LIUC Università Cattaneo

GREEN TRANSITION HUB

Measuring circularity, sustainability and resilience: new tools and perspectives

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Measuring resilience and sustainability

- "Measuring" is becoming a buzzword today - but why is measurement so important?

→ *because it can help to better understand our world and what we do.*

- Supply Chain resilience and sustainability are current topics that have gained the interest of academic and industrial discussions
- However, **mixed interpretations exist** on resilience and sustainability and on the interrelationships between them
- These mixed messages derive from a **lack of clarity**:
  - Some authors regard sustainability as a driver of resilience
  - others instead state that resilience is an antecedent of sustainability

- Is there a way to make some clarity?
- One possible way can be to try and be as specific as possible: by **jointly measuring sustainability and resilience in an integrative framework**
  - assessing the weight of these concepts and their dimensions
  - evaluating the interrelationships between them

Research framework

- We decided to tackle the measurement problem by **developing a composite indicator** that we named "RESIST-I" ("Resilience and Sustainability - Index")
- We took the guidelines for Constructing Composite Indicators of the OECD and the Joint Research Centre of the EU Commission, JRC-EU (OECD/JRC, 2008).

Research phases	Composite indicators building	Advisory board contributions
1.Scoping and framing	1. Conceptual framework	-Framework, indicators, and survey questionnaire validation
	2. Selection of indicators	
2.Survey and data treatment	3. Data treatment	-Validation of the survey sampling and data treatment
	4. Normalisation	
	5. Weighting	
3.Composite building	6. Aggregation	-Validation of indicators grouping, sub-pillars, pillars, and sub-indices
	7. Statistical coherence	
	8. Robustness and sensitivity	
4.Results: Analysis and benchmarking	9. Data sensemaking	-Results validation and insights for future research

Scoping and framing: resilience

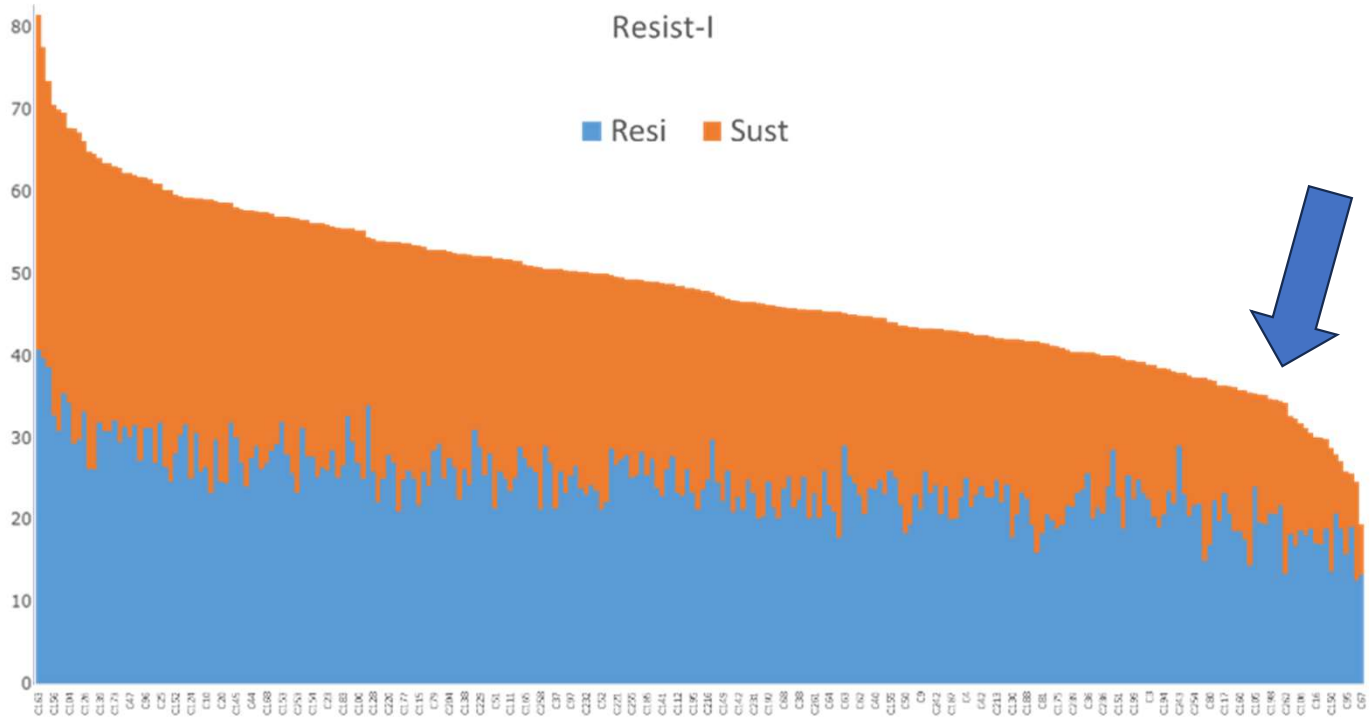
PILLAR	SUB-PILLAR	INDICATOR
Agility	Adaptability & Velocity	Transportation & Warehousing Flexibility
		Transportation Mode Flexibility
		Workforce Flexibility
	Responsiveness & Recovery	Production Volumes Flexibility
		Use of Small Minimum Batch Size from Supplier
		Use of Small Minimum Batch Size toward Customers
	Flexibility in Sourcing & Order Fulfilment	Production Systems Flexibility
		Supply Base Flexibility
Redundancy	Inventory Mgmt & Dispersion	Safety Stock Implementation
		SC Density
	Capacity	Production Capacity Saturation
	Supply Base	Use of Dual/Multiple Sourcing for Raw Materials
		Use of Dual/Multiple Sourcing for Finished Products
		Use of carriers Multisourcing
		Use of Logistics Multisourcing
Adaptive Risk management	Security & Robustness	Data Storage Backup System
		Suppliers Financial Robustness
	Risk Mgmt Culture & Business Continuity	Risk Metrics Use
		Business Continuity Plans
	Reliability	Presence of Nodes in High-Risk Areas
Collaboration	Visibility & Collaboration Practices	External Stocks and Downstream Demand Visibility
		Collaborative Forecasting Level
	Communication & ICT Skills	SC Information Sharing Quality
		Collaborative Communication Level

Scoping and framing: sustainability

PILLAR	SUB-PILLAR	INDICATOR
Environmental Sourcing	Suppliers Env. Certification & Green Procurement	Certified Suppliers Share
		Green Procurement Consideration
	Env. Supply Visibility	Second-tier Environmental Sustainability Assessment
Sustainable Supply Chain and Logistics Practices	SC Design & Transportation Mode	Modal Transportation
		Suppliers Dispersion
	Energy Use	Renewable Energy Use in Production and Storage facilities
	Waste Recyclability & Reuse, Recycling and Remanufacturing	Production Wastes Quality
		Recycling, Remanufacturing and Reuse
	Waste Production & Water Use	Total Waste Production
		Total Water Use
Environmental Commitment	Company's Commitment & Packaging Recyclability	Packaging Recyclability
		Environmental Roles Diffusion
		Environmental Impact Self-Assessment
	Env. Certification Use & Environmental Relevance in SCM	Environmental Impact in SCM Performance Evaluation
Socially Responsible Sourcing	Socially Responsible Procurement & Soc. Supply Visibility	Certified Suppliers Share
		Second-tier Social Sustainability Assessment
Internal Supply Chain	Working Conditions & Employees Satisfaction	Employees Satisfaction Measurement
		Health and Safety Practices Implementation
	Equity, Diversity and Inclusion & Gender Equality	Gender Equality Employment
		Inclusivity, Equity and Diversity Practices
	Social Sust. Relevance in SCM	Social Impact in SCM Performance Evaluation
External Stakeholders	Community Involvement Initiatives	Community Initiatives
Financial Management	Profitability & Growth	EBITDA Margin
		EBITDA Margin Growth
		Revenue Growth
	SC Finance	NWC/Turnover
	Short & Long Term Solvency	Current Ratio
		D/E

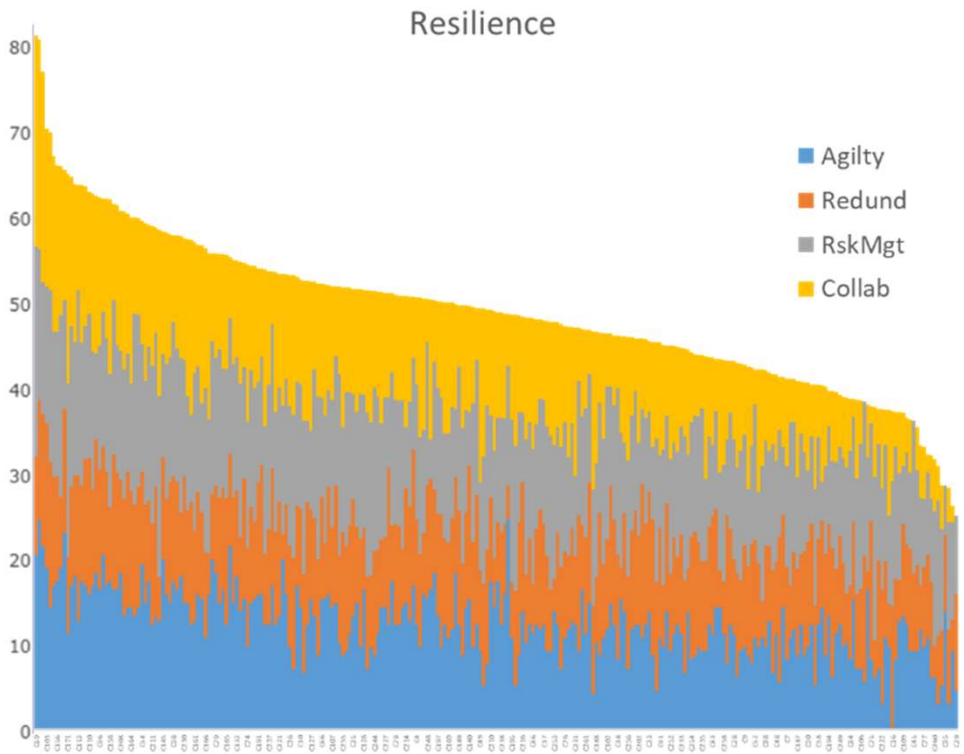
Results: supply chain resilience and sustainability

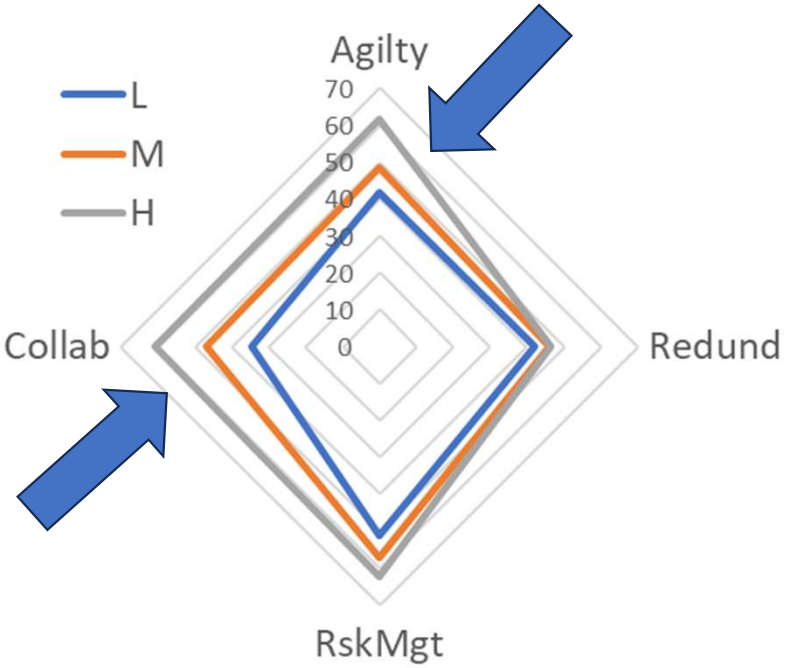
The survey was administered to a sample of companies obtained from the Orbis database (focusing on firms in Italy operating in the manufacturing, retail, and energy-supply sectors). We obtained **262 full valid responses**.



Firms with **lower scores in the overall index** also have a **lower contribution of supply chain sustainability**, showing that sustainability is less developed compared to resilience in terms of performance.

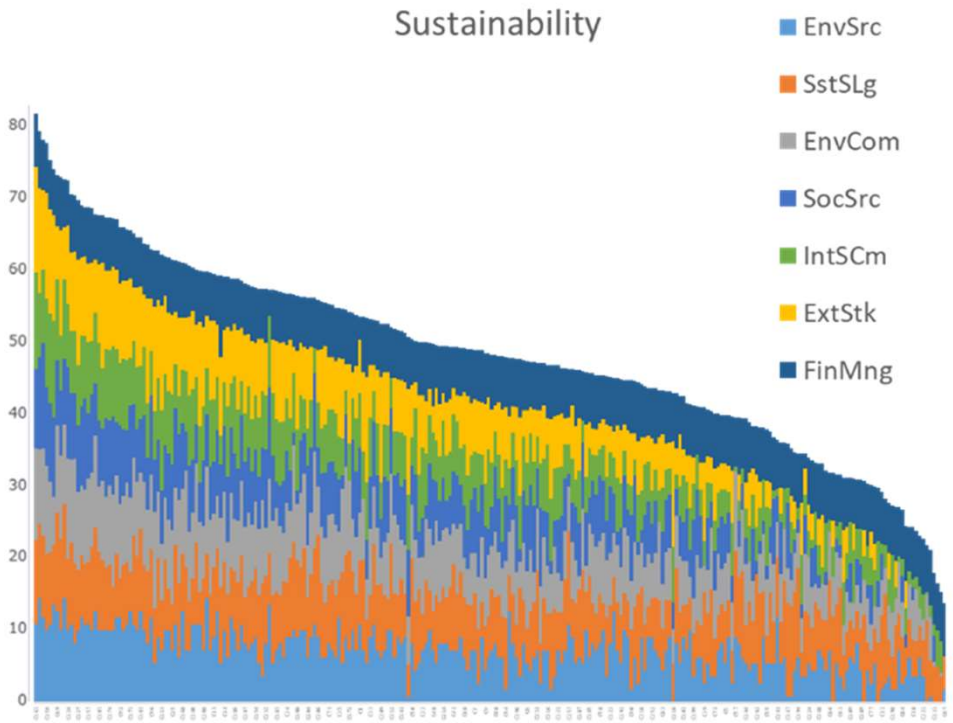
Results: the pillars of Supply chain resilience

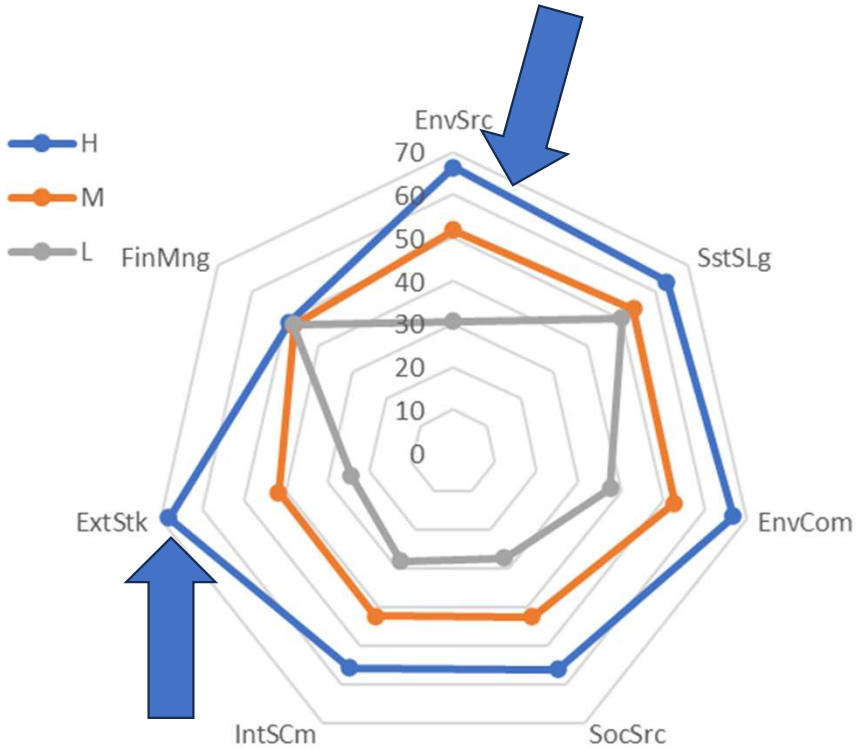




Low-performing companies tend to struggle especially in those areas that require capabilities that go beyond the boundaries of their own organization and that require the development of an external network of collaborations

Results: the pillars of Supply chain sustainability





“External Stakeholders” and “Environmental sourcing” make a difference between firms with low, middle, and high scores. The social sustainability side is acknowledged as a strategic goal for organizations

Results: interrelationships-resilience and sustainability

- The correlations confirm the **strong interrelationship between Collaboration and the Sustainability sub-index**, and **between Environmental Sourcing (EnvSrc) and Environmental Commitment (EnvCom) and the Resilience sub-index.**
- **Collaboration** can have a **significant impact in driving sustainability and resilience at the same time.**
- We found **no negative correlations between resilience and sustainability**

So what?

- Significant trade-offs between sustainability and resilience do not emerge according to our data

→ ***sustainability or resilience can be developed without a significant negative impact on the other***

- By developing resilience only, companies tend to predominantly enhance resilience. However, it seems that resilience represents a grounding element for developing sustainability.

→ ***An already resilient organization is more likely to "go green".***

- By leveraging sustainability, it seems that companies can achieve better performance in terms of both sustainability and resilience at the same time.

→ ***Sustainability can be an enabler of resilience and can reduce risks through better decision-making***

- In this sense, sustainability can be regarded as **an integral part of the social-ecological view of resilience**

Green Measurement Toolkit
The premise for its design

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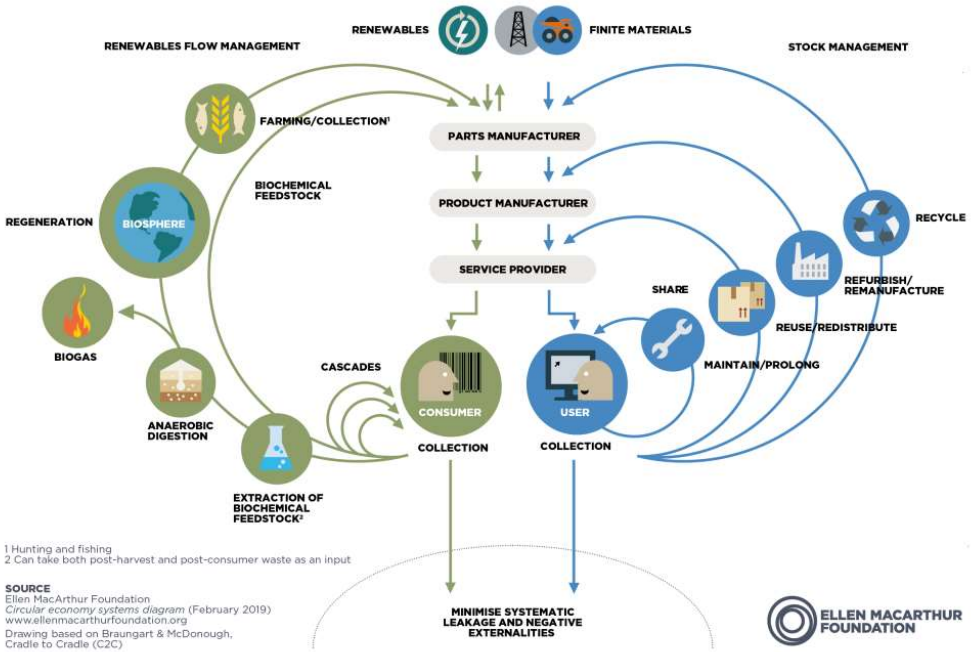
Framework 10R

Circular economy		Strategies	
Increasing circularity	Smarter product use and manu-facture	R0 Refuse	Make product redundant by abandoning its function or by offering the same function with a radically different product
		R1 Rethink	Make product use more intensive (e.g. by sharing product)
		R2 Reduce	Increase efficiency in product manufacture or use by consu-ming fewer natural resources and materials
	Extend lifespan of product and its parts	R3 Reuse	Reuse by another consumer of discarded product which is still in good condition and fulfils its original function
		R4 Repair	Repair and maintenance of defective product so it can be used with its original function
		R5 Refurbish	Restore an old product and bring it up to date
		R6 Remanufacture	Use parts of discarded product in a new product with the same function
		R7 Repurpose	Use discarded product or its parts in a new product with a different function
	Useful application of mate-rials	R8 Recycle	Process materials to obtain the same (high grade) or lower (low grade) quality
Linear economy		R9 Recover	Incineration of material with energy recovery

Butterfly Diagram



Green Measurement Toolkit
Categories for the design of circularity indicators

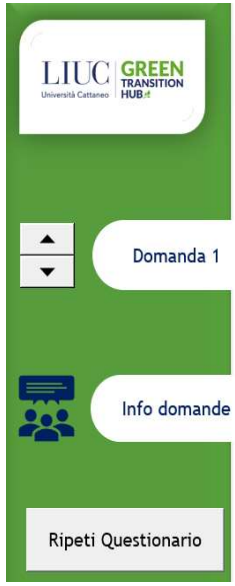
- The tool is based on seven main categories:

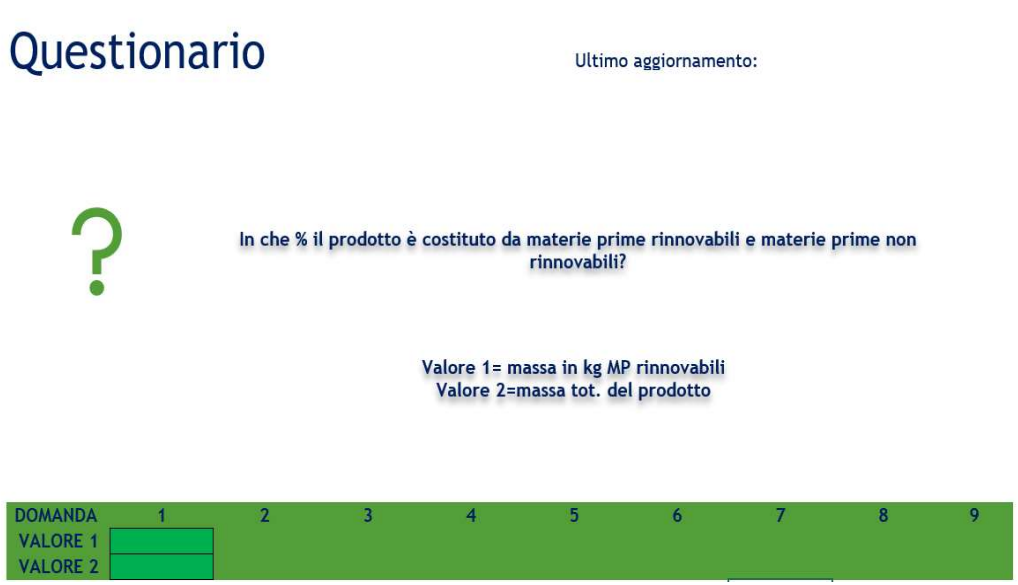
(i) product and process design
(ii) circular business model
(iii) end-of-life management of products
(iv) circular supply chain
(v) industrial symbiosis
(vi) adoption of digital technologies
(vii) circular training, education, and engagement

Green Measurement Toolkit
A questionnaire-based tool for Italian SMEs

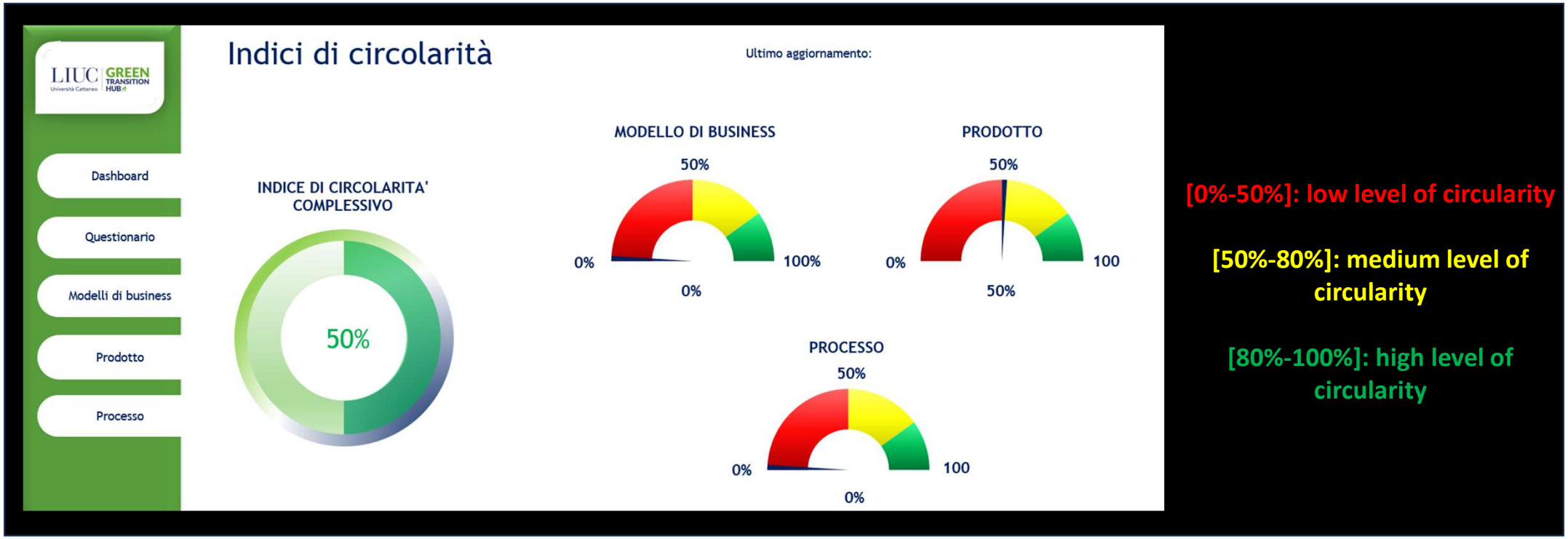
Info domande

Per MATERIE RINNOVABILI si intendono i materiali ottenuti da cicli naturali derivanti da attività come la zootecnica, forestazione e agricoltura. Per MATERIE NON RINNOVABILI si intendono i materiali caratterizzati da lunghi periodi di formazione e la cui estrazione impatta negativamente sull'ambiente poichè derivanti da combustibili fossili.





Green Measurement Toolkit
Dashboard



[0%-50%]: low level of circularity

[50%-80%]: medium level of circularity

[80%-100%]: high level of circularity

- One circularity measure for each category
- One overall circularity measure as result of matching the measure for each category

Green Measurement Toolkit
Toolkit features and next step

- It is a tool for disseminating circular economy principles to companies
- It allow to reflect on the enabling factors and barriers for the transition to the circular economy
- It enables the identification of actions to be implemented to improve the circularity level of the company
- Easiness of use
- The graphical user interface (i.e., the dashboard) is simple and intuitive
- Multidimensionality of the circular economy (reflected in the seven categories)
- The assessment is objective and synthetic
- Focus is on biological cycles, technological cycles, and product life cycle

Next Step

- *Test and validation*
- *Refinement and Consolidation*

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