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Alliance of Excellence for Research and Innovation on Aephoria

200 RESEARCHERS | 100 PROJECTS | 120 COUNTRIES | 150 CONFERENCES | 1,000 PUBLICATIONS | 500M MILLION FUNDING

WORLD LARGEST RESEARCH AND INNOVATION TEAM ON SCIENCE-BASED SUSTAINABILITY TRANSITION

Research and Innovation Centers

- ReSEES Research Laboratory - Athens University of Economics and Business
- Stochastic Modeling and Applications Laboratory - Athens University of Economics and Business
- Sustainable Development Unit - Athena Research Center
- Department of Technology, Management, and Economics - Technical University of Denmark

Innovation Acceleration Hubs

- UN Climate Change Global Innovation Hub
- EIT Climate-KIC
- Brigaid Connect
- MENA Maritime Accelerator
- Black Sea Accelerator

Science - Policy Networks

- Sustainable Development Solutions Network (SDSN)
- SDSN Global Climate Hub
- SDSN Europe
- SDSN Greece
- Water Europe
- Nexus cluster

Scientific Associations and Academies

- World Council of Environmental and Resource Economists Associations (WCEREA)
- European Association of Environmental and Resource Economists (EAERE)
- World Academy of Art and Science (WAAS)
- Academia Europaea
- European Academy of Sciences and Arts
- InterAcademy Partnership (IAP)

AE4RIA Metrix Spin Off

SDGs - ESG measurment
Sustainable Finance

Sustainable pathways to
Climate Neutrality and Resilience

Sustainable pathways for
Seas and Oceans

Sustainable pathways
Land Use and WFEB Nexus

Innovation Acceleration
Education, Upskilling and Reskilling

Prof. Phoebe Koundouri Founder and Scientific Chair
phoebekoundouri.org

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The Twin Transition for Blue Economy:

Mapping Demand for Green and Digital Skills in the Maritime Sector

14 October 2024

Exceed Talks

Dr. Conrad Landis, Athens University of Economics and Business

SDSN Global Climate Hub

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ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS
ReSEES Research laboratory on Socio-Economic and Environmental Sustainability

ΑΘΗΝΑ

Green And Digital Skills Hierarchy for the Maritime Sector

Table 8 - Green and Digital Skills Hierarchy for the maritime industry

Green and Digital Skills	Score
complying with environmental protection laws and standards	48,5%
environmental protection technology	45,5%
monitoring environmental conditions	39,4%
electronics and automation	33,3%
database and network design and administration	33,3%
designing electrical or electronic systems or equipment	33,3%
computer use	27,3%
analysing and evaluating information and data	27,3%
electricity and energy	21,2%
maintaining electrical, electronic and precision equipment	15,2%
analysing scientific and medical data	9,1%
handling and disposing of hazardous materials	9,1%
using precision measuring equipment	6,1%
operating agricultural or forestry equipment	0,0%
disposing of non-hazardous waste or debris	0,0%

- Identify “Blue Skills: Occupations and Skills Needed/requested in the Maritime Sector (Industrial Transportation- Shipping -, Ports, Maritime Logistics and Maritime Technology)

- Apply our model to rank “Green and Digital Skills”

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Top Green And Digital Skills Demanded in the Maritime Sector

Table 7 - Top 5 demanded occupations in the maritime industry

Level 1	Level 3	Top Skills	Score
3 - Technicians and associate professionals	Information and communications technology operations and user support technicians	protecting ict devices	0,164794007
		managing, gathering and storing digital data	0,112359551
		creating artistic designs or performances	0,08254717
		setting up computer systems	0,059925094
		working with computers	0,056179775
3 - Technicians and associate professionals	Business services agents	preparing documentation for contracts, applications, or permits	0,042335116
		technical or academic writing	0,04144385
		ensuring compliance with legislation	0,040998217
		communicating with colleagues and clients	0,040552585
		managing budgets or finances	0,038770053
7 - Craft and related trades workers	Machinery mechanics and repairers	installing wooden and metal components	0,081980519
		interpreting technical documentation and diagrams	0,068181818
		repairing and installing mechanical equipment	0,0625
		complying with health and safety procedures	0,047077922
		maintaining operational records	0,040584416

- Occupations and Skills with the highest demand in the “Blue Economy” (Shipping, Ports, Maritime Logistics and Maritime Technology) - based on online adds, e.g., Linked-in.

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Green and Digital Jobs for the Blue Transition

- Map Green Occupations and Skills to “Maritime” Policies

Policy	Industrial Sector (NACE Rev. 2)	Green and Digital Skills (Level 3)	Green and Digital Occupations (Level 2)
IMO Regulations MARPOL Convention Ballast Water Management Convention Energy Efficiency Design Index (EEDI) ship Energy Efficiency Management Plan (SEEMP)	Shipping, Ports, Industrial Transportation	conducting academic or market research promoting products, services, or programs installing and repairing electrical, electronic and precision equipment complying with health and safety procedures 'accompanying and welcoming people installing wooden and metal components	Electrical equipment installers and repairers Hotel and restaurant managers Electrotechnology engineers Electronics and telecommunications installers and repairers Process control technicians Life science professionals Travel attendants, conductors and guides Engineering professionals (excluding electrotechnology)
EU Policies EU MRV Regulation Clean Water Act Vessel Incidental Discharge Act (VIDA)	All Sectors	advising on environmental issues analysing and evaluating information and data complying with environmental protection laws and standards computer use database and network design and administration designing electrical or electronic systems or equipment electronics and automation maintaining electrical, electronic and precision equipment	environmental education officer environmental expert nature conservation officer sustainability manager green ICT consultant natural resources consultant

- Use our Data driven model to identify the top “Green and Digital Skills in the Maritime Sector

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AE4RIA Metrix

Spin Off

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AE4RIA metrix

Quantification and Acceleration – Measuring Sustainability

14 October 2024

Exceed Talks

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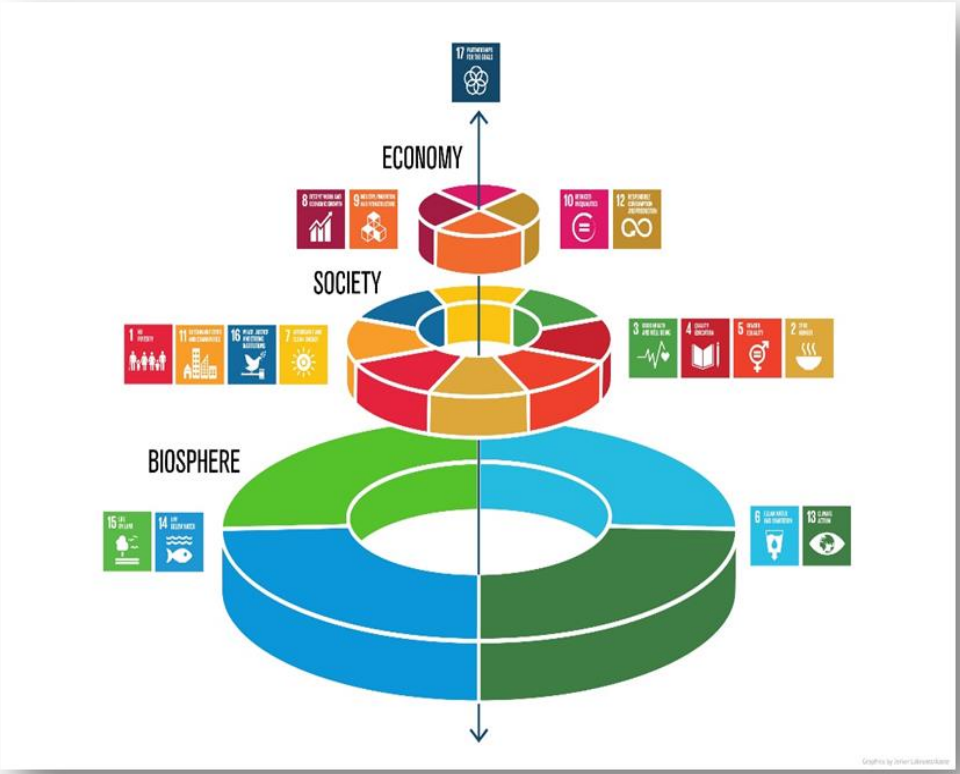
ΑΘΗΝΑ

AE4RIA metrix / ESG & SDGs Quantification and Acceleration

Aim

Downscale the Global and National UN SDSN Methodologies, Metrics and Dashboards at different Local Levels for entities and economic activities.

Global and National Implementation of the SDGs require ***Non-state actors*** – including companies, cities, regions, financial and educational institutions – to take rigorous and immediate action.



State of the Art

Sister Projects which refer to the quantification of the **SDG footprint** of:

- National State NUTS2 Level Regions, Cities and Municipalities
- Educational Institutions – Case Study : Universities –
- Companies (Corporate Sustainability Reports in line with CSRD)
- Financial Institutions - Portfolios

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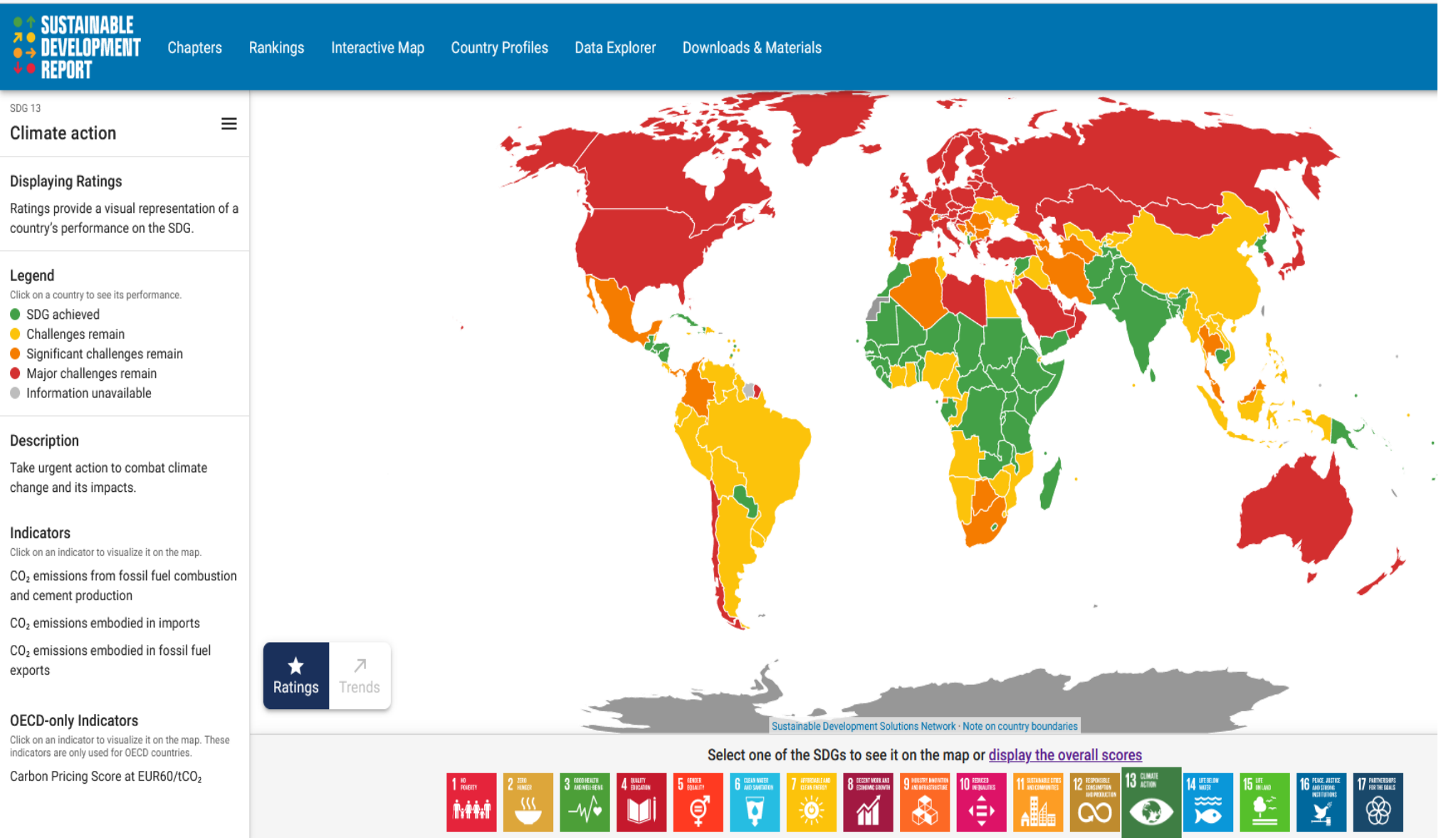
SDG Reporting



- 245 KPIs and their Targets for Implementation to 2030/2050.
- Aggregated in 17 Goals.
- Methodology Audited by JRC

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SDG Dashboards (Global/Regional/National)

European Union

OVERVIEW INDICATORS

SDG Index Rank	SDG Index Score	Spillover Score	LNOB Score
NA/34	71.4	65.3	74.2

SDG Dashboards and Trends

Click on a goal to view more information.

Dashboards: SDG achieved · Challenges remain · Significant challenges remain · Major challenges remain · Information unavailable

Trends: On track or maintaining SDG achievement · Moderately improving · Stagnating · Decreasing · Trend information unavailable

SUSTAINABLE DEVELOPMENT REPORT — Chapters · Rankings · Interactive Map · Country Profiles · Data Explorer · Downloads & Materials

Greece

OECD member

OVERVIEW INDICATORS POLICY EFFORTS

SDG Index Rank	SDG Index Score	Spillover Score
32/163	76.8	72.8

SDG Dashboards and Trends

Click on a goal to view more information.

Dashboards: SDG achieved · Challenges remain · Significant challenges remain · Major challenges remain · Information unavailable

Trends: On track or maintaining SDG achievement · Moderately improving · Stagnating · Decreasing · Trend information unavailable

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Progress at **Subnational** -NUTS2 **Level** - ***Greece***

Table 3 The SDGs heat map for the Greek regions

	Eastern Macedonia and Thrace (EL51)	Attica (EL30)	Northern Aegean (EL41)	Western Greece (EL63)	Western Macedonia (EL53)	Epirus (EL54)	Thessaly (EL61)	Ionian Islands (EL62)	Central Macedonia (EL52)	Crete (EL43)	Southern Aegean (EL42)	Peloponnese (EL65)	Central Greece (EL64)
SDG1													
SDG2													
SDG3													
SDG4													
SDG5													
SDG6													
SDG7													
SDG8													
SDG9													
SDG10													
SDG11													
SDG13			N/A					N/A			N/A	N/A	
SDG14													
SDG15													
SDG16													

- SDG Indicators at Subnational Level
- 13 Greek Administrating Distinct

Target achieved
Minor challenges
Significant challenges
Major challenges

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➢ *Athens University of Economics and Business*

Research on the SDGs
Interdisciplinary and transdisciplinary research
Innovations and solutions
National & local implementation
Capacity building for research

Education for sustainable development
Jobs for implementing the SDGs
Capacity building
Mobilising young people

Governance and operations aligned with SDGs
Incorporate into university reporting

Public engagement
Cross-sectoral dialogue and action
Policy development and advocacy
Advocacy for sector role
Demonstrate sector commitment

Machine Learning Approaches to ***Map***

- Research output
- Course Outlines
- ESGs (Governance Criteria)
- Outreach (Events and News)

Identify Gaps in the implementation of the SDGs at the University Level.

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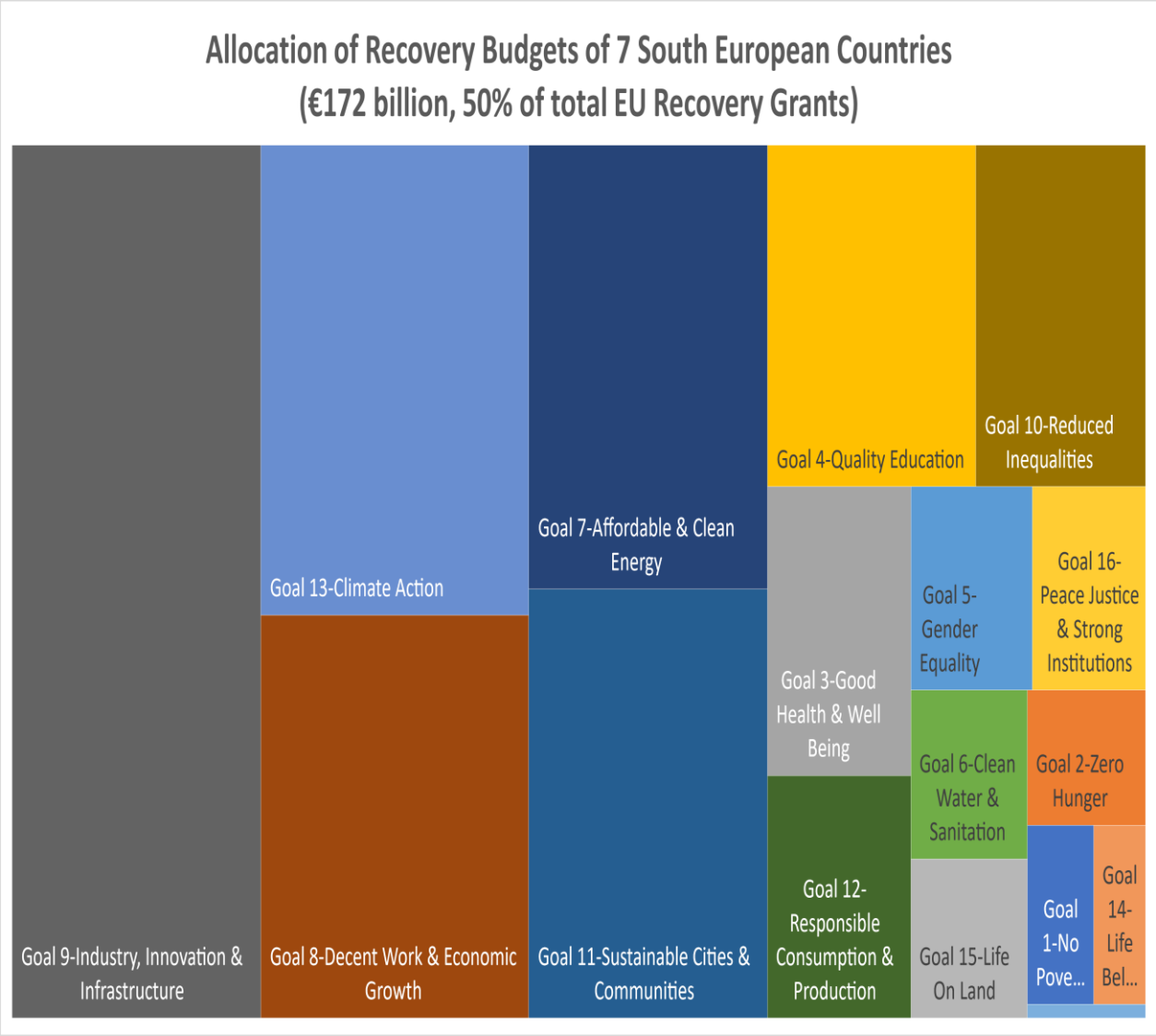
SDGs - Budgets & Investment Plans

Sustainability Assessment of the National Recovery & Resilience Plans 7 South European Member States Bulgaria, Croatia, Cyprus, Greece, Italy, Slovenia and Spain



- All SDGs are addressed by most EU countries, albeit to different degrees.
- SDGs mostly covered, in terms of the number of stimulus measures and budget allocated, **are not always those on which countries face the biggest sustainability challenges** (according to UN SDSN SDR 2021).

- Although several European nations demonstrate relatively poor performance on transforming **food systems and diets** and **biodiversity** goals, these challenges have received lower attention in national RRPs than those of other SDGs like green energy, electrification of transport, and energy efficiency measures.

- Call for increased attention of EU nations to these topics through other post-pandemic public and private investments.

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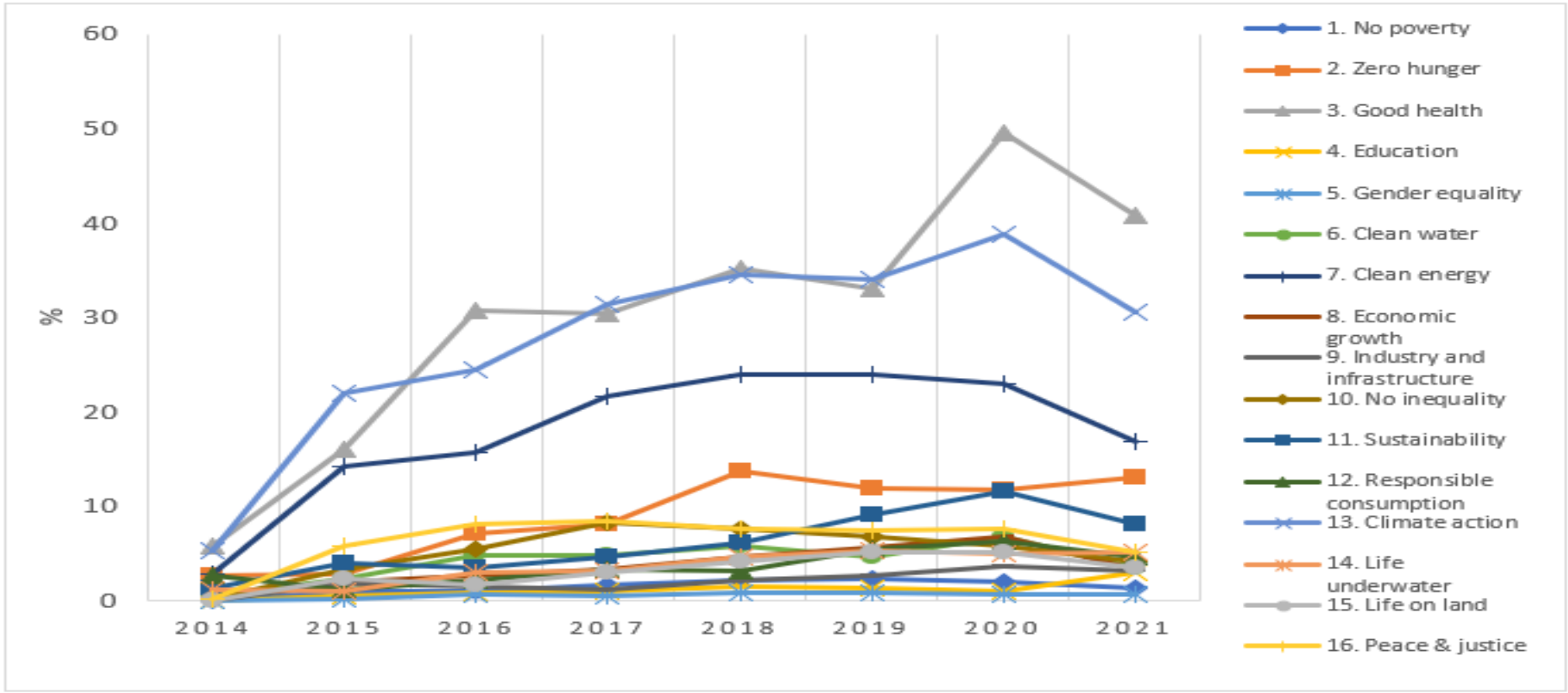
Effectiveness of EU Funds Allocated in H2020

Impact of European research financing to the production of Scientific Research on SDGs

- Map the outputs of H2020 (Deliverables, Publications, Papers, Patents etc.) to SDGs
- These Metrics can be used to measure Impact/ Effectiveness VS Rio Markers (Based on the Intention)

FIGURE 7.11. SDCCB SDG FLAGGED KPIS - % FWCI WEIGHTED EU CONTRIBUTION PER SDG



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Circular Economy vs SDG (2000-2023)

CE Categories	CE Indicators	SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9	SDG10	SDG11	SDG12	SDG13	SDG14	SDG15	SDG16	SDG17
1. Production and Consumption	1.1.Resource productivity	0,73	0,79	0,95	0,91	0,94	0,97	0,95	0,74	0,96	0,77	0,96	0,94	0,90	0,96	0,85	0,81	0,52
	1.2 Generation of municipal waste per capita	0,32	0,21	0,37	0,12	0,35	0,29	0,24	0,38	0,32	0,41	0,29	0,42	0,28	0,29	0,24	0,14	0,61
	1.3 Generation of packaging waste per capita	0,07	0,22	0,26	0,61	0,19	0,45	0,48	0,12	0,33	0,18	0,42	0,14	0,16	0,37	0,61	0,42	0,40
	1.4 Generation of plastic packaging waste per capita	0,10	0,25	0,29	0,64	0,23	0,47	0,51	0,14	0,36	0,20	0,44	0,16	0,19	0,40	0,63	0,45	0,39
2. Waste Management	2.1 Recycling rate of municipal waste	0,16	0,34	0,30	0,57	0,30	0,42	0,46	0,13	0,37	0,12	0,41	0,22	0,33	0,40	0,43	0,46	0,30
	2.2 Recycling rate of packaging waste by type of packaging	0,01	0,19	0,24	0,62	0,17	0,45	0,48	0,06	0,32	0,15	0,41	0,12	0,18	0,36	0,62	0,41	0,42
	2.3 Recycling rate of waste of electrical and electronic equipment	0,27	0,62	0,55	0,83	0,58	0,66	0,68	0,24	0,64	0,23	0,67	0,51	0,66	0,73	0,57	0,72	0,18
3. Secondary Raw Materials	3.1 Circular material use rate	0,20	0,25	0,45	0,70	0,37	0,61	0,60	0,27	0,50	0,34	0,56	0,34	0,31	0,53	0,75	0,49	0,14
	3.2 Trade in recyclable raw materials	0,76	0,94	0,89	0,85	0,92	0,84	0,85	0,74	0,90	0,62	0,88	0,83	0,81	0,94	0,68	0,91	0,42
4. Competitiveness and Innovation	4.1 Private investment and gross added value related to circular economy sectors	0,35	0,66	0,59	0,83	0,62	0,68	0,71	0,31	0,67	0,28	0,70	0,54	0,67	0,74	0,58	0,77	0,14
	4.2 Persons employed in circular economy sectors	0,31	0,64	0,57	0,84	0,60	0,67	0,70	0,27	0,66	0,25	0,69	0,53	0,67	0,74	0,58	0,74	0,16
	4.3 Patents related to recycling and secondary raw materials	0,06	0,43	0,38	0,69	0,35	0,54	0,53	0,03	0,46	0,07	0,50	0,28	0,49	0,55	0,50	0,59	0,32
1 Global Sustainability and Resilience	5.1 Greenhouse gases emissions from production activities	0,26	0,31	0,47	0,72	0,41	0,67	0,69	0,24	0,53	0,37	0,60	0,42	0,51	0,52	0,72	0,50	0,10
	5.2 Material import dependency	0,38	0,61	0,64	0,79	0,61	0,70	0,66	0,40	0,67	0,32	0,67	0,53	0,49	0,76	0,62	0,73	0,02
	5.3 Consumption footprint	0,54	0,78	0,73	0,85	0,77	0,77	0,78	0,49	0,79	0,43	0,78	0,68	0,74	0,85	0,63	0,73	0,13

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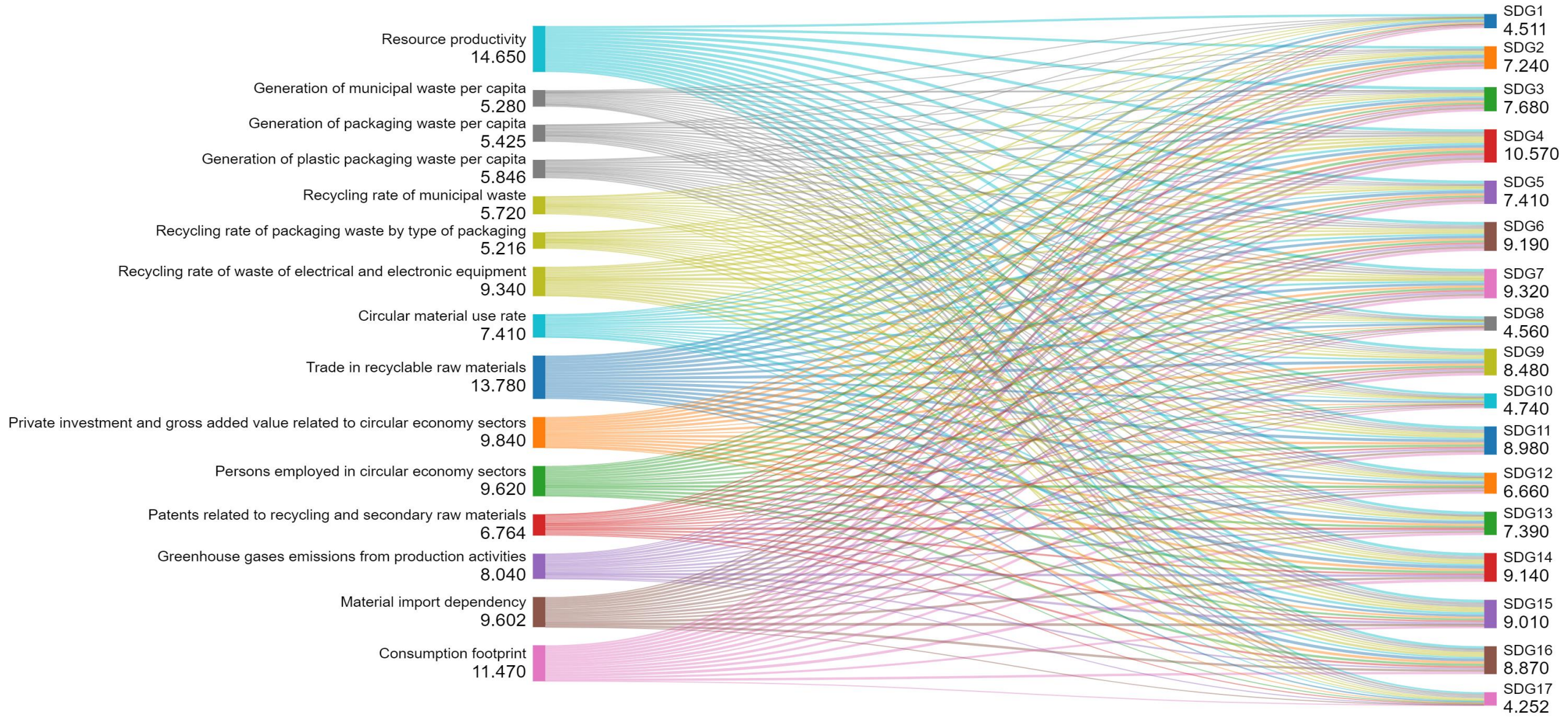
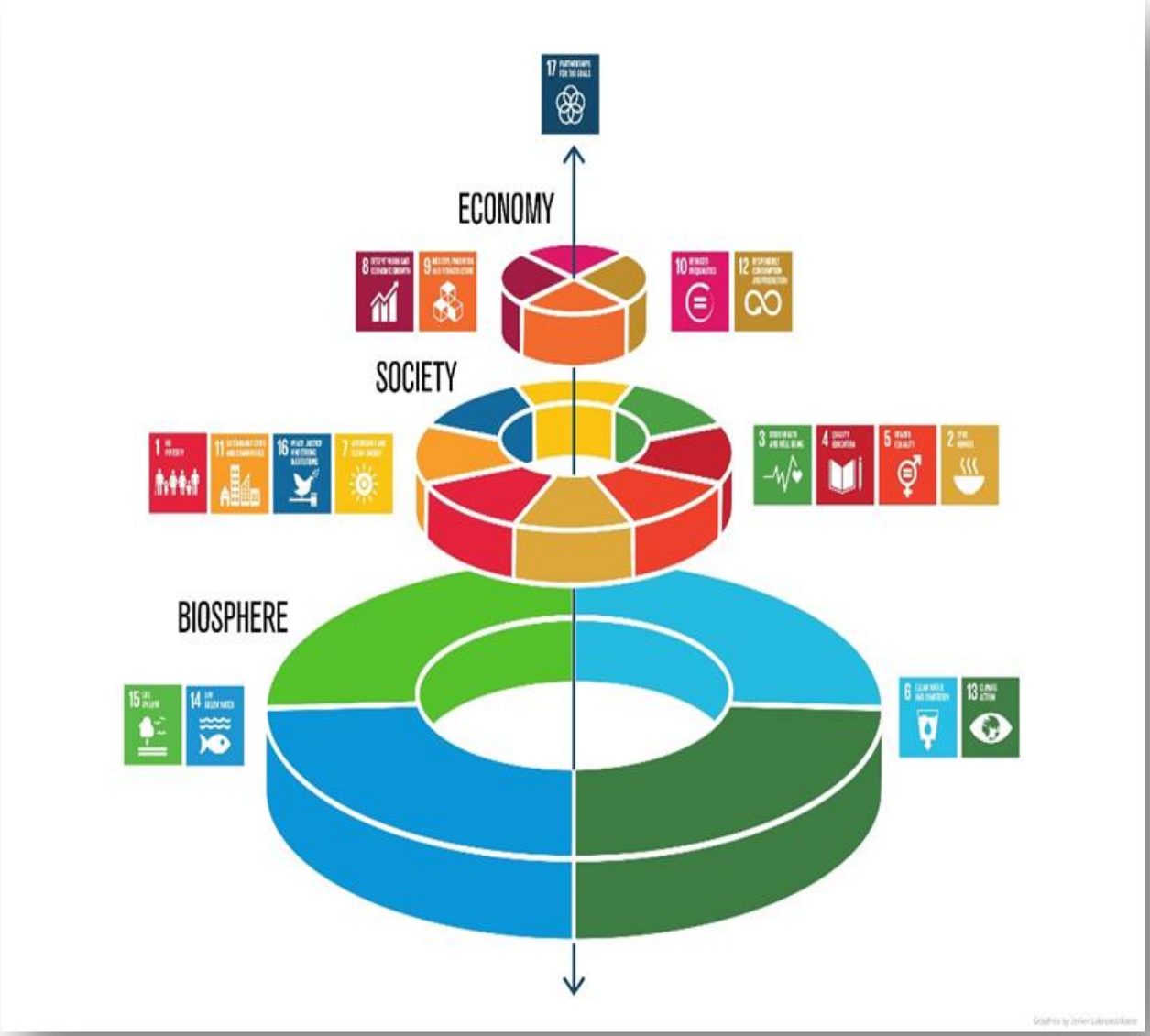
Circular Economy vs SDGs



SDG Footprint - Companies



AE4RIA Metrix

- Integrate SDGs into the Corporate Sustainability Reporting (CSR)
- Decision Making Tools and Models to Accelerate the Transition

Environment

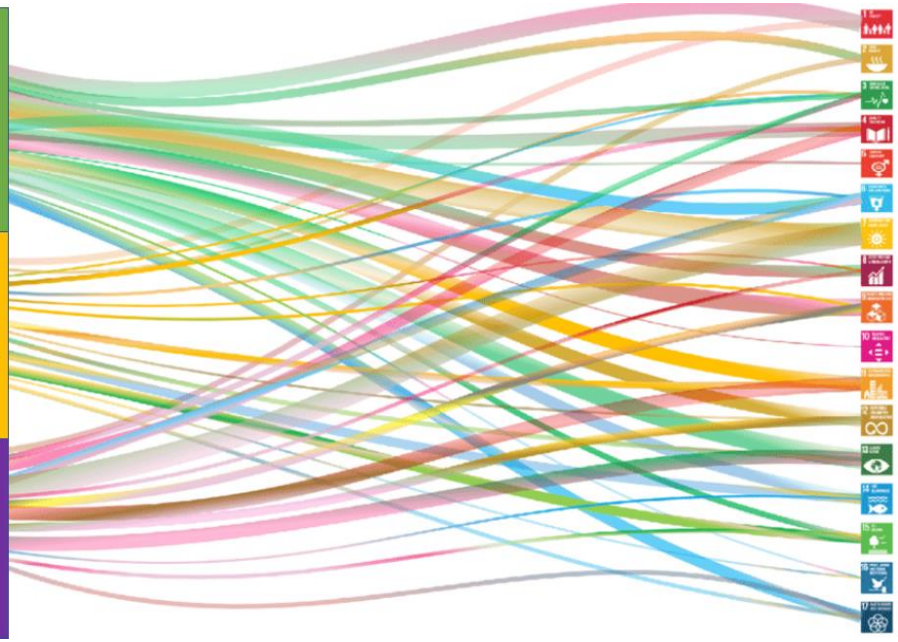
Company's impact (at supply chain level) on the natural environment and its response to the challenge of climate change (greenhouse gas emissions, energy consumption, generation and use of renewable energy, biodiversity and habitat, impact on water resources and deforestation, pollution, efficient use of resources, the reduction and management of waste)

Social

Company's interaction with workers, other stakeholders and the communities in which it operates and the role of the Company in society including: workplace policies ethical/responsible sourcing and social aspects and labour standards of the supply chain, and engagement with and contribution to the broader community through social projects and charitable donations.

Governance:

The ethical conduct of the Company's business including its corporate governance framework, business ethics, policies, code of conduct and the transparency of non-financial reporting.



CSRD-consistent Holistic Approach for Businesses
Create value and move beyond compliance-based codes

Mapping

- Map Entire Value Chain of Company - Products and Services
- Map Stakeholders
- Materiality Assessment By Stakeholder

Measurement

- ESG KPIs in accordance with Sustainability Reporting Standards (2023, 2024)
- Map ESG KPIs across the Value Chain
- Map ESG KPI's to SDGs Indicators
- Set Targets

Assessment & Monitoring

- ESG/SDG Dashboards – Level of Implementation of SDGs and trends to 2030/2050
- Monetization of externalities/ intangible assets
- Design Hybrid Metrics to Optimize for Value
- Restructure Business Plan

AE4RIA Metrix

Spin Off

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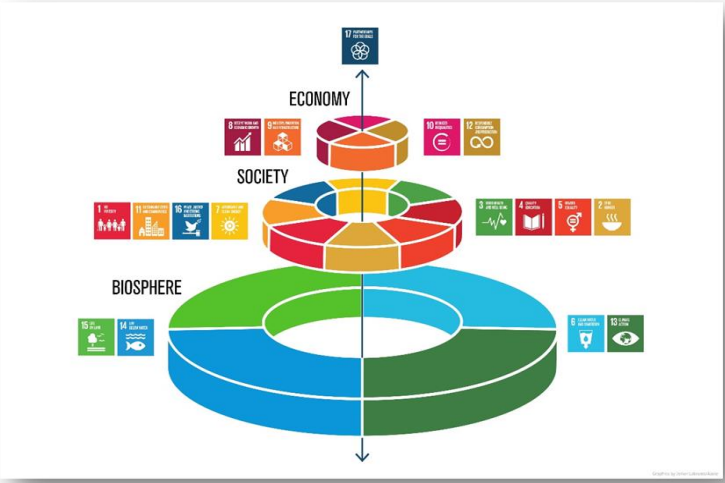
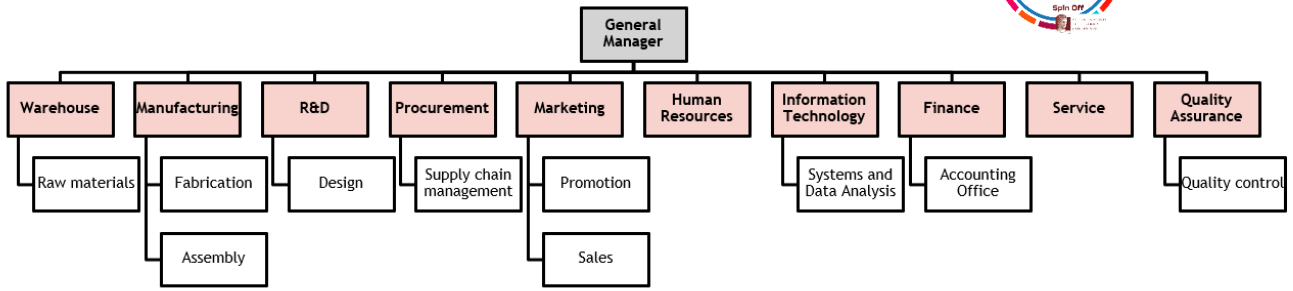
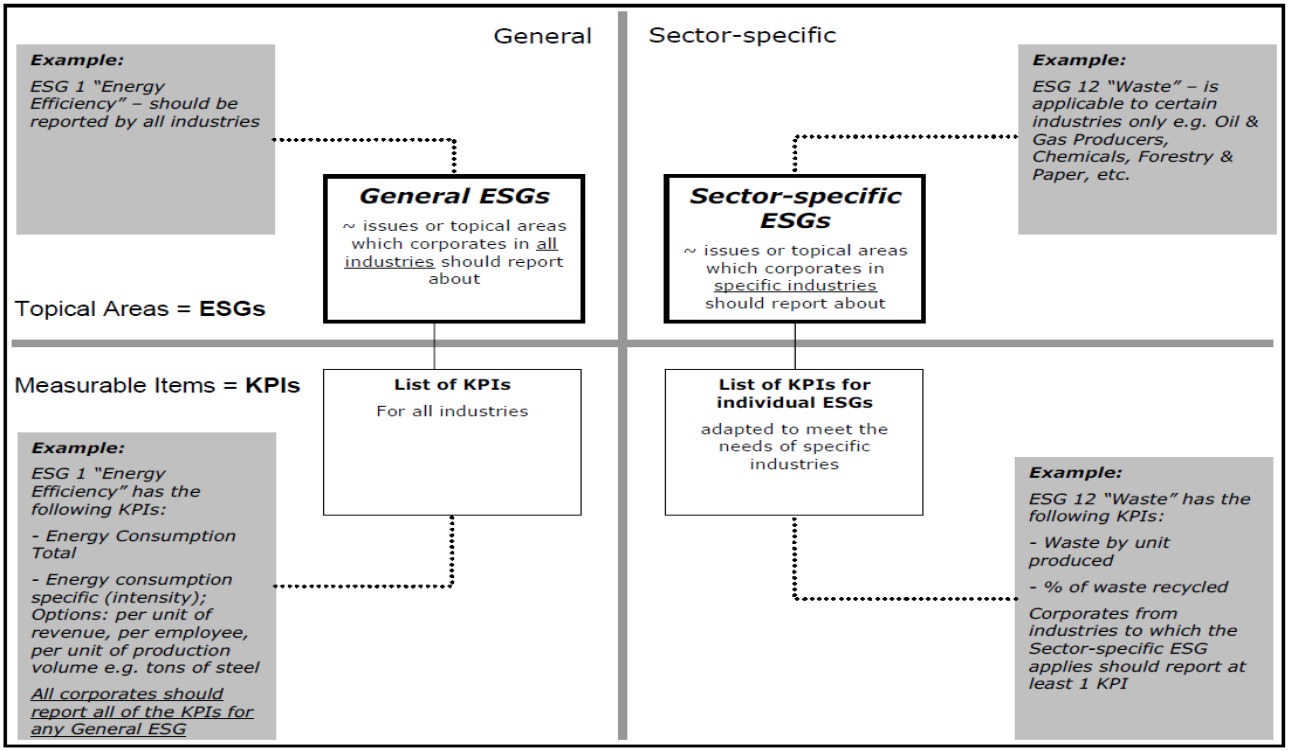


ESG/SDG Footprint - Companies

- Mapping the **value chain** of the company
- ESG **Materiality Assessment** By Stakeholder Type
- Mapping of Relevant **KPIs** across value chain
  (**Multiple Layers** – Generic – Sector Specific – Unit Specific)
- KPIs in Line with **ESRS, CSRD, EU Taxonomy**





Environmental

1 Recycling & waste
2 Water stewardship
3 Carbon emissions

Social

4 Employee development
5 Employee diversity, equity & inclusion
6 Occupational health & safety
7 Employee engagement
8 Community engagement

Governance

9 Business ethics & integrity
10 Transparency & disclosure
11 Data protection & cyber security

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Food Sector Case Study – Material Issues and KPIs

ESG Categories	Material Issues	KPI's Name
Environmental	GHG Emissions	Scope 1 emissions Scope 2 emissions Scope 3 emissions
	Energy Management	Thermal energy consumption Electricity consumption Fuel oil consumption % Renewable Energy Sources (RES)
	Water Consumption	Water consumption
	Waste Management & Circular Economy	Total amount of waste % waste to landfill
	Food Waste	Volume of food waste
	Sustainable Packaging	% of plastic in packaging
	Animal Welfare	Certifications for animal welfare
Social	Product Quality & Safety	Number of recalls
	High Nutritional Value	Number of products promoting healthy nutritional habits
	Employee Health & Safety	Absenteeism Rate Number of work-related accidents
	Diversity, Equality & Inclusion Human Rights	% of women in total workforce Number of human rights violations
	Community Support & Social Contribution	€ money spent Number of ethics-related incidents
Governance	Business Ethics	Code of Conduct in place
	Regulatory Compliance	Number of non-compliance incidents

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ESG Performance / Management

- **Hybrid** Metrics to account for **Profitability** and Size
- Set **Science** & **Policy** Based **Targets** for KPIs and Material Issues
- **Dashboards** and **Pathways** for the implementation of Targets
- Aggregate performance, **ESG scores** and **Ratings** By Pillar
- Model Incorporates **Benchmarking** against Sector Peers
- Test Scenarios to actively manage ESG related risks and opportunities

$$\frac{Water\ Use}{Revenues - Turnover}$$

$$score_k = 100\ \frac{(x_k - LB)}{(Target - LB)}$$

$$Yellow/Orange\ Limit\ (YOL)\ \pm STD(x_k)$$

Pillar	Material Issue	KPI Name	L0 - KPI Score	L0 - KPI Rating
1. Environment	Energy Management	Energy consumption to Sales (GJ/MilEuro)	61,27	3
	Food Waste	% Volume of food waste	67,02	3
	GHG Emissions	Scope 1 emissions	0,00	1
		Scope 2 emissions	0,00	1
		Scope 3 emissions	0,00	1
	Sustainable Packaging	% of Packaging from recycled raw materials	22,80	2
		% of Recyclable packaging	100,00	4
	Waste Management & Circular Economy	% Recyclable waste	100,00	4
		% Waste to landfill	75,94	4
	Water Consumption	Water consumption to Sales (m3 to MilEuro)	28,03	2
2. Social	Community Support & Social Contribution	Number of ethics-related incidents	100,00	4
	Diversity; Equality & Inclusion	% of women in total workforce	74,02	3
	Employee Training & Development	Training and Development	71,71	3
	Human Rights	Number of human rights violations	100,00	4
3. Governance	Regulatory Compliance	Number of non-compliance incidents	100,00	4

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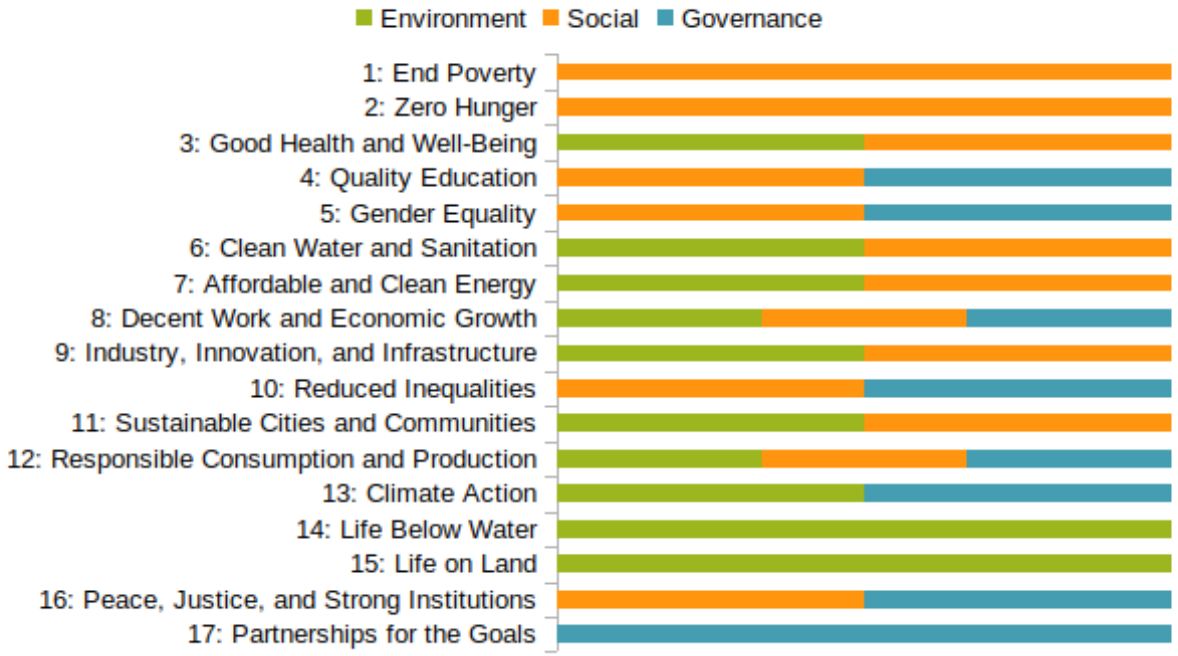
Mapping ESG KPIs to SDG Indicators

- ***ESG KPI***s are mapped to SDGs Indicators.
- ***Experts*** Classification & ***Machine/Deep learning*** Approaches to map ESG KPIs to the 232 Indicators of 17 SDGs.
- **Targets** are set for ESG KPIs following the common **UN SDSN** methodology.



Corporate Sustainability Assessment Framework

Environment

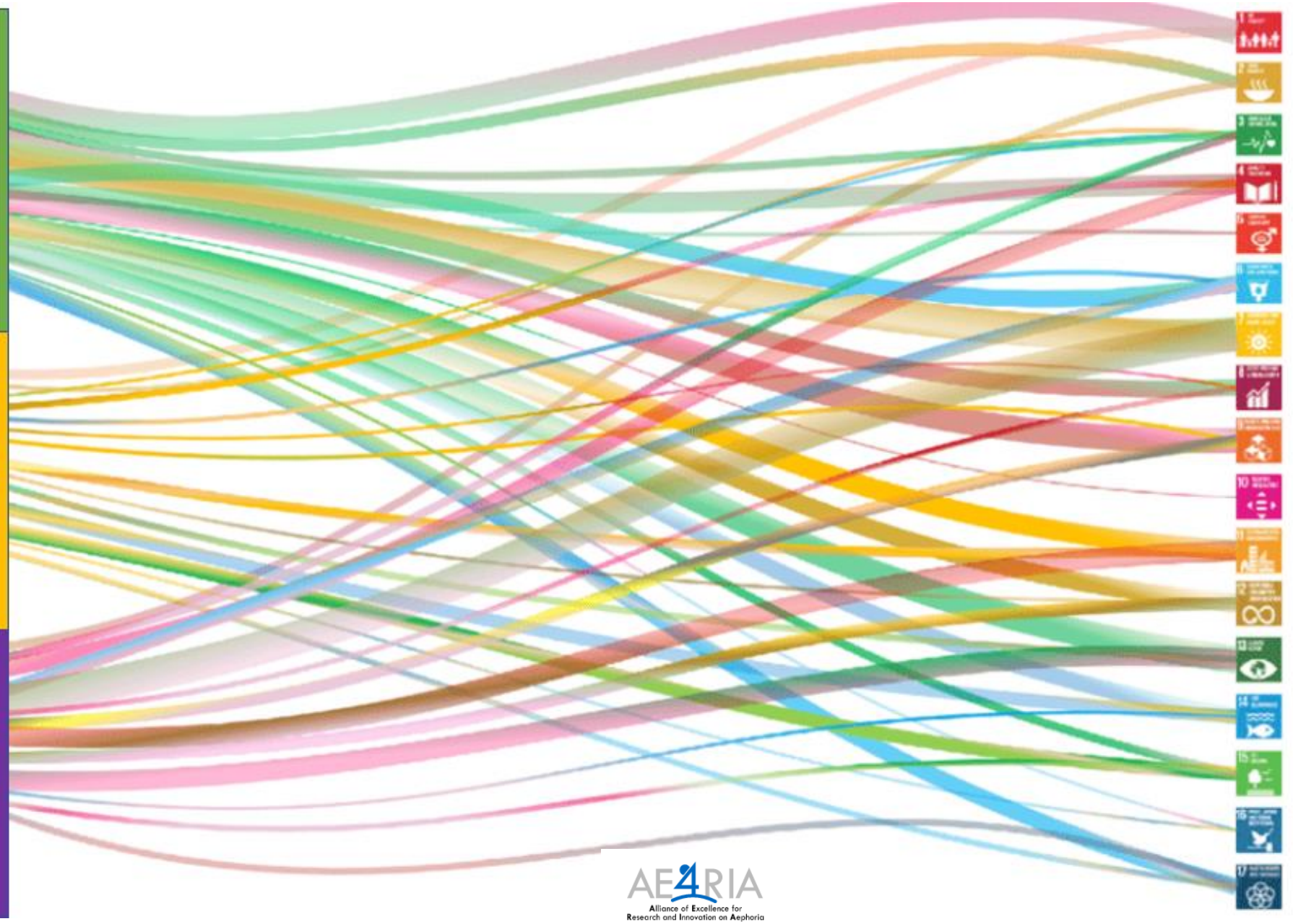
Company's impact (at supply chain level) on the natural environment and its response to the challenge of climate change (greenhouse gas emissions, energy consumption, generation and use of renewable energy, biodiversity and habitat, impact on water resources and deforestation, pollution, efficient use of resources, the reduction and management of waste)

Social

Company's interaction with workers, other stakeholders and the communities in which it operates and the role of the Company in society including: workplace policies ethical/responsible sourcing and social aspects and labour standards of the supply chain, and engagement with and contribution to the broader community through social projects and charitable donations.

Governance:

The ethical conduct of the Company's business including its corporate governance framework, business ethics, policies, code of conduct and the transparency of non-financial reporting.



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Corporate Sustainability Assessment Framework

- **Integrate** SDGs in **CSR** Framework
- **Machine Learning Algorithms** to Map ESG KPIs vs 232 SDG Indicators

$$W_{i,k}^{SDG} = \frac{\sum SDG\ Indicators\ mapped\ to\ KPI_k\ under\ SDG_i}{\sum Indicators\ under\ SDG_i}$$

- Model to Evaluate **SDG performance** at the **Company Level** and **Across the Value Chain**

Environment

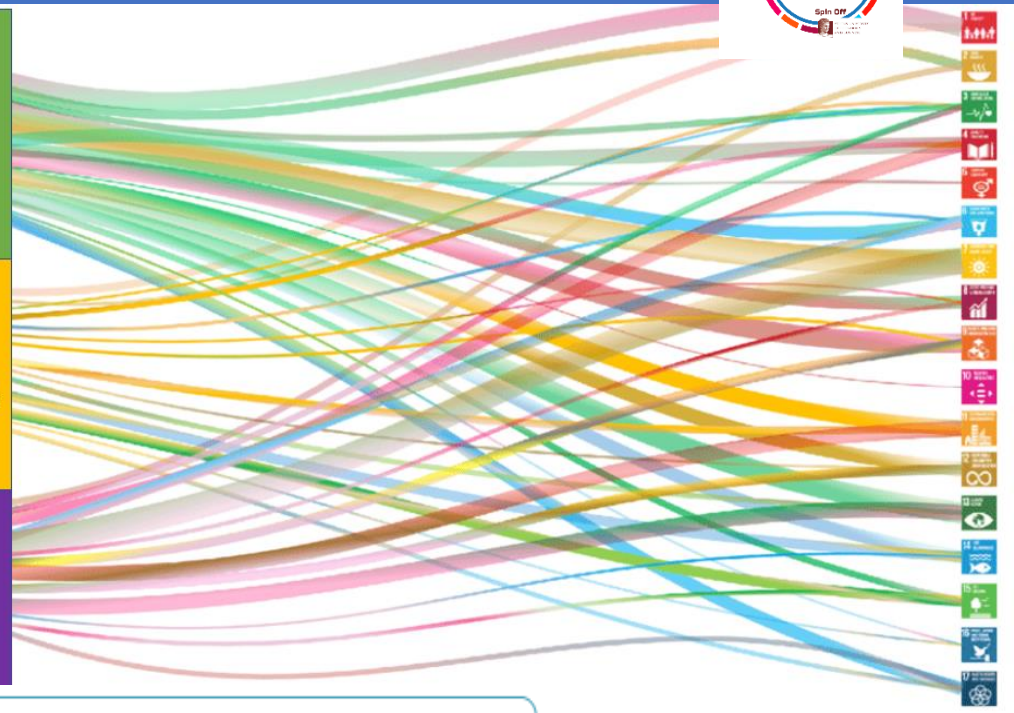
Company's impact (at supply chain level) on the natural environment and its response to the challenge of climate change (greenhouse gas emissions, energy consumption, generation and use of renewable energy, biodiversity and habitat, impact on water resources and deforestation, pollution, efficient use of resources, the reduction and management of waste)

Social

Company's interaction with workers, other stakeholders and the communities in which it operates and the role of the Company in society including: workplace policies ethical/responsible sourcing and social aspects and labour standards of the supply chain, and engagement with and contribution to the broader community through social projects and charitable donations.

Governance:

The ethical conduct of the Company's business including its corporate governance framework, business ethics, policies, code of conduct and the transparency of non-financial reporting.



Value Chain Level 1	Value Chain Level 2	SDG 1	2	3	4	5	6	7	8	9	10	12	13	15	16	17
1. Sourcing	1.1 Inbound Logistics	4	4	4	2	3		4	3	2	4	2	4		4	4
	1.2 Milk Zone	4	4	4	2	3		4	3	2	4	2	4		4	4
	1.3 Raw Materials WH	4	4	4	2	3		4	3	2	4	2	4		4	4
2. Production	2.1 Processing	4	4	4	4	3	2	3	4	3	4	4	3	3	4	4
3. Logistics	3.1 Intercompany	4	4	4	2	1			3	2	2	2	4		4	4
	3.2 Outbound Logistics	4	4	4	2	1			3	2	2	2	4		4	4
4. Sale and end of cycle	4.1 Retail	4	4	4	3			4	3	2	2	2	4		4	4
	4.2 Disposal / recycling	4	4	4	3			4	3	2	2	2	4		4	4

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ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

ReSEES Research laboratory on Socio-Economic and Environmental Sustainability

Food Sector Case Study – Material Issues and KPIs

ESG Categories	Material Issues	KPI's Name
Environmental	GHG Emissions	Scope 1 emissions Scope 2 emissions Scope 3 emissions
	Energy Management	Thermal energy consumption Electricity consumption Fuel oil consumption % Renewable Energy Sources (RES)
	Water Consumption	Water consumption
	Waste Management & Circular Economy	Total amount of waste % waste to landfill
	Food Waste	Volume of food waste
	Sustainable Packaging	% of plastic in packaging
	Animal Welfare	Certifications for animal welfare
Social	Product Quality & Safety	Number of recalls
	High Nutritional Value	Number of products promoting healthy nutritional habits
	Employee Health & Safety	Absenteeism Rate Number of work-related accidents
	Diversity, Equality & Inclusion Human Rights	% of women in total workforce Number of human rights violations
	Community Support & Social Contribution	€ money spent Number of ethics-related incidents
Governance	Business Ethics	Code of Conduct in place
	Regulatory Compliance	Number of non-compliance incidents

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Food Sector Case Study – KPIs Targets and Justification

KPI	Target	Direction	Benchmarking	Justification for Target
Scope 1 emissions	0.00	0	0	Paris Agreement - Net Zero Tagret
Scope 2 emissions	0.00	0	0	Paris Agreement - Net Zero Tagret
Scope 3 emissions (mTon To MilEuro)	1.11	0	1	Industry Benchmarking
Energy consumption to Sales (GJ/MilEuro)	857.90	0	1	Industry Benchmarking
Water consumption to Sales (m3 to MilEuro)	2052.48	0	1	Industry Benchmarking
Volume of food waste (Tonnes)	0.00	0	0	Agenda 2030 SDG12
Total amount of waste to Sales (Tonnes to MilEuro)	9.59	0	1	Industry Benchmarking
% waste to landfill	0.00	0	0	Agenda 2030 SDG9 & SDG12
% recycable waste	0.77	1	1	Industry Benchmarking
% of recycable packaging	1.00	1	0	Agenda 2030 SDG9 & SDG12
Number of recalls	0.00	0	0	Agenda 2030 SDG12
Number of work-related accidents	0.00	0	0	Agenda 2030 SDG12
% of women in total workforce	0.00	0	0	Agenda 2030 SDG8 and SDG10
Number of products promoting healthy nutritional habits	1.00	1	0	Agenda 2030 SDG12
Number of human rights violations	0.00	0	0	Agenda 2030 SDG8
Number of ethics-related incidents	0.00	0	0	Agenda 2030 SDG8
Number of non-compliance incidents	0.00	0	0	Agenda 2030 SDG8

$$score_k = 100 \frac{(x - LB)}{(UB - LB)}$$

- Scores Calculate the distance from the Target adjusted with the Standard deviation of the cross-sectional distribution

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Food Sector Case Study – Benchmarking

Company	Region	Sector		Scores											
		SIC CODE 1	SIC CODE 2	Environment Pillar Score	Social Pillar Score	Governance Pillar Score	ESG Score	Resource Use Score	Emissions Score	Environmental Innovation Score	Workforce Score	Human Rights Score	Product Responsibility Score	Management Score	Shareholders Score
H & H INTERNATIONAL HOLDINGS	Asia Pacific	2023	2099	94.42	60.47	66.03	71.68	98.02	92.63	85.40	76.99	30.31	55.31	71.89	28.70
BEGA CHEESE	Asia Pacific	2022	2096	78.76	66.35	43.62	63.98	91.10	82.42	0.00	94.94	38.28	84.93	46.33	23.67
SAPUTO	North American	2021	2026	89.54	95.05	78.68	89.19	89.63	89.40	84.91	96.52	94.35	99.63	96.20	8.59
NESTLE (MALAYSIA)	Asia Pacific	2026	2023	74.21	68.12	64.16	68.84	88.79	70.20	19.58	86.85	84.18	34.80	58.47	84.56
EMMI AG	Europe	2026	2021	71.04	45.43	60.01	56.60	82.27	69.49	54.29	68.82	30.16	64.58	57.83	63.82
DANONE	Europe	2023	2026	66.07	80.40	58.41	70.54	79.29	54.29	58.91	78.43	83.13	89.51	64.20	32.95
INDOFOOD SUKSES MAKMUR	Asia Pacific	2098	2023	87.13	82.21	79.68	82.96	78.76	95.58	85.40	74.10	73.28	99.09	88.96	36.46
NESTLE INDIA	Asia Pacific	2023	2095	73.91	95.38	57.66	79.36	72.16	75.47	44.55	93.37	93.91	95.60	77.76	13.12
ALMARAI	MENA	2026	2022	51.64	64.90	83.46	65.94	70.58	43.30	0.00	77.23	1.41	99.61	76.15	98.46
VIETNAM DAIRY PRODUCTS	Asia Pacific	2026	2023	72.99	69.81	75.68	72.26	68.73	87.53	21.53	98.19	9.69	95.60	90.74	12.96
NEW HOPE DAIRY 'A'	Asia Pacific	2026	2023	49.61	26.18	30.19	33.96	65.83	43.57	0.00	67.59	9.69	12.82	22.96	18.05
STANDARD FOODS	Asia Pacific	2079	2023	71.59	59.67	64.82	64.44	61.35	93.16	21.53	51.69	45.00	73.19	65.79	51.17
FIRST PACIFIC	Asia Pacific	2034	2023	65.89	64.88	88.99	71.47	55.01	90.21	0.00	65.90	45.00	67.10	87.87	93.20
GLANBIA	Europe	2026	2022	35.99	46.20	51.64	44.69	52.88	29.09	21.53	30.96	37.34	64.64	51.75	57.02
SAVENCIA	Europe	2022	2026	52.44	55.83	35.40	49.52	45.51	65.55	21.53	81.57	63.91	34.97	23.13	86.04
BRIGHT DAIRY & FOOD 'A'	Asia Pacific	2026	2021	66.45	73.51	85.17	74.53	40.61	85.91	84.91	86.40	74.29	62.87	93.06	85.65
NOUMI	Asia Pacific	2023	2026	44.21	29.26	74.55	45.39	37.68	49.75	40.57	70.22	0.00	28.06	97.33	8.92
TAT GIDA SANAYI	Europe	2026	2021	33.37	48.27	35.62	40.68	35.49	32.79	19.58	50.67	25.56	79.29	40.56	18.33
PATANJALI FOODS	Asia Pacific	2079	2021	38.86	51.88	61.94	50.77	29.27	44.57	63.28	74.28	9.34	92.48	47.55	97.99
CHINA FEIHE	Asia Pacific	2023	2026	13.77	21.69	18.44	18.57	28.27	2.62	0.00	13.15	35.03	21.45	8.38	21.11
HOCHDORF N	Europe	2023	2034	18.64	14.73	41.02	22.72	28.10	9.65	21.53	16.27	0.00	34.97	37.45	69.05
CAN-ONE	Asia Pacific	3411	2023	6.64	50.54	60.97	37.09	14.38	2.74	0.00	61.88	38.24	92.31	74.77	3.52
DODLA DAIRY	Asia Pacific	2026	2021	6.83	6.85	50.88	18.35	8.54	6.48	0.00	12.47	0.00	0.00	52.35	67.90
LIFEWAY FOODS	North American	2026	2022	10.40	35.56	81.19	40.25	5.94	0.00	85.40	14.10	0.00	78.24	96.43	84.50
BALADNA FOOD INDUSTRIES CO WLL	MENA	2023	NA	8.98	13.03	53.01	22.31	5.01	14.75	0.00	11.45	0.00	24.87	55.21	59.38
BUBS AUSTRALIA	Asia Pacific	2023	5499	1.78	18.28	19.98	13.98	0.00	0.00	19.58	31.57	0.00	34.80	20.33	32.11
ARABIAN FOOD INDUSTRIES	Africa	2022	2026	0.00	9.15	40.46	14.70	0.00	0.00	0.00	12.65	0.00	12.82	31.94	95.83

- Sector Identification 2020 to 2023 for Diary Products.
- Top 10% performers are identified based on the “Environmental Pillar Score”. For all calculations we use data from Thompson Reuters REFINITIVE.

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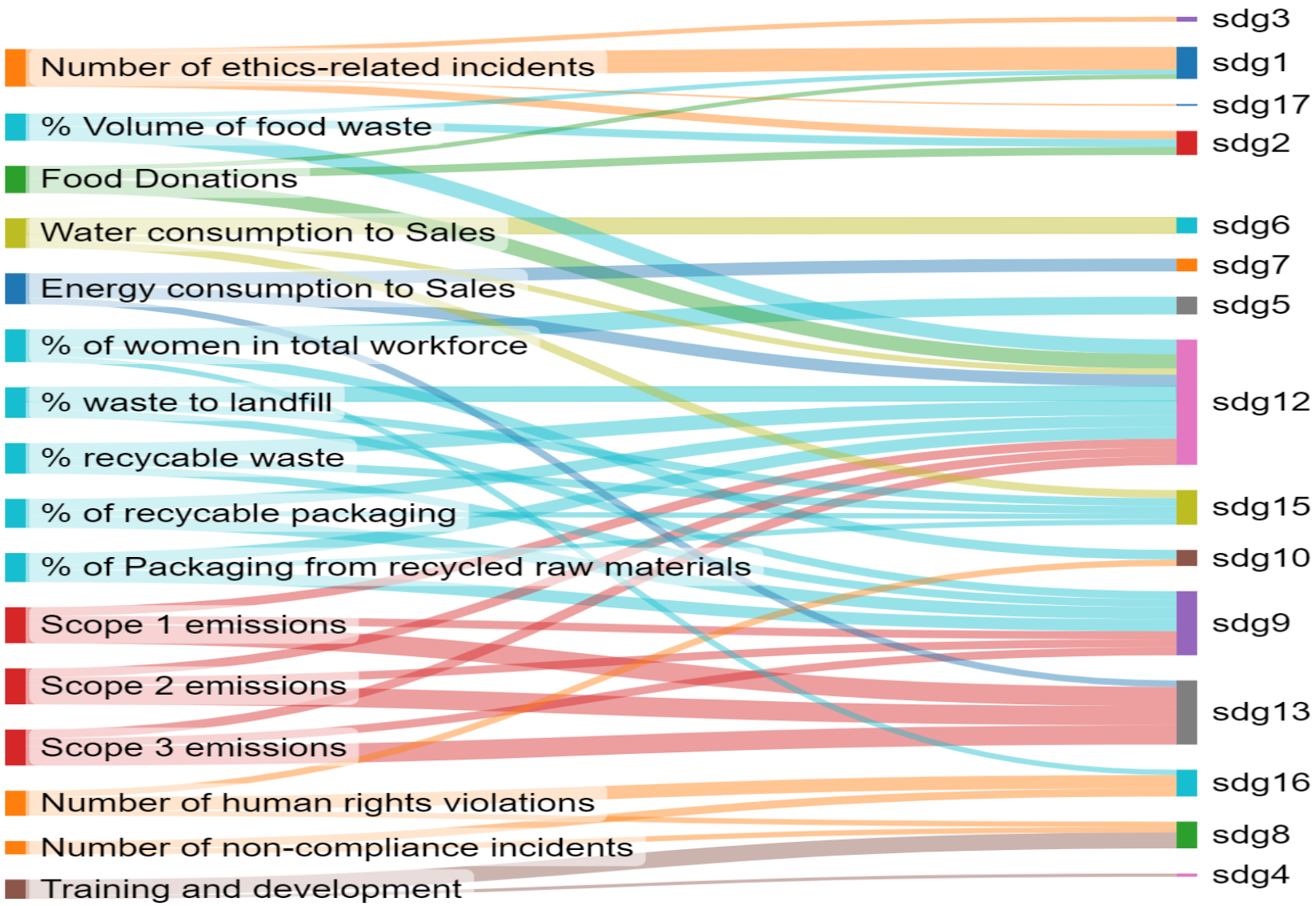
Food Sector Case Study – ESG & SDG Mapping



$$W_{i,k}^{SDG} = \frac{\sum \text{ SDG Indicators mapped to } KPI_k \text{ under } SDG_i}{\sum \text{ Indicators under } SDG_i}$$

$$\widetilde{W_{i,k}^{SDG}} = \frac{W_{i,k}^{SDG}}{\sum_{k=1}^{K} W_{i,k}^{SDG}}$$

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Food Sector Case Study– Dashboard –Scores & Ratings

Pillar	Material Issue	KPI Name	L0 - KPI Score	L0 - KPI Rating
1. Environment	Energy Management	Energy consumption to Sales (GJ/MilEuro)	61,27	3
	Food Waste	% Volume of food waste	67,02	3
	GHG Emissions	Scope 1 emissions	0,00	1
		Scope 2 emissions	0,00	1
		Scope 3 emissions	0,00	1
	Sustainable Packaging	% of Packaging from recycled raw materials	22,80	2
		% of Recyclable packaging	100,00	4
	Waste Management & Circular Economy	% Recyclable waste	100,00	4
		% Waste to landfill	75,94	4
	Water Consumption	Water consumption to Sales (m3 to MilEuro)	28,03	2
2. Social	Community Support & Social Contribution	Number of ethics-related incidents	100,00	4
	Diversity; Equality & Inclusion	% of women in total workforce	74,02	3
	Employee Training & Development	Training and Development	71,71	3
	Human Rights	Number of human rights violations	100,00	4
3. Governance	Regulatory Compliance	Number of non-compliance incidents	100,00	4

	SDG	1	2	3	4	5	6	7	8	9	10	12	13	15	16	17
Value Chain Level 1	Value Chain Level 2															
1. Sourcing	1.1 Inbound Logistics	4	4	4	2	3		4	3	2	4	2	4		4	4
	1.2 Milk Zone	4	4	4	2	3		4	3	2	4	2	4		4	4
	1.3 Raw Materials WH	4	4	4	2	3		4	3	2	4	2	4		4	4
2. Production	2.1 Processing	4	4	4	4	3	2	3	4	3	4	4	3	3	4	4
3. Logistics	3.1 Intercompany	4	4	4	2	1			3	2	2	2	4		4	4
	3.2 Outbound Logistics	4	4	4	2	1			3	2	2	2	4		4	4
4. Sale and end of cycle	4.1 Retail	4	4	4	3			4	3	2	2	2	4		4	4
	4.2 Disposal / recycling	4	4	4	3			4	3	2	2	2	4		4	4

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Ports Case Study – Material Issues and KPIs

Table 1 – Ports KPIs - Material Issues/ Categories

ESG Categories	Material Issues / Categories	# KPIs
Environmental	Climate Change and Environment	6
	Water and Wastewater Management	6
	Energy, Emissions and Energy Efficient Buildings	18
	Biodiversity	6
	Waste, Material and Hazardous Material Management	11
	Environment - Ports Specific	17
Social	Employees	27
	Suppliers	5
	Community	11
	Social - Ports Specific	14
Governance	Highest Governance Body and Committees	12
	Remuneration	5
	Policies	14

Water and Wastewater Management:

Total annual water consumption
Use of wastewater treatment plant
Measures of recycling/reusing water
Employee training programmes on water conservation
Change in local water balance

Environment – Port Specific:

Development of clean energy vessels initiatives
Flood risk management plan
Carbon capture (CO2e) and storage initiatives
Electricity use reduction measures
Total amount of reduced energy (in kWh)
Monitoring of dB inside the Port and the surrounding area
Amount of dB in the port (annual average)
Amount of dB in the surrounding area (annual average)

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Ports Case Study – Benchmarking

Table 6 -Panel A – Benchmarking Scores

Table present the companies included in our benchmarking methodology, so to derive data driven plausible bounds for the scoring and ranking methodology. Highlighted in green are the companies with a SIC (Sector Identification Code) 1 or a SIC 2, defined in the set [2020,2023], that is dairy products. Panel A reports the scores, used to identify top performers, while Panel B reports the value for the KPIs used in the calculations of targets and bounds.

Company	Region	Sector		Scores											
		SIC CODE 1	SIC CODE 2	Environment Pillar Score	Social Pillar Score	Governance Pillar Score	ESG Score	Resource Use Score	Emissions Score	Environmental Innovation Score	Workforce Score	Human Rights Score	Product Responsibility Score	Management Score	Shareholders Score
H & H INTERNATIONAL HOLDINGS	Asia Pacific	2023	2099	94.42	60.47	66.03	71.68	98.02	92.63	85.40	76.99	30.31	55.31	71.89	28.70
BEGA CHEESE	Asia Pacific	2022	2096	78.76	66.35	43.62	63.98	91.10	82.42	0.00	94.94	38.28	84.93	46.33	23.67
SAPUTO	North American	2021	2026	89.54	95.05	78.68	89.19	89.63	89.40	84.91	96.52	94.35	99.63	96.20	8.59
NESTLE (MALAYSIA)	Asia Pacific	2026	2023	74.21	68.12	64.16	68.84	88.79	70.20	19.58	86.85	84.18	34.80	58.47	84.56
EMMI AG	Europe	2026	2021	71.04	45.43	60.01	56.60	82.27	69.49	54.29	68.82	30.16	64.58	57.83	63.82
DANONE	Europe	2023	2026	66.07	80.40	58.41	70.54	79.29	54.29	58.91	78.43	83.13	89.51	64.20	32.95
INDOFOOD SUKSES MAKMUR	Asia Pacific	2098	2023	87.13	82.21	79.68	82.96	78.76	95.58	85.40	74.10	73.28	99.09	88.96	36.46
NESTLE INDIA	Asia Pacific	2023	2095	73.91	95.38	57.66	79.36	72.16	75.47	44.55	93.37	93.91	95.60	77.76	13.12
ALMARAI	MENA	2026	2022	51.64	64.90	83.46	65.94	70.58	43.30	0.00	77.23	1.41	99.61	76.15	98.46
VIETNAM DAIRY PRODUCTS	Asia Pacific	2026	2023	72.99	69.81	75.68	72.26	68.73	87.53	21.53	98.19	9.69	95.60	90.74	12.96
NEW HOPE DAIRY 'A'	Asia Pacific	2026	2023	49.61	26.18	30.19	33.96	65.83	43.57	0.00	67.59	9.69	12.82	22.96	18.05
STANDARD FOODS	Asia Pacific	2079	2023	71.59	59.67	64.82	64.44	61.35	93.16	21.53	51.69	45.00	73.19	65.79	51.17
FIRST PACIFIC	Asia Pacific	2034	2023	65.89	64.88	88.99	71.47	55.01	90.21	0.00	65.90	45.00	67.10	87.87	93.20
GLANBIA	Europe	2026	2022	35.99	46.20	51.64	44.69	52.88	29.09	21.53	30.96	37.34	64.64	51.75	57.02
SAVENCIA	Europe	2022	2026	52.44	55.83	35.40	49.52	45.51	65.55	21.53	81.57	63.91	34.97	23.13	86.04
BRIGHT DAIRY & FOOD 'A'	Asia Pacific	2026	2021	66.45	73.51	85.17	74.53	40.61	85.91	84.91	86.40	74.29	62.87	93.06	85.65
NOUMI	Asia Pacific	2023	2026	44.21	29.26	74.55	45.39	37.68	49.75	40.57	70.22	0.00	28.06	97.33	8.92
TAT GIDA SANAYI	Europe	2026	2021	33.37	48.27	35.62	40.68	35.49	32.79	19.58	50.67	25.56	79.29	40.56	18.33
PATANJALI FOODS	Asia Pacific	2079	2021	38.86	51.88	61.94	50.77	29.27	44.57	63.28	74.28	9.34	92.48	47.55	97.99
CHINA FEIHE	Asia Pacific	2023	2026	13.77	21.69	18.44	18.57	28.27	2.62	0.00	13.15	35.03	21.45	8.38	21.11
HOCHDORF N	Europe	2023	2034	18.64	14.73	41.02	22.72	28.10	9.65	21.53	16.27	0.00	34.97	37.45	69.05
CAN-ONE	Asia Pacific	3411	2023	6.64	50.54	60.97	37.09	14.38	2.74	0.00	61.88	38.24	92.31	74.77	3.52
DODLA DAIRY	Asia Pacific	2026	2021	6.83	6.85	50.88	18.35	8.54	6.48	0.00	12.47	0.00	0.00	52.35	67.90
LIFEWAY FOODS	North American	2026	2022	10.40	35.56	81.19	40.25	5.94	0.00	85.40	14.10	0.00	78.24	96.43	84.50
BALADNA FOOD INDUSTRIES CO WLL	MENA	2023	NA	8.98	13.03	53.01	22.31	5.01	14.75	0.00	11.45	0.00	24.87	55.21	59.38
BUBS AUSTRALIA	Asia Pacific	2023	5499	1.78	18.28	19.98	13.98	0.00	0.00	19.58	31.57	0.00	34.80	20.33	32.11
ARABIAN FOOD INDUSTRIES	Africa	2022	2026	0.00	9.15	40.46	14.70	0.00	0.00	0.00	12.65	0.00	12.82	31.94	95.83

- Sector Identification 2020 to 2023 for Dairy Products.
- Top 10% performers are identified based on the “Environmental Pillar Score”. For all calculations we use data from Thompson Reuters REFINITIVE.

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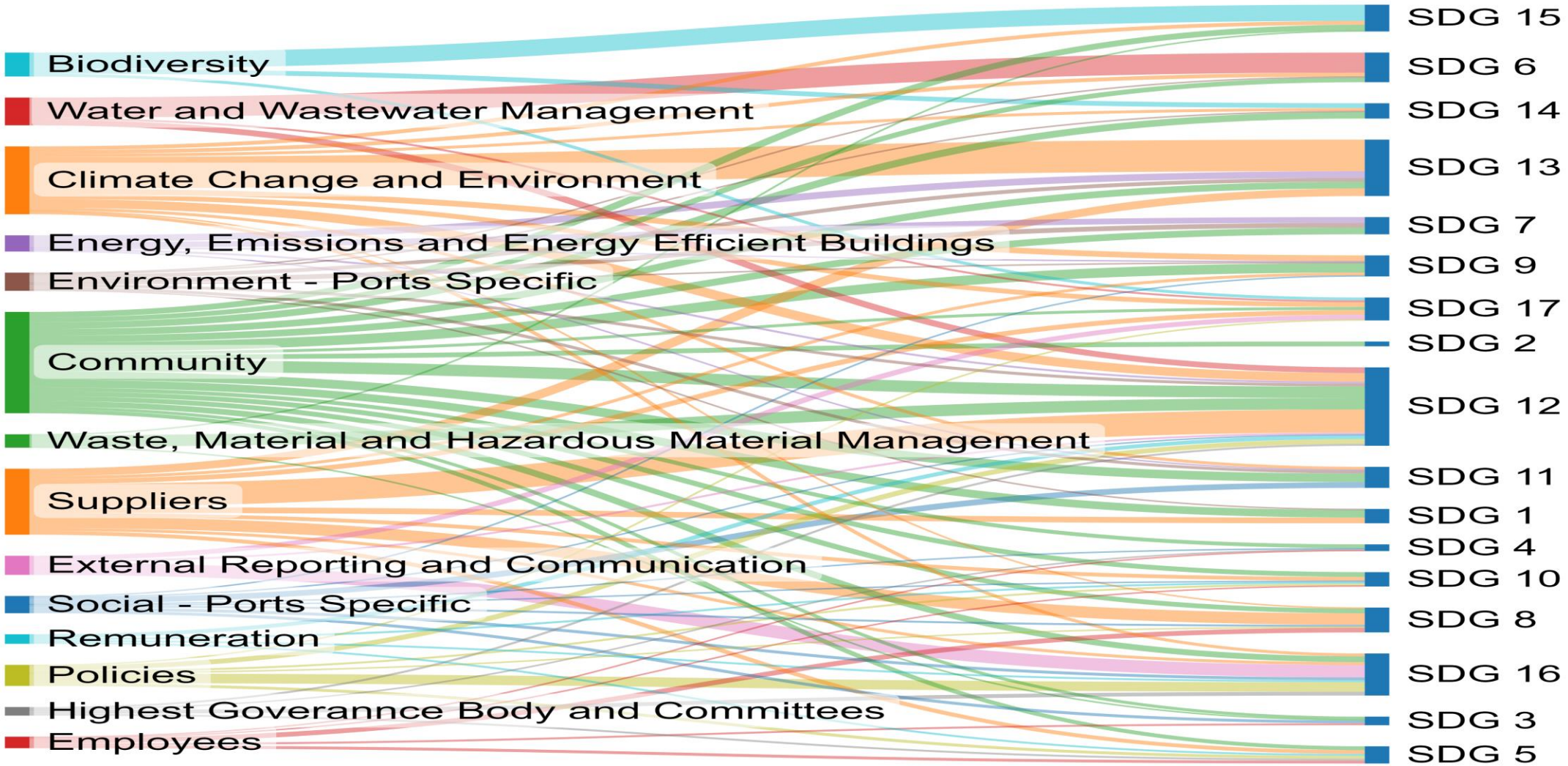
Ports Case Study – ESG & SDG Mapping



$$W_{i,k}^{SDG} = \frac{\sum SDG\ Indicators\ mapped\ to\ KPI_k\ under\ SDG_i}{\sum Indicators\ under\ SDG_i}$$

$$\widetilde{W_{i,k}^{SDG}} = \frac{W_{i,k}^{SDG}}{\sum_{k=1}^{K} W_{i,k}^{SDG}}$$

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Ports Case Study – Dashboard -Scores

ESG/SDG Dashboard Scores	ESG scores	SDG Scores					
							
ESG	**55.36**						
Environmental	***39.86***						
Biodiversity	63.64						
Climate Change and Environment	70.00	***70.37***	***75.00***	***55.56***	***62.50***	***84.23***	***64.58***
Energy, Emissions and Energy Efficient Buildings	17.24						
Environment - Ports Specific	34.02						
Waste, Material and Hazardous Material Management	47.65						
Water and Wastewater Management	53.11	***38.46***	***74.83***	***55.19***	***70.59***	***47.53***	***46.94***
Governance	***52.20***						
External Reporting and Communication	14.74						
Highest Goverannce Body and Committees	94.00						
Policies	65.79	***25.33***	***73.33***	***72.00***	***36.08***	***28.35***	
Remuneration	77.78						
Social	***76.48***						
Community	80.00						
Employees	79.17						
Social - Ports Specific	68.18						
Suppliers	77.78						

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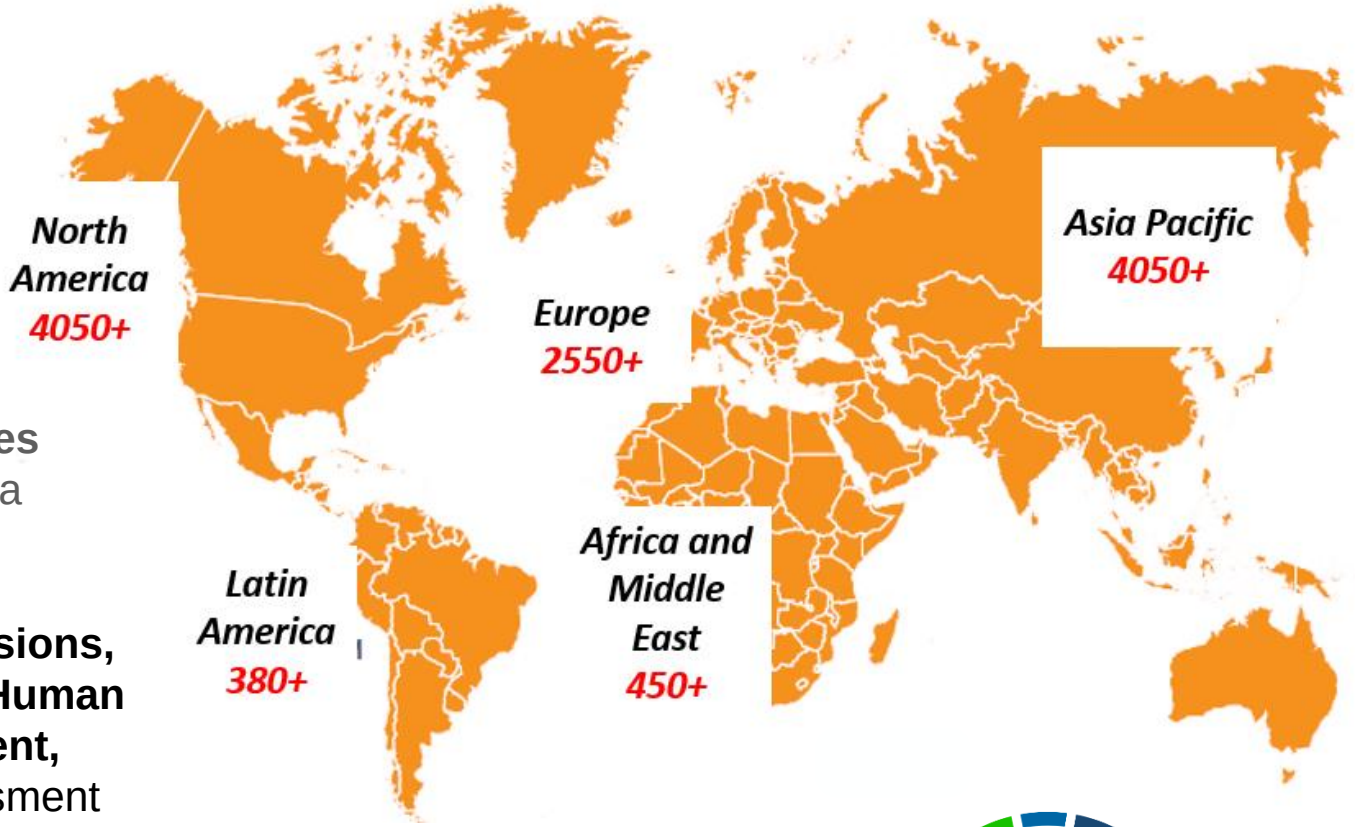
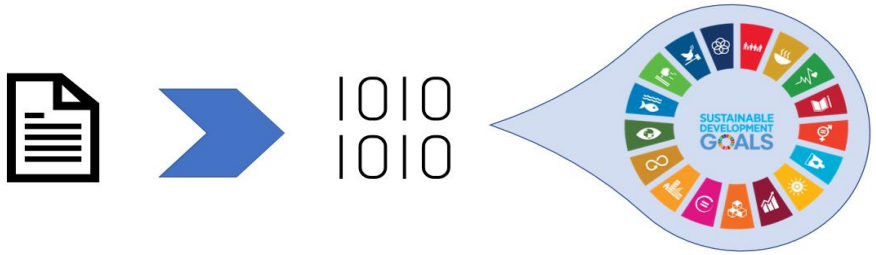
Ports Case Study – Dashboard - Ratings

ESG/SDG Dashboard Ratings	ESG Ratings	SDG Ratings					
ESG	3.0						
Environmental	2.0						
Biodiversity	3.0						
Climate Change and Environment	3.0	3.0	4.0	3.0	3.0	4.0	3.0
Energy, Emissions and Energy Efficient Buildings	1.0						
Environment - Ports Specific	2.0						
Waste, Material and Hazardous Material Management	2.0						
Water and Wastewater Management	3.0	2.0	3.0	3.0	3.0	2.0	2.0
Governance	3.0						
External Reporting and Communication	1.0						
Highest Goverannce Body and Committees	4.0						
Policies	3.0	2.0	3.0	3.0	2.0	2.0	
Remuneration	4.0						
Social	4.0						
Community	4.0						
Employees	4.0						
Social - Ports Specific	3.0						
Suppliers	4.0						

ESG/SDG Footprint – Financial Portfolios

- Extend Dataset Covering **11.000+** Companies Worldwide (**97%** of Global Market Cap)
- **>600 ESG KPIs** from Reuters, Bloomberg, Asset 4
- Arbitrage Asset Pricing Theory extend Fama & French Model to create factors mimicking ESG/ SDG related Risk
- **Machine Learning Based** KPIs – Measuring **Controversies** in ESG Performance by processing News and Social Media Coverage (KPIs Controlling for **Green Washing**)
- **ESG Scores** (By Pillar and By **10 material issues – Emissions, Environmental Innovation, Resource Use, Workforce, Human Rights, Community, Product Responsibility, Management, CSR, Shareholders**) based on a double materiality assessment by sector





AE4RIA Metrix

Spin Off

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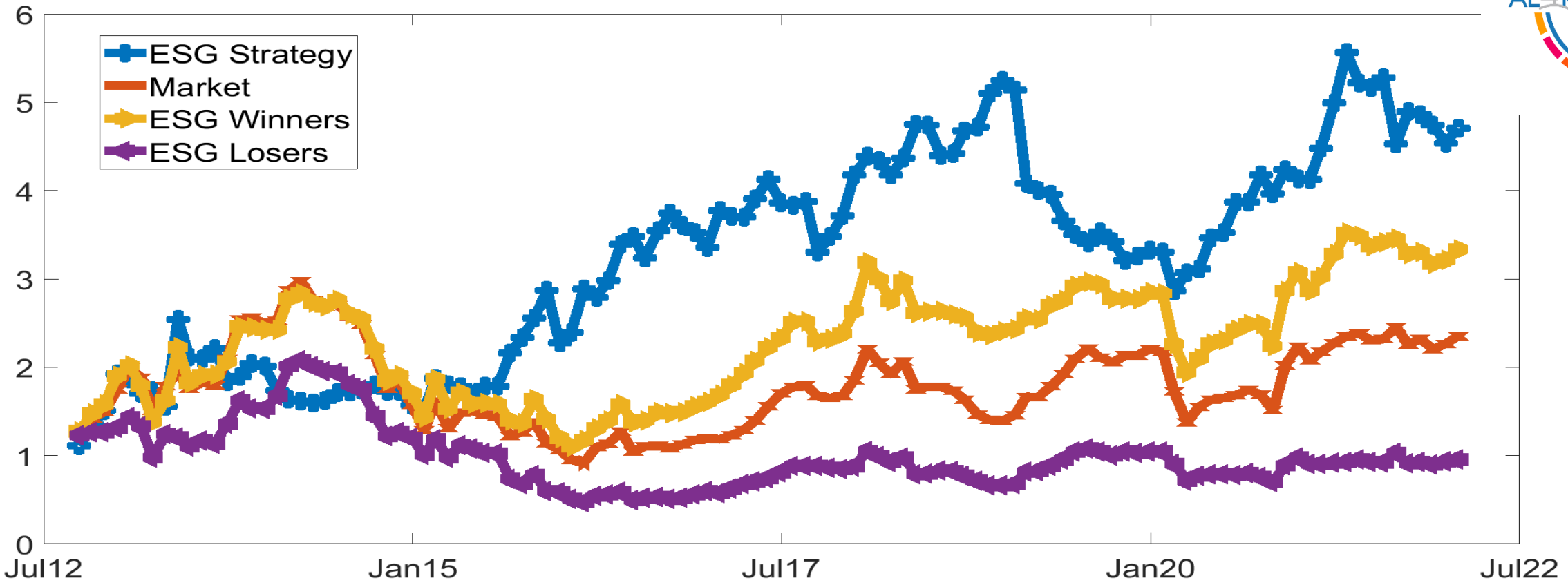
ESG Momentum in Internationall Stock Exchanges

- Strong **ESG Momentum (ESGM)** In International Stock Markets



- Value of 1 dollar Invested to **ESGM Winners vs ESGM Losers**
  ESGM Winners significantly outperform the market
  ESGM Losers significantly underperform the market

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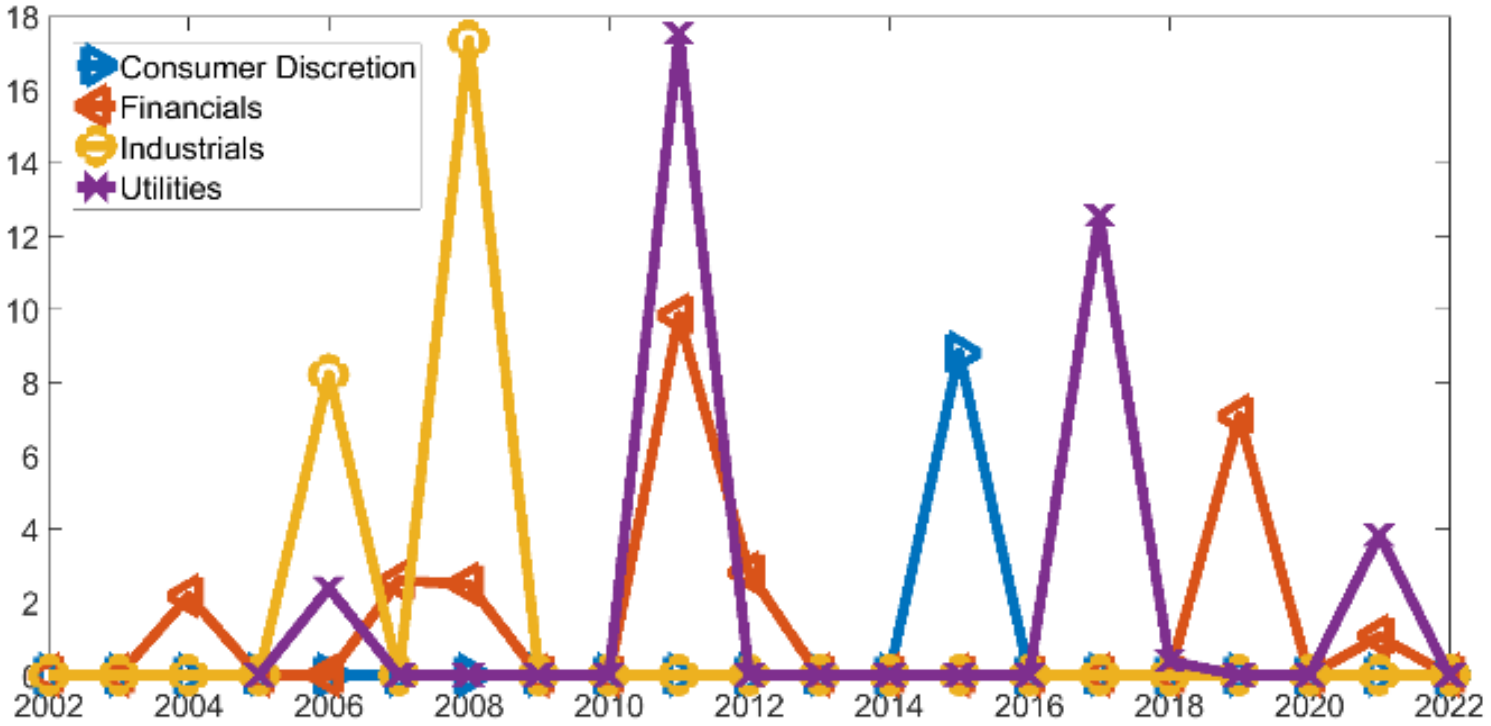
ReSEES Research laboratory on Socio-Economic and Environmental Sustainability

AE4RIA Alliance of Excellence for Research and Innovation on Aephoria

Level of Greenwashing in International Stock Exchange



- ESG Score VS **ESG Controversies**
- Controversies reveal **Inconsistencies** in Performance as **reported by Company**
- Absence of a policy to impose auditing of Sustainability Related data
- Example: Greek Companies listed in Athens Stock Exchange

Consumer Discretion	Financials	Industrials	Utilities
0.42	**1.34**	1.22	**2.04**
(1.12)	**(2.92)**	(1.31)	**(2.64)**

- Statistically Significant Green-Washing to **Financials** and **Utilities** Sectors
- Green-Washing decrease post 2019 with the introduction of EU policies

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ReSEES — Research laboratory on Socio-Economic and Environmental Sustainability

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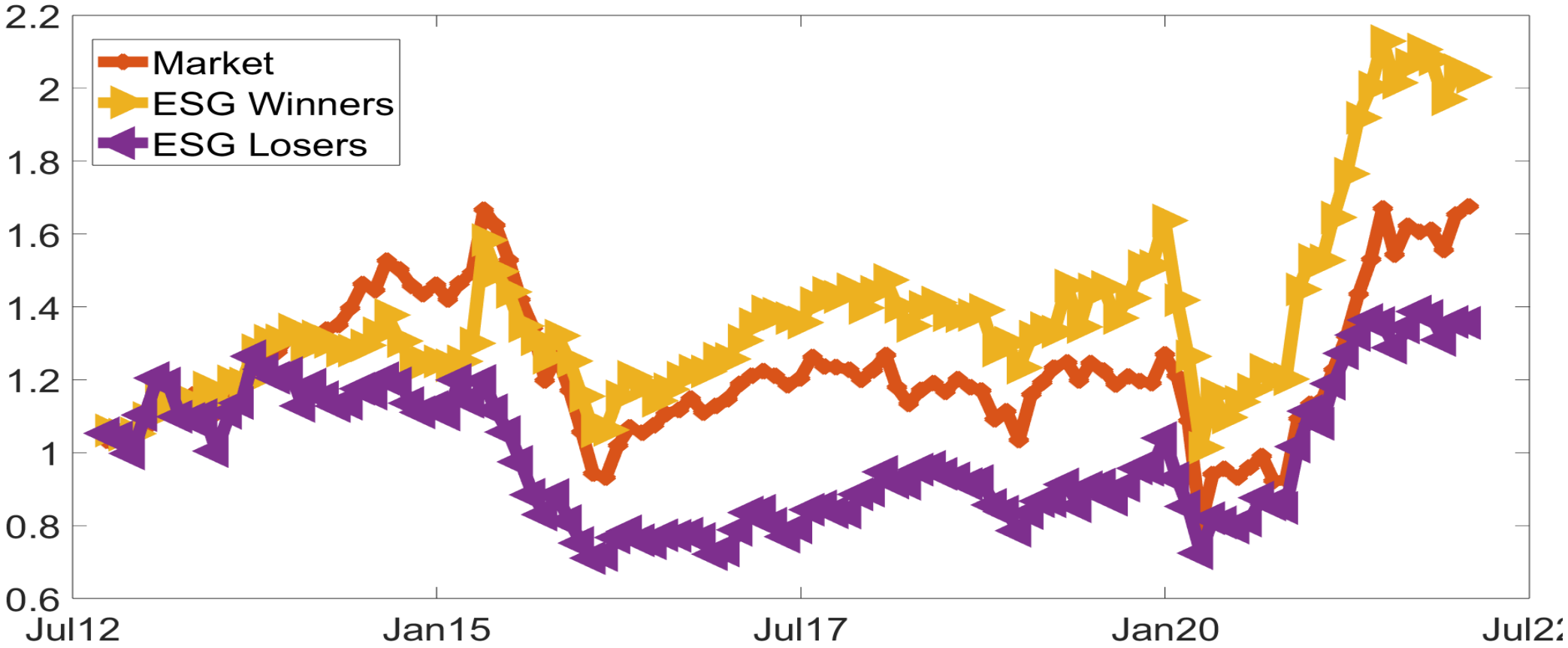
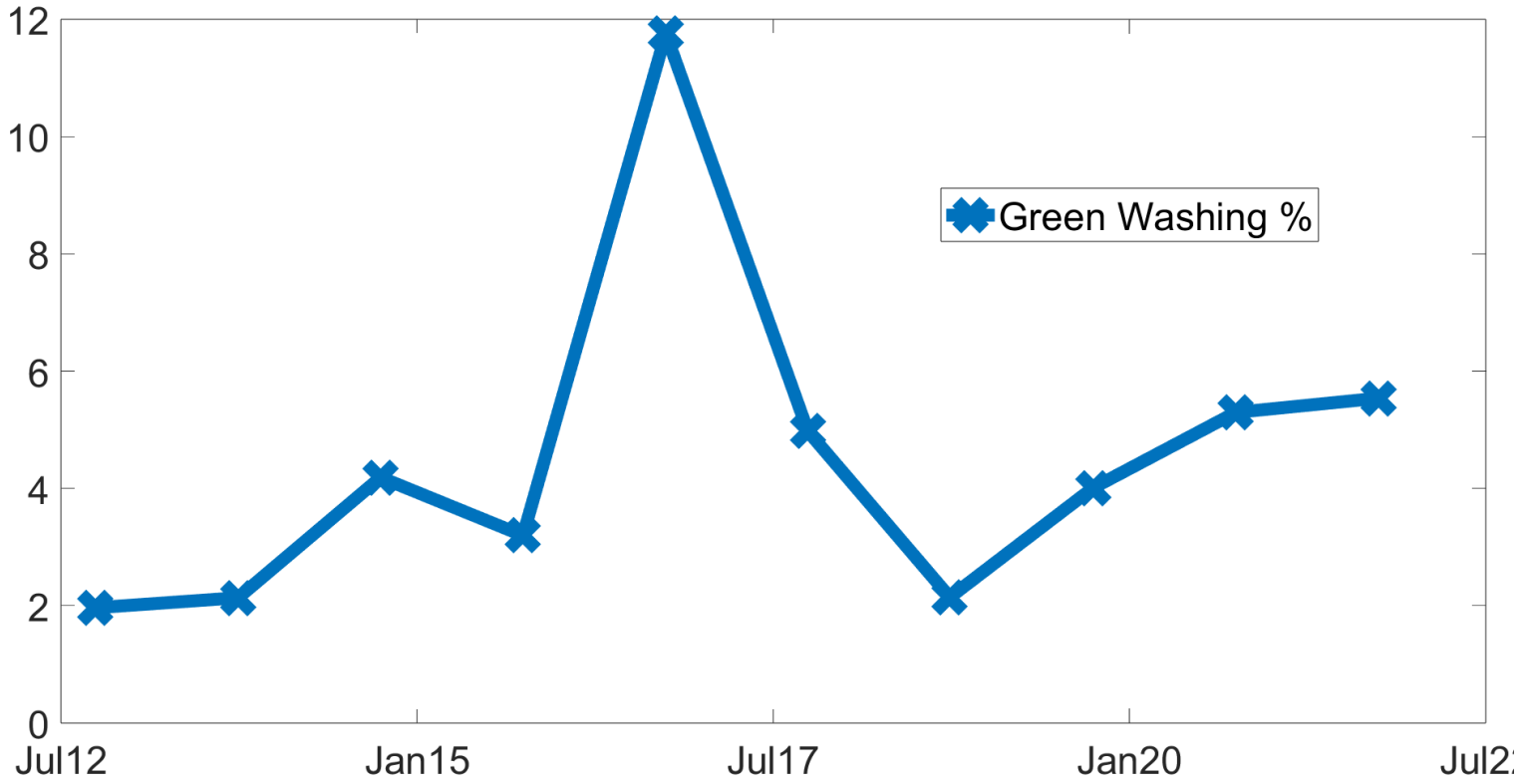
ESG Momentum - Shipping Companies

- Strong **ESG Momentum (ESGM)** In Shipping Sector Global



- Value of 1 dollar Invested to **ESGM Winners vs ESGM Losers**
  ESGM Winners significantly outperform the market
  ESGM Losers significantly underperform the market

Level of Greenwashing in Shipping Sector (Global)



- ESG Score VS **ESG Controversies**
- Controversies reveal **Inconsistencies** in Performance as **reported by Company**
- Absence of a policy to impose auditing of Sustainability Related data
- Example: Shipping Companies listed in International Stock Exchanges

Shipping
4.52
(4.66)

- Statistically Significant Green-Washing to **Shipping Sector**

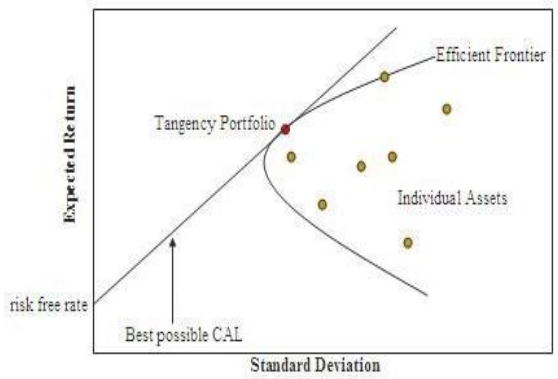
ESG Pricing Model

- The Capital Asset Pricing Model (CAPM, Sharpe 1964) describes the relationship between systematic risk and expected return for assets: linear relationship between the required return on an investment and its risk. The model is based on the relationship between an asset's beta, the risk-free rate (typically the Treasury bill rate), and the equity risk premium, or the expected return on the market minus the risk-free rate.

$$r_{p,t} - r_{f,t} = \beta_0 + \beta_1 \left(r_{m,t} - r_{f,t}\right) + \varepsilon_t$$

- Fama and French (1992,1993) augmented the model to account for other sources of priced risk, that is size (market capitalization) of companies and their Value (book value: shareholder's equity to market capitalization ratio).

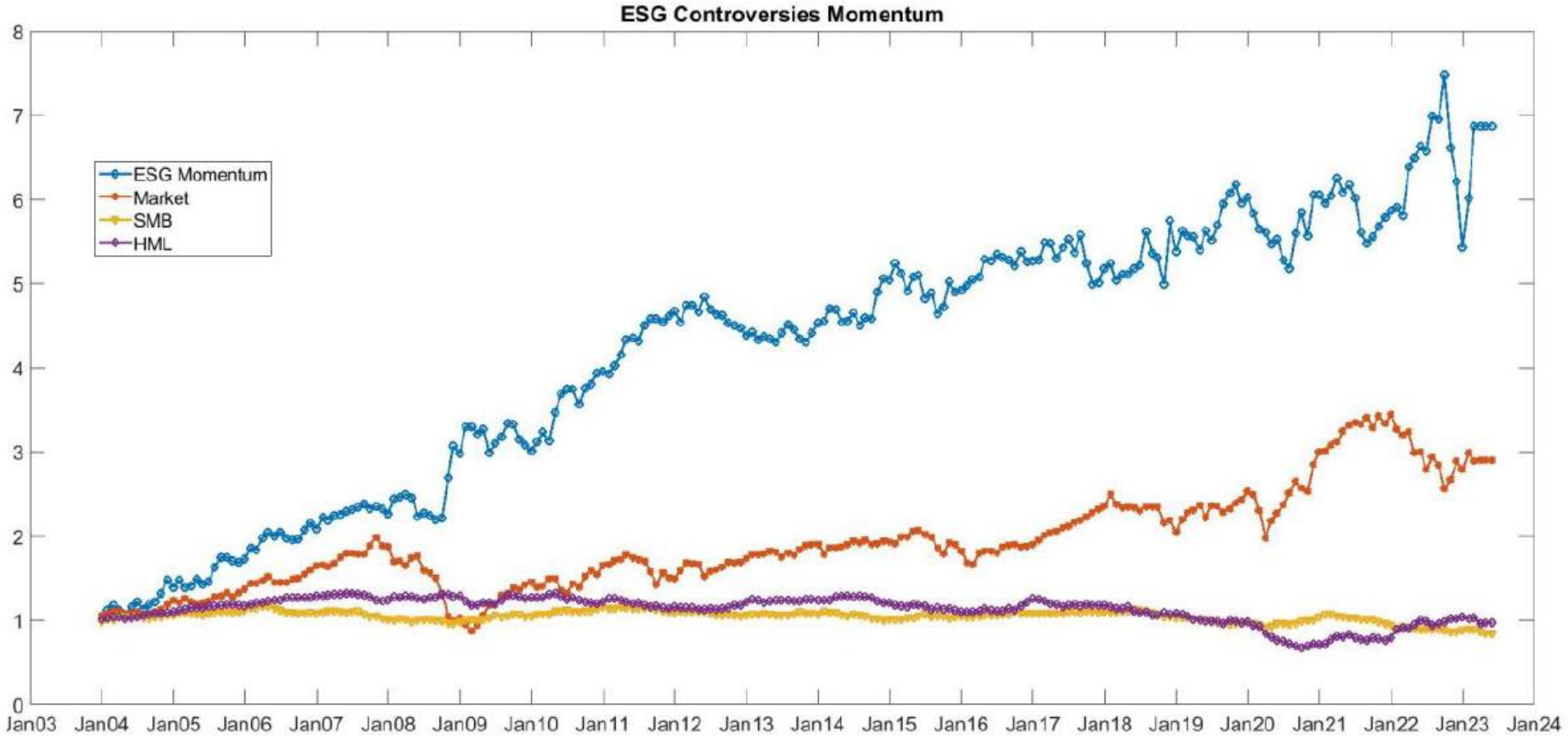
$$r_{p,t} - r_{f,t} = \beta_0 + \beta_1 \left(r_{m,t} - r_{f,t}\right) + \beta_2 \left(SMB_t\right) + \beta_3 \left(HML_t\right) + \varepsilon_t$$



- **Expand Fama and French Methodology to account for ESG related risks:**

$$r_{p,t} - r_{f,t} = \beta_0 + \beta_1 \left(r_{m,t} - r_{f,t}\right) + \beta_2 \left(SMB_t\right) + \beta_3 \left(HML_t\right) + \beta_4 \left(ESG_t\right) + \varepsilon_t$$

AE4RIA ESG Pricing Factor



ESG Combined (ESG + Controversies) Momentum **Factor Mimicking Portfolio** – A well diversified Double sorted Portfolio on Size (market cap and ESG momentum) following Fama and French methodology

- **Value of 1 dollar invested in an ESG factor-mimicking portofolios Hedging against ESG related risk**
- Model Produces lower absolute pricing errors and a lower GRS tests in pricing 20 ESG Momentum and Controversies portfolios.

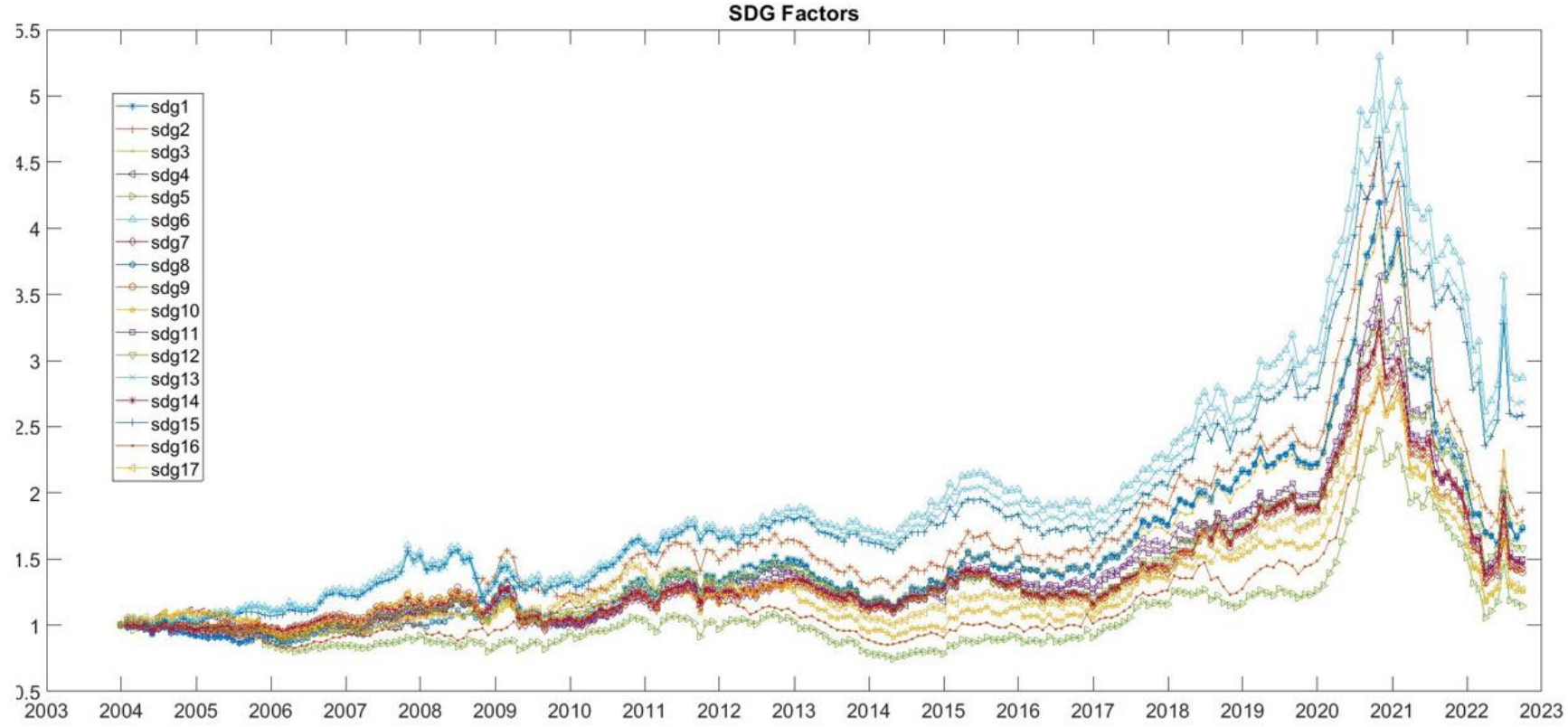
	$\frac{\sum_{i=1}^{20}\lvert a_i\rvert}{20}$	**GRS Test**
3 Factor Model	0.0015	2.73*** (p=0.00)
ESG Factor Model	0.001	2.05** (p=0.02)

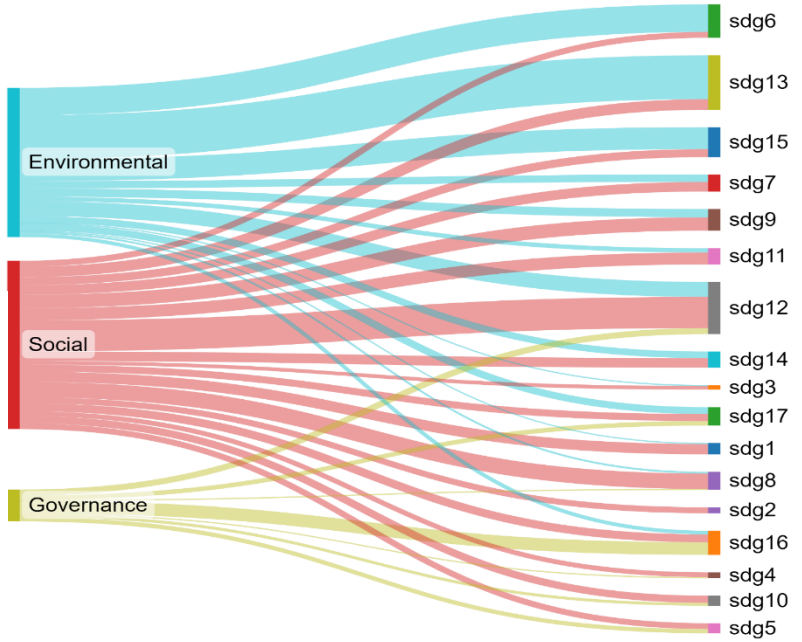
AE4RIA's SDG Pricing Factors

- Machine Learning Algorithms to Map ESG KPIs to 232 SDG Indicators

- **AE4RIA's SDG** Pricing Model:

$$r_{p,t} - r_{f,t} = \beta_0 + \beta_1 \left(r_{m,t} - r_{f,t}\right) + \beta_2 \left(SMB_t\right) + \beta_3 \left(HML_t\right) + \sum_{i=4}^{20} \beta_i \left(SDG_{i-3,t}\right) + \varepsilon_t$$





- Sensitivity of portfolio with respect to factor f_k is

$$\gamma_k = \sum_j \alpha_j \beta_{jk}$$

- SDG Footprint = the sensitivity of portfolio to the specific SDG factors.

Portfolio SDG Footprint – SDG Pricing Model

- Regress portfolio returns on factor directly or on portfolio that mimics SDG factor:

$$r_{p,t} - r_{f,t} = \beta_0 + \beta_1 \left(r_{m,t} - r_{f,t}\right) + \beta_2 \left(SMB_t\right) + \beta_3 \left(HML_t\right) + \sum_{i=4}^{20} \beta_i \left(SDG_{i-3,t}\right) + \varepsilon_t$$

  where:

  $r_{f,t}$ = risk free rate – A short Term Treasury Bill or Interbank rate as a proxy.

- Suppose portfolio contains N shares $\alpha_1, \ldots, \alpha_N$ with $\sum_j^N \alpha_j = 1$.
  Weights of Portfolio Assets Sum to 1.

- Sensitivity of portfolio with respect to factor f_k is
  $\gamma_k = \sum_j \alpha_j \beta_{jk}$

- Footprint to SDGs as the sensitivity of portfolio to the specific SDG factors.

Portfolio SDG Footprint – SDG Pricing Model - SMEs

- We use the SDG scores calculated for companies publishing Sustainability Reports.
- For each SDG we calculate sectoral zero- cost portfolios, mimicking SDG factors, using the Fama and French (2015) methodology.
- Sector Specific Factor Mimicking Portfolios are double sorted on Size (market Capitalization) and performance on SDG:

  6 value weighted Portfolios from the intersection of 2 Size and 3 SDG Performance categories :

  50% breakpoint are used to classify companies as Big or Small based on Market Capitalization
  (Small – Big)
  30%-40%-30% breakpoints are used to classify companies as having a good performance on SDG_i
  (high SDG_i – medium SDG_i - low SDG_i)

SDG_i factor is calculated as the difference between the average return of the 2 portfolios which contain stocks with a high performance on SDG_i minus the average of the two portfolios which contain stocks with a low performance on SDG_i.

$$SDG_i = \frac{1}{2}(highSDG_I\text{Big} + highSDG_I\text{Small}) - \frac{1}{2}(lowSDG_I\text{Big} + lowSDG_I Small)$$

Portfolio SDG Footprint – SDG Pricing Model

- Regress portfolio returns on factor directly or on portfolio that mimics SDG factor:

$$r_{p,t} - r_{f,t} = \beta_0 + \beta_1 \left(r_{m,t} - r_{f,t}\right) + \beta_2 \left(SMB_t\right) + \beta_3 \left(HML_t\right) + \sum_{i=4}^{20} \beta_i \left(SDG_{i-3,t}\right) + \varepsilon_t$$

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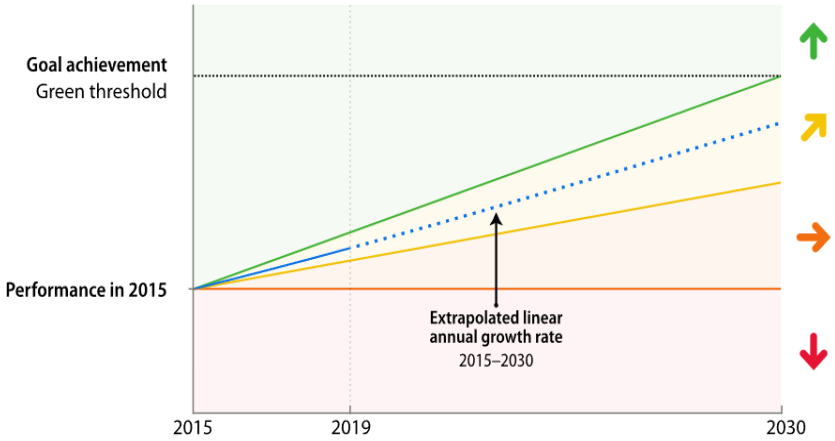
- Footprint to SDGs as the sensitivity of portfolio to the specific SDG factors.

Company/ Portfolio Level Dashboards

- *Enhance **Indicators** to **account** for the **Value** and the Flow of **Externalities***

- *ES Valuation Based KPIs and Trends At National / Regional and Global Level*



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Thank You!!

Contact us: Prof. Phoebe Koundouri

pkoundouri@aueb.gr

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