

11. BIENALNO 2026
SAVJETOVANJE

Suvremeni izazovi u
laboratorijima i mjeriteljstvu

Opatija, 4 opatijska cvijeta, 23-25. travnja
www.HMD-konferencija.hr

HMD
HRVATSKO MJERITELJSKO DRUŠTVO
CROATIAN METROLOGY SOCIETY

ECL
EUROPEAN CENTRE FOR
LABORATORY EXCELLENCE



Marija Cundeva-Blajer

Ss. Cyril & Methodius University in Skopje

Faculty of Electrical Engineering and Information Technologies-Skopje

Republic of North Macedonia



**SUSTAINABILITY OF CONFORMITY ASSESSMENT
BODIES - BETWEEN ENVIRONMENTAL REQUIREMENTS
AND MARKET REALITY**



Contents/Outline

- **Introduction**

- **Guidelines for managing sustainability in CABs**
 - Background
 - Eurolab Position Paper
 - Eurolab Technical Report 1/2025

- **Methodology for evaluation the laboratory maturity towards the UN SDGs**



Contents/Outline

- **KPIs for tracking environmental sustainability performance**
- **KPIs for tracking social sustainability performance**
- **KPIs for tracking governance sustainability performance**
- **Case Study**
 - Maturity evaluation of laboratory sustainability
 - Strategic measures for improvement towards greener and more sustainable lab
 - Assessment of the introduced strategic documents in context of the UN SDGs
 - Achievements and lessons learnt



Contents/Outline

- **Practical tips for strategic measures for management improvement towards greener and more sustainable lab**
 - Tools and resources
- **Discussion and conclusions**



Introduction

- **Quality Infrastructure (QI)** is a crucial element in promoting and sustaining economic development.
- QI is also important for environmental and social wellbeing, thereby contributing to the Sustainable Development Goals (SDGs) as part of the 2030 Agenda for Sustainable Development.

SUSTAINABLE DEVELOPMENT GOALS





Introduction

- Such a system relies on metrology, standardization, accreditation, conformity assessment, and market surveillance, and **Conformity Assessment Bodies (CABs) are a key component.**
- CABs are necessary for proving the compliance of products and services with regulations and conformity with market requirements.

SUSTAINABLE DEVELOPMENT GOALS





Introduction

➤ Definition(s) of laboratory sustainability:

“**Laboratory sustainability** refers to the practice of designing, operating, and maintaining laboratories in a way that minimizes their environmental impact while supporting human health and safety, and ensuring long-term economic viability.” [*]



[*]<https://www.waldner.de/en/about-us/magazine/sustainability-in-the-laboratory-benefits-first-steps/>



Introduction

- Reducing the environmental impact of laboratory activities, such as energy and water use, waste production, and greenhouse gas emissions, is the aim of the laboratory sustainability.
- The laboratory sustainability can also improve:
 - ✓ the quality,
 - ✓ safety,
 - ✓ efficiency of laboratory work,
 - ✓ the social and economic aspects of the laboratory practice.





Introduction

➤ **Benefits of the laboratory sustainability:**

- ✓ cutting costs by using less resources and materials,
- ✓ improving the reputation and credibility of the laboratory and the institution,
- ✓ supporting the global goals of environmental protection and social justice,
- ✓ promoting a culture of innovation and collaboration among laboratory staff and stakeholders.





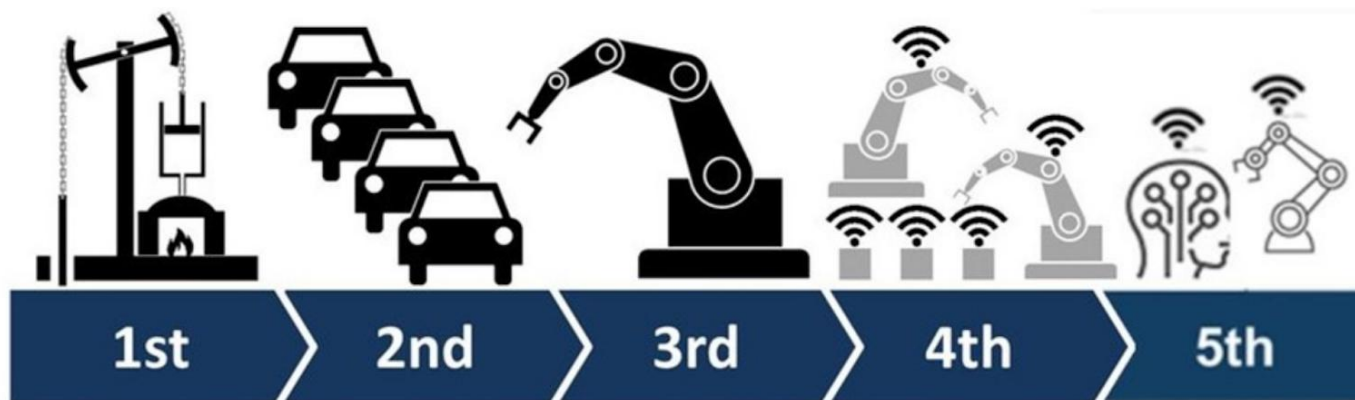
Introduction

- **A sustainable lab is one that's able to reduce consumption, while still maintaining efficient operations**, and in the case of an accredited laboratory to maintain the quality assurance requirements of the international standard EN ISO/IEC 17025:2017.
- In recent years, there has been an increasing awareness of the environmental footprint of labs and a rising trend toward “sustainable laboratories”.
- Diverse original approaches for evaluation of the laboratory maturity for transformation are developed, like **lately AI**, and more specifically **addressing the maturity for sustainability lab transformation**.



Introduction

- Another aspect of the laboratory sustainability, is the **transformation from Industry 4.0 towards Industry 5.0**.
- **Industry 5.0 is the re-humanization of the race towards automation.**
- It is the recognition that both robotic/automated/digital advances and the questioning/insight/innovation/creativity that comes from the human being are of equal value in the manufacturing process.



Industrial revolutions



Introduction

- Each industrial revolution is unbreakably connected to a corresponding metrology revolution, thus delivering the **Metrology 5.0** in near future for which the laboratories have to be prepared.

- **The orientation towards laboratory sustainability directly contributes to the evolvement of the Metrology 5.0 and the laboratory of the future.**





Introduction

➤ My Green Lab[®] categorises laboratory sustainability into **14 focus areas**:

1. **Community:** working together
2. **Waste Reduction:** Minimising waste volumes
3. **Resource Management:** well-planned material management
4. **Purchasing:** sustainable purchasing processes
5. **Green Chemistry:** using more eco-friendly chemicals
6. **Water:** Reducing water consumption
7. **Plug Load:** Minimising the energy consumption of laboratory devices





Introduction

8. **Fume Hoods:** Reducing the energy consumption of laboratory fume hoods
9. **Cold Storage:** Reducing the energy consumption of refrigerating equipment and rooms
10. **Large Equipment:** Analysing the largest consumers of the laboratory's equipment
11. **Infrastructure Energy:** Optimising ventilation, air conditions, lighting, and so on
12. **Travel:** more eco-friendly commuting routes and business trips
13. **Field Work:** Incorporating field research in the strategy
14. **Animal Research:** efficient, animal-friendly biological research





Guidelines for managing sustainability in CABs

BACKGROUND

➤ Corporate sustainability has increasingly been regulated under frameworks such as **ESG**:

- **Environmental**
- **Social Responsibility**
- **Governance**



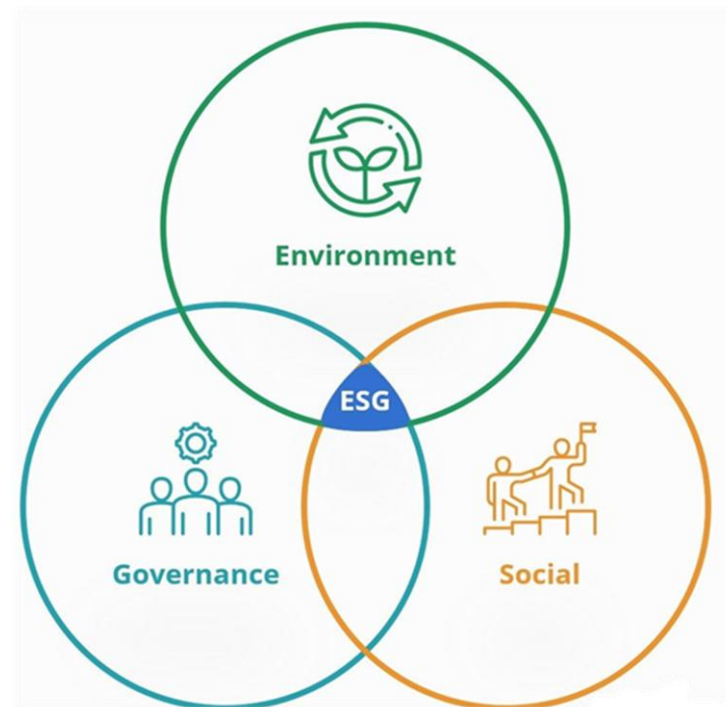
promoted by the **UN** through the **seventeen SDGs**.



Guidelines for managing sustainability in CABs

BACKGROUND

- Although it was adopted with the intention of improving sustainable practices in companies and increasing transparency by disclosing their actions to avoid greenwashing, this standard has become a tool emulating the principles of centralized planning.





Guidelines for managing sustainability in CABs



Eurolab Position Paper

- EUROLAB has a dedicated position paper highlighting the consequences of such regulatory frameworks, particularly their impact on the business landscape and the viability of Conformity Assessment Bodies (CABs).
- These concerns include:
 - **disproportionate compliance burdens,**
 - **reduced room for innovation, and**
 - **the shrinking of the SME ecosystem within the TIC sector.**
- The full position can be seen at eurolab.org.





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Scope of the document

➤ The objective is to promote genuine sustainability within CABs by encouraging the adoption of practices that ensure long-term continuity by:

- economic viability,
- environmental awareness, and
- social responsibility

while enhancing:

- ✓ operational resilience,
- ✓ stakeholder trust, and
- ✓ long-term competitiveness.

eurolab TECHNICAL REPORT





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Strategic orientation for sustainability in CABs

- **Sustainability is a continuous process by which Conformity Assessment Bodies (CABs) ensure their long - term viability.**
- In a free and open market, sustainability is achieved when a CAB can maintain operations profitably, ethically, and with respect for the environment and the communities it serves.

eurolab TECHNICAL REPORT





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Strategic orientation for sustainability in CABs

- CABs are best positioned to determine how sustainability applies to their unique context.
- This requires:
 - entrepreneurial judgment,
 - adaptation to client expectations, and
 - efficient use of available resources.

eurolab TECHNICAL REPORT





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Strategic orientation for sustainability in CABs

Three core principles support this approach:

- ✓ **Continuity through value creation:** A CAB's sustainability depends on its capacity to generate value over time and maintaining technical excellence while building trust with clients and society.
- ✓ **Freedom to adapt:** CABs operate in highly diverse environments. Sustainability must be shaped internally, based on business models, market signals, and stakeholder priorities.
- ✓ **Ownership of strategy:** True sustainability emerges when each CAB assumes responsibility for its own direction, defining objectives and priorities aligned with its mission.



Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Environmental dimension of sustainability

- Environmental sustainability is often the most visible component of sustainability efforts, and in the context of labs, it must be approached pragmatically.
- Labs should view it as a strategic opportunity:
 - ✓ reducing waste,
 - ✓ improving energy efficiency, and
 - ✓ optimising resource use



can lower operational costs, improve performance, and strengthen client trust!



Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Environmental dimension of sustainability

- **There is no universal blueprint!**
- Each CAB should define its own environmental priorities based on:
 - size,
 - technical activities, and
 - local context.
- Voluntary, context-driven actions can yield real benefits.





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Environmental dimension of sustainability

- Sustainable social practices involve creating work environments where people can:
 - ✓ grow,
 - ✓ contribute, and
 - ✓ remain engaged.





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Environmental dimension of sustainability

➤ When employees are:

- healthy,
- motivated, and
- continuously developing their skills,

they become a strategic asset that supports technical excellence and organizational stability.





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Environmental dimension of sustainability

Some initiatives may include:

- Maintaining safe and healthy working conditions.
- Supporting training and opportunities for skill development.
- Creating a workplace culture that encourages merit, responsibility, and mutual respect.
- Ensuring clear communication and conflict resolution mechanisms.
- Treating collaborators and clients with integrity and transparency.





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Governance dimension of sustainability

- Good governance supports the long-term sustainability of laboratories by enabling consistent decision-making.
- It requires a structure that is appropriate to:
 - the organisation's size and complexity,
 - balancing flexibility with accountability.





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

Governance dimension of sustainability

- Labs may consider the following governance practices:
 - **Clarity in decision-making:** Defined roles and responsibilities to support operational consistency.
 - **Accountability:** Mechanisms for leadership to be answerable to internal teams and stakeholders.
 - **Impartiality management:** Safeguards to protect the independence of technical decisions.
 - **Risk awareness:** Identification and monitoring of strategic, operational, and reputational risks.





Guidelines for managing sustainability in CABs

Eurolab Technical Report 1/2025

- The Eurolab Technical Report X/2025 provides:
 - ✓ Practical actions CABs may consider
 - ✓ Defined indicators with appropriate description and measurement units





Methodology for evaluation the laboratory maturity towards the UN SDGs

A holistic approach for achieving improved sustainability practices in the laboratory has to be implemented, considering different aspects:

- ❑ the scope of laboratory activities,
- ❑ the current laboratory practices, habits and level of awareness of the employed personnel.





Methodology for evaluation the laboratory maturity towards the UN SDGs

- ❑ the available laboratory resources (infrastructure, equipment, personnel, information)
- ❑ the inputs to and outputs from the laboratory
- ❑ the overall operations environment of the laboratory (national/regional/global context, regulatory requirements, culture, traditions and mentality,...)





Methodology for evaluation the laboratory maturity towards the UN SDGs

Circular methodology for establishment long-term laboratory sustainability through gap analysis





Methodology for evaluation the laboratory maturity towards the UN SDGs

- **The maturity of the current-state-of-the-art towards sustainability in the laboratory, is to be evaluated on systematic level:**
 1. by conducting a thorough survey of the current-state-of-the-art of the most relevant aspects in the laboratory operations,
 2. through benchmarking of the existing laboratory strategic documents, like the laboratory Quality Policy and the master procedures documents like the laboratory Quality Manual in compliance to EN ISO/IEC 17025:2017, against the different UN SDGs.



Key performance indicators on laboratory sustainability

According to **Guidelines for managing sustainability in CABs, Eurolab Technical Report 1/2025**, the key performance indicators (KPI) on laboratory sustainability should be assigned in respect to the three laboratory sustainability dimensions:

- Environmental
- Social
- Governance

eurolab TECHNICAL REPORT

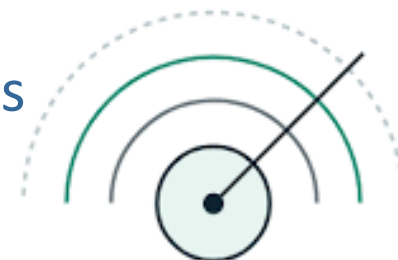


<https://www.eurolab.org/pubs-techreports>



KPIs for tracking environmental performance

- Environmental sustainability is often the most visible component of sustainability efforts, and in the context of laboratories, it must be approached pragmatically.
- Labs should view it as a strategic opportunity: reducing waste, improving energy efficiency, and optimising resource use can lower operational costs, improve performance, and strengthen client trust.
- **There is no universal blueprint.**
- Each CAB should define its own environmental priorities based on size, technical activities, and local context.
- Voluntary, context-driven actions can yield real benefits.





KPIs for tracking environmental performance

Indicator	Description	Unit of measurement
Total energy consumption	Energy used annually in all operations	kWh/year
Energy intensity	Energy consumption per test/inspection activity	kWh/unit of activity
Share of renewable energy	Proportion of energy sourced from renewable providers	%
Waste generation	Total waste generated annually	kg/year
Waste recovery rate	Percentage of waste reused, recycled, or recovered	%
Hazardous waste	Quantity of hazardous waste managed	kg/year
Avoided travel	Number of business trips replaced by virtual alternatives	Number of trips
Environmental incidents	Recorded environmental non-conformities or incidents	Number per year



KPIs for tracking social sustainability dimension

- Sustainable social practices involve creating work environments where people can grow, contribute, and remain engaged.
- When employees are healthy, motivated, and continuously developing their skills, they become a strategic asset that supports technical excellence and organisational stability.
- These practices, when adopted and tailored to each organisation's unique context, contribute to stable operations, professional excellence, and long-term trust.





KPIs for tracking social sustainability dimension

- Investing in employee training, fair compensation, and clear career development pathways is not only a matter of respect for individual contributions, but a rational strategy to retain talent, reduce operational risk, and ensure continuity.
- It is the internal alignment of personal and business incentives that builds resilience and supports the sustainable success of each laboratory.





KPIs for tracking social sustainability dimension

Indicator	Description	Unit of measurement
Training per employee	Annual training hours provided per staff member	Hours/person/year
Voluntary turnover rate	Share of employees who leave the company voluntarily	% per year
Absenteeism	Number of unplanned absence days	Days/year
Health and safety incidents	Events impacting the safety or well-being of staff	Number/year
Participation in feedback tools	Engagement in internal surveys or similar instruments	% of workforce



KPIs for tracking governance sustainability dimension

- Good governance supports the long-term sustainability of the laboratory by enabling consistent decision-making.
- It requires a structure that is appropriate to the organisation's size and complexity, balancing flexibility with accountability.
- The governance model of each lab should reflect its mission, technical scope, and operational reality.
- The objective is to make decisions responsibly, and remain adaptive over time.





KPIs for tracking governance sustainability dimension

Indicator	Description	Unit of Measurement
Documented governance model	Existence of an internal governance framework	Yes/No
Role clarity	Share of roles with clearly defined responsibilities	% of positions
Audit planning based on risk	Use of risk-based criteria to determine audit priorities	Yes/No
Defined impartiality safeguards	Existence of internal mechanisms for impartiality assurance	Yes/No
Risk register update frequency	Regular review and update of the organizational risk register	Number/year



Case Study - maturity evaluation of laboratory sustainability



- The **Laboratory for Electrical Measurements (LEM)**, is an accredited calibration laboratory for electrical instruments according to EN ISO/IEC 17025:2017, at the Ss. Cyril and Methodius University in Skopje (UKIM), Faculty of Electrical Engineering and Information Technologies (FEEIT).
- The LEM also serves as a research infrastructure FEEIT, in particular for the education and research purposes of the third cycle of studies, the doctoral studies in metrology.





Case Study - maturity evaluation of laboratory sustainability



- **Survey of the current-state-of-the-art of the most relevant aspects in the laboratory operations:**
 - an original questioner is developed
 - applied to identify the current state-of-the-art in the Laboratory for Electrical Measurements,
 - deploying the risk-based thinking,
 - enabling the metrics of the key sustainability indicators.





Case Study - maturity evaluation of laboratory sustainability



- The overall laboratory life-cycle is encompassed by the quantified analysis, including:
 - building the laboratory infrastructure,
 - the daily laboratory operations as well as
 - laboratory environmental issues beyond the laboratory life-time (which is in case of this electrical laboratory is very critical due to the high degree of electronic waste).



Case Study - maturity evaluation of laboratory sustainability



- The following main areas are addressed:
 - ✓ Reduction of energy and water consumption
 - ✓ Reduction of the negative impact on the environment
 - ✓ Reduction of harmful waste
 - ✓ Improving the laboratory to increase productivity



Case Study - maturity evaluation of laboratory sustainability



- Based on the obtained survey results, corrective or mitigation measures are suggested, and some of them are already implemented in the procedures of the Laboratory for Electrical Measurements, thus contributing to the strategic goal of LEM to be recognized as a 'green lab'.



Case Study - maturity evaluation of laboratory sustainability



- The **maturity of the current-state-of-the-art towards sustainability in the LEM, is evaluated on systematic level** i.e., through benchmarking of the existing laboratory strategic documents, like:
 - the **LEM Quality Policy** and
 - the master procedures document the **LEM Quality Manual** in compliance to EN ISO/IEC 17025:2017, against the different UN SDGs.
- The evaluation is done by deployment of the **validated on-line tool EU SDG Mapper**.



Case Study - maturity evaluation of laboratory sustainability

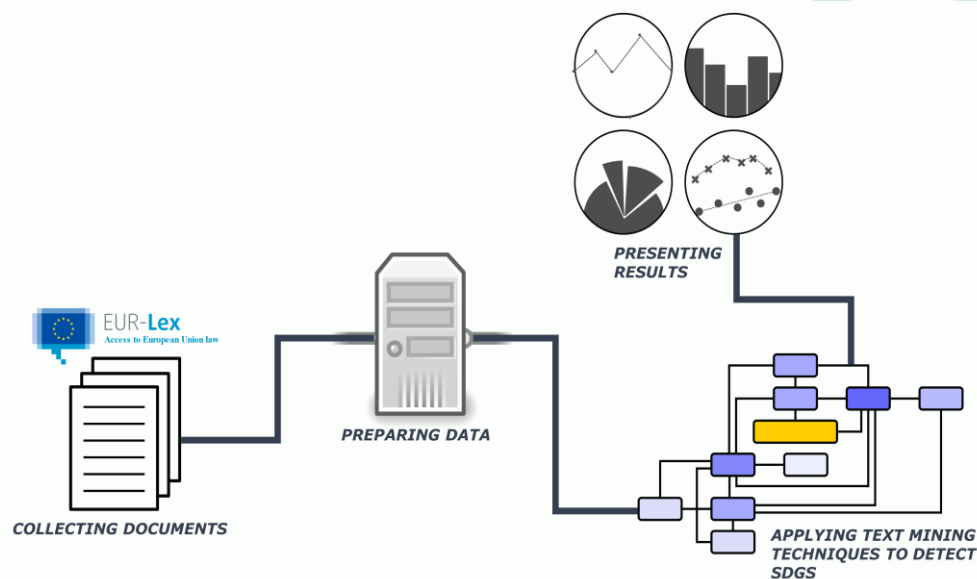
- **KnowSDGs (Knowledge base for the Sustainable Development Goals)** is a web platform that provides tools and organises knowledge on policies, indicators, methods and data to support the evidence-based implementation of the SDGs.
- **The SDG Policy Mapping tool** shows how EU policies address the Sustainable Development Goals (SDGs).





Case Study - maturity evaluation of laboratory sustainability

- The documents are uploaded in the SDG Mapper.
- The tool is run to identify relevant SDGs in the text.
- Some SDGs are more prevalent than others along with their associated targets and indicators.
- The tool provides several visualisations showing how the SDGs are addressed.



EU KnowSDGs – SDGs Mapper flow-chart



Case Study - maturity evaluation of laboratory sustainability



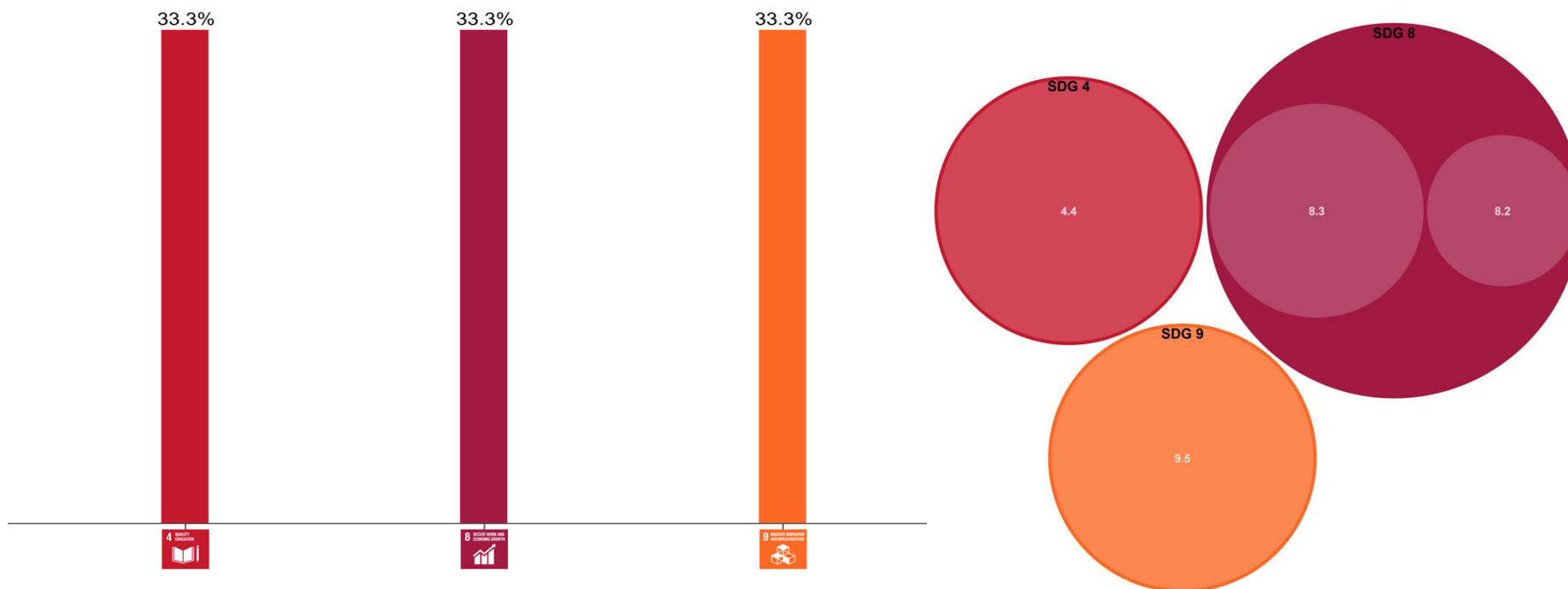
- The evaluation of the laboratory maturity towards sustainability starts with the SDGs Mapping of the master strategic document of the LEM i.e. the **Quality Policy**.
- The SDGs Mapper tool, provided that the current issue of the **LEM Quality Policy does NOT address at all any of the UN SDGs**.



Case Study - maturity evaluation of laboratory sustainability



- The second document which was subjected to the SDGs mapping was the accredited **LEM Quality Manual from September 2023**.





Case Study - Strategic measures for improvement towards greener and more sustainable lab



- Based on the initially conducted analysis at policy level and at operational level, **several possible measures for improving the laboratory's environmental orientation are suggested.**
- The derived results are analysed by deployment of the **risk-based thinking and the Failure Mode and Effects Analysis (FMEA)**, already adopted in LEM and its PR 8. 5 Procedure for Risks and Opportunities.





Case Study - Strategic measures for improvement towards greener and more sustainable lab

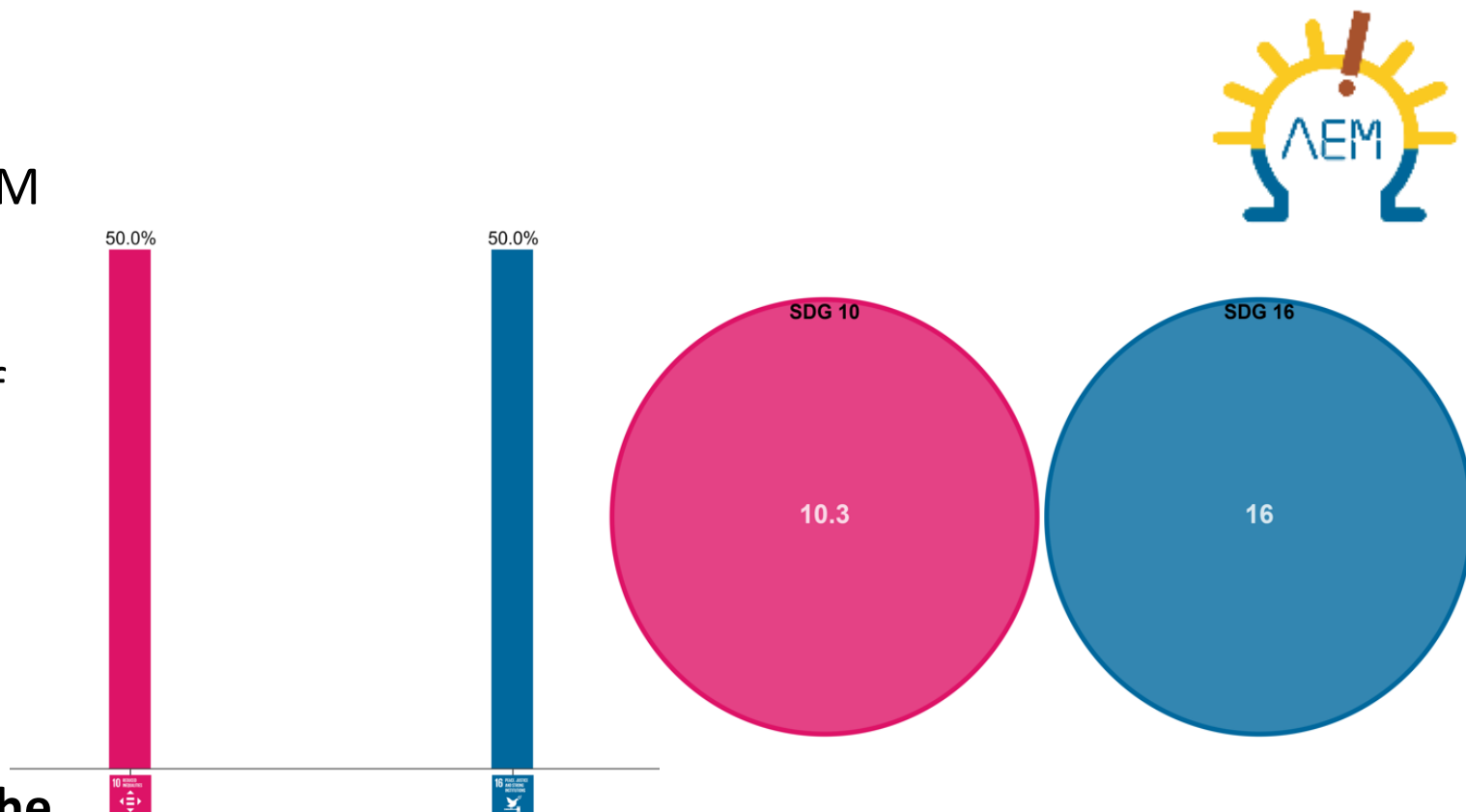


- **Mitigation measures are suggested at different levels:** policies, procedures, working instructions and other documented information in the quality assurance system of LEM.
- Namely, **the overall mitigation approach is strategic**, with interventions in the strategic orientation of LEM as changes are proposed in its Vision, Mission, and Strategic Statements and Policies.
- **It is decided to conduct an integrated transformation of the laboratory management system by fusing the quality assurance and the sustainability approach, and simultaneously compiling to the requirements of the standard ISO/IEC 17025: 2017 and the UN SDGs principles.**



Case Study - Assessment of the introduced strategic documents in context of the UN SDGs

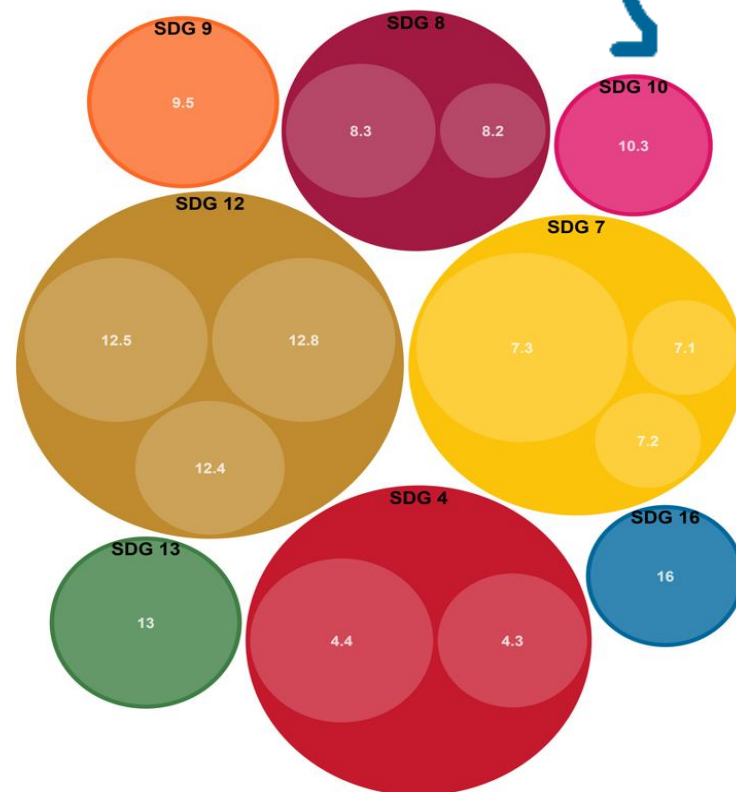
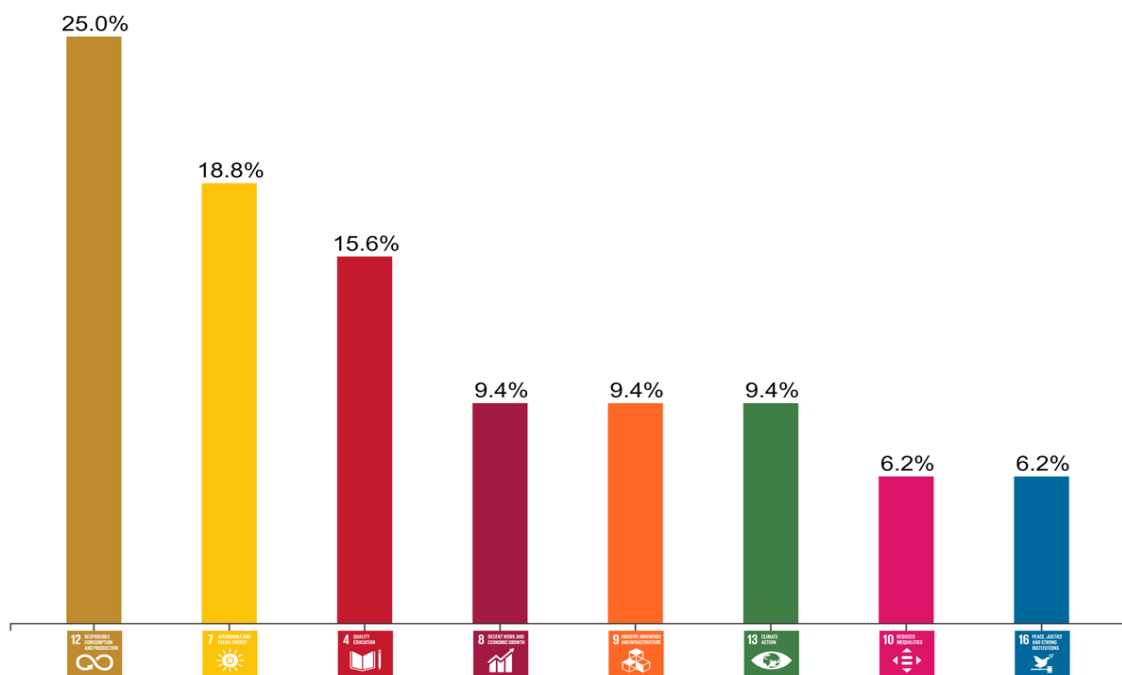
- The revised strategic documents of LEM are iteratively subjected to another round of SDGs Mapping check.
- The integrated Quality and Sustainability Policy aligns to the following SDGs.





Case Study - Assessment of the introduced strategic documents in context of the UN SDGs

- The integrated revised Quality and Sustainability Manual of LEM aligns to the following SDGs:





Case Study - Achievements and lessons learnt

- ✓ From the results obtained from the EU SDGs Mapper tool, it is evident that **the introduced strategic changes and the integrated approach to comply to the quality assurance requirements of the standard ISO/IEC 17025:2017 and the orientation towards the UN SDGs, contribute significantly to the fulfilment of the UN strategic development goals.**
- ✓ In the integrated Quality and Sustainability Policy of LEM, two SDGs are clearly addressed, in comparison to NO SDGs approach in the initial version of the LEM Quality Policy.





Case Study - Achievements and lessons learnt



☑ In the integrated Quality and Sustainability Manual of LEM, eight SDGs are clearly addressed, with relatively fair distribution, in comparison to only three SDGs approach in the initial version of the LEM Quality Manual.



☑ This is only an initial step towards the full laboratory sustainability orientation of LEM, as for the long-term results of this strategic re-orientation, longer period of monitoring and observation of the key sustainability indicators is needed.



Discussion and conclusions

- The initial step towards more sustainable laboratory paves the path for achieving the strategic goal of the laboratory, to be attributed as a green and sustainable laboratory.
- The long-term performance and the efficiency of the undertaken systematic measures for contribution towards sustainability, can be evaluated at least in annual time interval.
- It is of high importance to build smart, operational and sustainable strategies within the laboratories and to apply specific expertise to enhance different sustainable best practices.





Discussion and conclusions

- Sustainability cannot be imposed through centralised regulations. Instead, it arises from:
 - the spontaneous interaction between private incentives,
 - competition in open markets, and
 - the responsible management of resources, grounded in the respect for property rights.
- This approach enables laboratories to effectively adapt to market demands and the specific realities of their sectors while fostering innovative solutions that promote long-term sustainability.





Thank you for your attention 😊

Questions?

E-mail: mcundeva@feit.ukim.edu.mk

