelerating the scale-up across global supply chains”²²)
- Strategies developed centrally by the European Commission to address the Industry 4.0 themes (i.e. EU Circular Economy Action Plan²³, the Green Deal²⁴, the EU Plastics Strategy²⁵)
- Activities, measure and regulations that global institutions and other global counterparts have undertaken (i.e. France’s “Roadmap for the Circular Economy”²⁶, Portugal’s “Leading the transition: A circular economy action plan for Portugal”²⁷, etc.)
- Specific indicators that demonstrate where Greece currently stands regarding this Industry 4.0 theme (i.e. according to Eurostat data, the average circular use of materials as a percentage of total material use averaged 12% in the EU in 2016. On the country level, the circularity of national economies varies

²⁰ The performed analysis and the respective conclusions were based on data recorded through the “Industry 4.0” survey run by the Ministry of Development, PwC and Accenture, with 152 Greek executives across the following sectors: B. Mining & Quarring, C: Manufacturing, E: Water supply; sewage, waste management and remediation activities, F: Constuction, H: Transportation, J: Information & Communication, which was launched on November 2019 and closed in February 2020.

²¹ The performed analysis and the respective conclusions were based on data recorded through the “Industry 4.0” survey run by the Ministry of Development, PwC and Accenture, with 152 Greek executives across the following sectors: B. Mining & Quarring, C: Manufacturing, E: Water supply; sewage, waste management and remediation activities, F: Constuction, H: Transportation, J: Information & Communication, which was launched on November 2019 and closed in February 2020.

²² <https://reports.weforum.org/toward-the-circular-economy-accelerating-the-scale-up-across-global-supply-chains/>

²³ European Commission, EU Circular Economy Action Plan, <https://ec.europa.eu/environment/circular-economy/>

²⁴ European Commission, Communication on The European Green Deal, https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

²⁵ European Commission, European strategy for plastics, https://ec.europa.eu/environment/waste/plastic_waste.htm

²⁶ <https://www.ecologie.gouv.fr/sites/default/files/FREC%20anglais.pdf>

²⁷ https://circulareconomy.europa.eu/platform/sites/default/files/strategy_-_portuguese_action_plan_paec_en_version_3.pdf

highly with the Netherlands leading the way at 29% circular material use while Greece, Europe’s lowest ranking country, reports only 1% circular material use.²⁸⁾

5.1.3 Step 3: Perform an As-Is analysis for the selected priority cases

Having identified and selected the priority cases, where the Industry 4.0 stakeholders would like to further focus on and identify targeted interventions, the next step in our methodology is for them to identify and analyse the as-is situation regarding each of the selected priority cases. To elicit and record the key As-Is findings, stakeholders could indicatively:

- Leverage findings recorded under Deliverables 1 & 2, with regards to Greece’s Industry 4.0 “state of the nation” and the country’s Industry 4.0 SWOT analysis.
- Explore additional 3rd party datasets (if and where available) to further validate and detail Greek Industry’s performance across each priority case.
- Conduct online surveys to surface Greek Industry’s organizations’ perception regarding their performance, needs and requirements across each priority case.
- Conduct a set of workshops with local and global Subject Matter Experts and Industry stakeholders
- Conduct a thorough desk-research of the Greek As-Is situation regarding each priority case.

This As-Is analysis will surface potential strengths that the Greek Industry may demonstrate regarding each priority case, as well as possible gaps and weaknesses that the initiatives to be designed should address and tackle.

5.1.4 Step 4: Consolidate and review international leading practices for the selected priority cases

In parallel with the performance of the As-Is analysis for each selected priority case, Industry 4.0 stakeholders could perform a thorough analysis, in order to identify what measures and initiatives other countries and global institutions have undertaken across the selected priority cases. These initiatives can be used as “inspiration” for the design of similar interventions for the Greek priority cases. In addition, the exchange of best practices between Greek stakeholders and their global counterparts can help the Greek Industry 4.0 stakeholders avoid common “mistakes” and identify from the beginning the critical success factors that should be implemented to achieve maximum results regarding the design and implementation of targeted initiatives.

5.1.5 Step 5: Design a set of interventions for each selected priority case

After the identification of the priority cases and Greece’s as-is situation across each priority case, the next step for Industry 4.0 stakeholders will be to design the set of targeted interventions for each of the priority cases. It is suggested that Industry 4.0 stakeholders should aim to design a well-rounded set of interventions for each priority area that will cover all six Industry 4.0 strategic pillars. Namely, the identified interventions are suggested to cover:

²⁸ Eurostat, Circular material use rate, https://ec.europa.eu/eurostat/databrowser/product/view/cei_srm030?lang=en

- **Digital skills & human capital qualifications:** Industry 4.0 stakeholders should design targeted interventions per priority case that shall aim to digitally upskill and reskill all the current workforce of the Greek industry, mainly focusing on professionals with technical skills.
- **Innovation & start-up supporting mechanisms in the Digital Age:** A set of interventions could refer to the enhancement and promotion of innovation and respective innovation structures across the Greek Industry and the closer and more targeted collaboration of the Greek Government, Industry and Research & Academia (triple helix innovation model).
- **Collaborations and Synergies:** A set of interventions per priority case can also refer to the development of a collaborative industrial ecosystem, where Industry stakeholders shall cooperate and utilise each other’s expertise in order to achieve greater goals. The ultimate goal is to assist the Greek industry to advance “as one” to the Industry 4.0 era and cumulatively reap the benefits that it has to offer, instead of having a few i4.0-advanced groups of firms and many i4.0-laggards operating in two different speeds.
- **Standardisation & Norms:** Priority cases that refer directly to technological domains can also benefit from the design and implementation of targeted interventions with regards to the introduction and set up of Industry 4.0 standardization mechanisms and frameworks. Similar initiatives have also been included both in the horizontal Operational plan, as well as in high priority case 1 (Smart Manufacturing Technologies) and high priority case 3 (Circular Economy).
- **Regulatory Environment:** The introduction of targeted interventions for each priority case is usually accompanied by relevant measures to modernise and revamp the Greek regulatory environment in order to become more flexible and Industry 4.0 friendly. Targeted initiatives across this area shall aim at the removal of unnecessary obstacles that currently exist for businesses under each priority case that hinder them in conducting their operations and collaborations efficiently.
- **Acceleration of investment in digital technologies:** Finally, the identified interventions that are defined per priority case, shall be accompanied by relevant financial mechanisms that will provide the financial means to implement the designed interventions. As such, these financial mechanisms shall be linked with all other initiatives identified under each priority case.

Each intervention that will be identified and analysed shall cover the topics presented in the table below. These topics have been also analysed for all initiatives recorded within the Industry 4.0 Operational plan and the three high priority cases presented in Deliverable 3.

Topic	Brief explanation
Title of the initiative	Refers to the name of the initiative, capturing the essence of its content.
Initiative’s Coding	Refers to the discrete coding of the initiative, categorising it among all other initiatives of the Operational plan.
Pillar	Refers to the execution pillar of the proposed Industry 4.0 Strategy the initiative belongs in.
Link with strategic goals	Reflects how each respective initiative is linked directly with one or more strategic goals as proposed in the lines of the Industry 4.0 strategy.

Description of the initiative	Provides the rationale behind the need for each initiative within each priority case, presenting the link between the “As-is” study and the proposed Industry 4.0 strategy. It also provides more specific details with regards to the focus of the initiative, elaborating on how it should be implemented within the Industrial ecosystem.
Stakeholders	Presents the key stakeholders involved with regards to the design as well as the implementation of the respective initiative.
Key beneficiaries (Target group)	Refers to the Group of individuals/ firms/ entities or other parties of the Greek industrial ecosystem that will ultimately benefit from the implementation of the respective initiative.
Potential funding sources	Refers to the sources the initiative can draw funding from (national or European sources) in order to be implemented.
Indicative Budget	Refers to an indicative budgeting range (regarding the initiatives such a budget is applicable for) covering their funding needs within the Operational plan’s period.
Dependencies with other initiatives	Reflects how each respective initiative is linked/ interrelated with other initiatives within the same or the rest of the priority cases and execution pillars of the Operational plan
Timeline of implementation	Refers to the timing of implementation for each respective initiative, seeking to place it within a discrete period of the Operational plan, categorising it as “Immediate” (1-2 years) – “short-medium term”(2-5 years) or “mid-long term”(5-7 years). It refers to amount of time required for its design and implementation.
Feasibility and Necessity of the initiative	Refers to the scoring of the respective initiative, after the meetings conducted with stakeholders for the development of the Operational Plan. The scoring examines the “feasibility” of the initiative, indicating the degree of readiness to implement it as well as the “necessity” of the initiative, indicating the need for the initiative within the Greek industrial ecosystem.

The current version of the document represents the Final Draft of Deliverable 4. This has been prepared in the context of the project “Digital transformation of the Greek Industry”, for the purposes of the Deliverable 4 in accordance with the signed contract.

© 2021 PricewaterhouseCoopers Business Solutions SA. All rights reserved. PwC refers to the Greece member firm and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see www.pwc.com/structure for further details.

At PwC, our purpose is to build trust in society and solve important problems. We’re a network of firms in 158 countries with more than 250,000 people who are committed to delivering quality in assurance, tax and advisory services. Find out more and tell us what matters to you by visiting us at www.pwc.com.