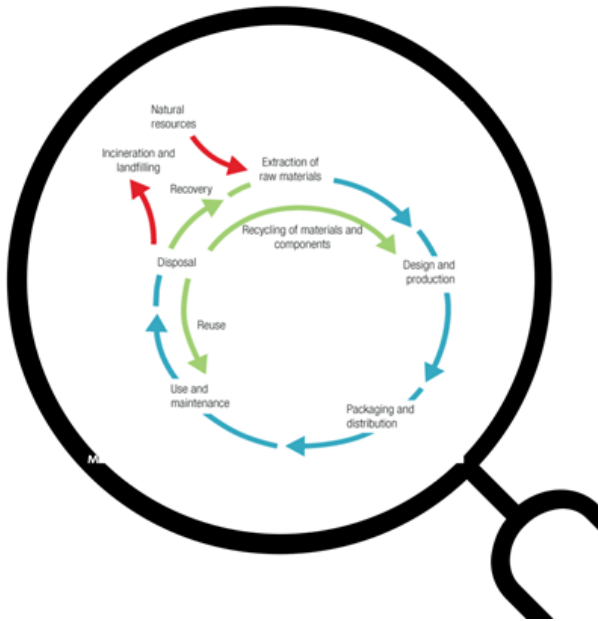




# LIFE CYCLE ASSESSMENT



**Life Cycle Assessment (LCA)** means systematic integration for analysis and management purposes:

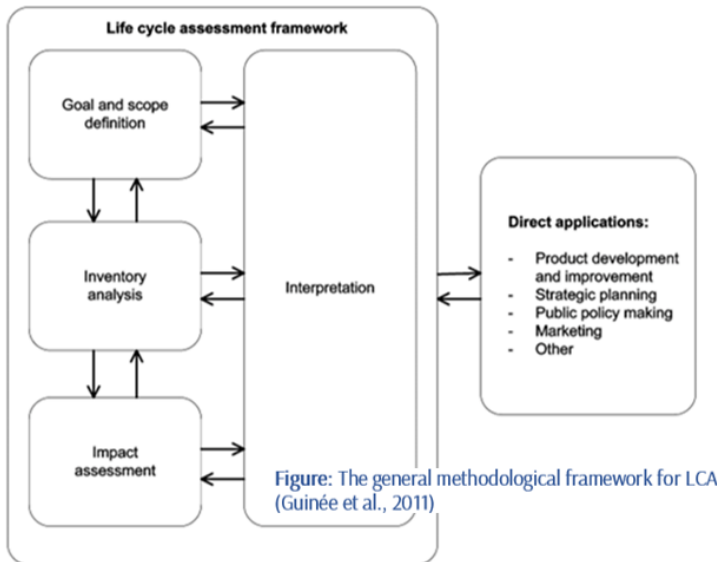
- life cycle actors (organizations, business entities, consumers, institutions, and authorities);
- processes constituting life cycle;
- parameters (of product system analysed) along the whole life cycle
- Use of LCA for:
  - design and improvement of (product / process / organization or complex system)
  - minimization of impacts (environmental, social)
  - decrease of resource use and costs optimization (savings);
  - development of actions for environmental management / modernization / policy;
  - certification of the environmental management system;
  - development of actions for corporate social responsibility programs and policy;
  - increase of competitiveness and for marketing purposes.

**Objects analyzed within the LCA framework:**

- products and services (as flow);

- processes;
- systems (complex) – organizations, territories, cities, regions, countries, global systems.

 ICS 13.102.10 <b>ISO 14040:2006</b> Environmental management – Life cycle assessment – Principles and framework	 ICS 13.102.10 <b>ISO 14044:2006</b> Environmental management – Life cycle assessment – Requirements and guidelines	impacts of a product system throughout its life cycle. LCA is an element of comprehensive policy and tool to support sustainable development path in production and consumption sides, circular economy expansion.
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**LCA procedures:** Comparative or Attributional LCA – provide an opportunity to evaluate existing systems (processes) & Consequential LCA – provide an opportunity to predict the possible impact of the system due to changes of its parameters

Environmental LCA, E-LCA – environmental impact assessment

Life Cycle Costing, LCC – cost estimation and management within the entire supply chain

Social LCA, S-LCA – assessment of the impact on the well-being of stakeholders

Sustainable LCA – integration of social, environmental, and economic impacts and assessments

Material Flow Analysis is a balance method of analyzing resources and material flows of the system

**LCA methodology according to ISO 14040**

**Software for LCA:**



OpenLCA (top-10, for free)  
<http://www.openlca.org>  
<https://nexus.openlca.org>  
 Developed by: GreenDelta



SimaPro (top-12)  
<https://simapro.com>  
 Developed by: PRÉ Sustainability



GaBi (top-10)  
<http://www.gabi-software.com>  
 Developed by: Thinkstep (Sphera - now)

The Global Compact Self Assessment Tool (questionnaire, self-assessment)  
<https://globalcompactselfassessment.org>



Air.e LCA (top-10, for free)  
<https://www.solidforest.com>  
 Developed by: Solidforest



Umberto LCA+ (top-12)  
<https://www.ifu.com>  
 Developed by: IFU Hamburg



BImpactAssessment (опитувальник, самооцінка)  
<https://bimpactassessment.net>  
 Розробник: B Lab (B Corporation)

<https://www.unglobalcompact.org/library/235>  
 Developed by: Danish Institute for Human Rights

Table – The possible software to manage environmental impact

Software	Options*									
	WF	LF	CF	MU	EU	LCA	ER	ED	FV	
1	2	3	4	5	6	7	8	9	10	
GEMIS <a href="http://iinas.org">http://iinas.org</a>	+	+	+	+	+	+				
EarthSmart (ES) <a href="http://www.earthshiftglobal.com">www.earthshiftglobal.com</a>				+		+		+		
REGIS <a href="http://www.sinum.com">http://www.sinum.com</a>						+C	+		+C	
Air.e LCA <a href="http://www.solidforest.com">www.solidforest.com</a>	+		+			+	+	+		
eToolLCD <a href="https://etoolglobal.com">https://etoolglobal.com</a>		+	+		+	+		+		
GEMI SD Planner <a href="http://gemi.org">http://gemi.org</a>						+		+		
Carbon Footprint <a href="http://www.carbonfootprint.com">www.carbonfootprint.com</a>			+			+		+		
OpenLCA <a href="https://nexus.openlca.org">https://nexus.openlca.org</a>	+		+			+C	+	+		
Umberto LCA+ <a href="https://www.ifu.com">https://www.ifu.com</a>			+			+C	+			
e!Sankey <a href="https://www.ifu.com">https://www.ifu.com</a>						+C			+C	
Umberto Efficiency+ <a href="https://www.ifu.com">https://www.ifu.com</a>			+					+	+C	
SimaPro <a href="https://simapro.com">https://simapro.com</a>	+		+			+	+	+		
GaBi <a href="http://www.gabi-software.com">www.gabi-software.com</a>	+		+	+ Ef	+ Ef	+	+	+		

**Legend:**

\* WF – water footprint assessment;  
LF – land footprint assessment;  
CF – carbon footprint assessment;  
MU – material use (efficiency - Ef) assessment;  
EU – energy use (efficiency - Ef) assessment;  
LCA – life cycle assessment and (C) – associated costs;  
ER – environmental reporting;  
ED – environmental design;  
FV – visualization of material and energy flows and (C) – associated costs.

**LCA development prospects & main sectors.** In the near future, green procurement and sustainable practices in construction will become locomotives for the LCA development, triggering a "domino" effect.

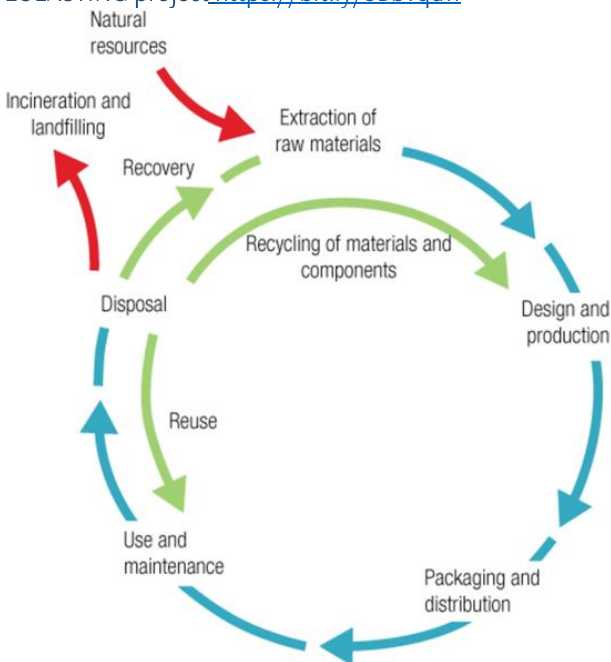


**LCA resources:**

**International:**

- ⇒ "Life cycle initiative" (<https://www.lifecycleinitiative.org/>) supported by UNEP/ SETAC
- ⇒ European Platform on Life Cycle Assessment (EPLCA) <https://eplca.jrc.ec.europa.eu/ilcd.html>.
- ⇒ «Pre-sustainability» Initiative <https://pre-sustainability.com/>
- ⇒ LCA examples database <http://www.designlife-cycle.com>

- ⇒ LCA for SMEs Initiative <http://www.lifelpcip.eu/>
- ⇒ **Ukrainian:**
- ⇒ EULASTING project <https://bit.ly/3Bbvquw>



**A typical product lifecycle diagramme**

Source: (Life Cycle Initiative, <https://www.lifecycleinitiative.org/>)

**Literature:**

1. Коблянська І.І., Ковальова О.М. Планування інновацій урахуванням екологічних аспектів: огляд сучасних програмних продуктів. *Інфраструктура ринку*, 2021. № 58. С. 46–51. DOI: <https://doi.org/10.32843/infrastruct58-9>
2. Guinée, J. B., Heijungs, R., Huppes, G., Zamagni, A., Masoni, P., Buonamici, R., Ekvall, T., & Rydberg, T. (2011). Life Cycle Assessment: Past, Present, and Future. *Environmental Science & Technology*, 45(1), 90–96. <https://doi.org/10.1021/es101316v>
3. ISO 14040:2006. Environmental management – Life cycle assessment – Principles and framework. <https://www.iso.org/standard/37456.html> (Accessed 26 March 2022).



# SOCIAL, ENVIRONMENTAL ACCOUNTING, SUSTAINABILITY REPORTING AND ITS ASSURANCE

## SOCIAL ACCOUNTING = STAKEHOLDERS' ACCOUNTING

Table - Frameworks for sustainability reporting

Framework	Year	Link
World Business Council for Sustainable Development (WBCSD)	1995	<a href="https://www.wbcsd.org/">https://www.wbcsd.org/</a>
Global Reporting Initiative (GRI)	1997	<a href="https://www.globalreporting.org/">https://www.globalreporting.org/</a>
Institute of Social and Ethical Accountability (AA1000)	1999	<a href="https://www.accountability.org/">https://www.accountability.org/</a>
The United Nations Global Compact	2000	<a href="https://www.unglobalcompact.org/">https://www.unglobalcompact.org/</a>
Greenhouse Gas (GHG) protocol	2001	<a href="https://ghgprotocol.org/">https://ghgprotocol.org/</a>
International Integrated Reporting Council (IIRC)	2010	<a href="https://www.integratedreporting.org/">https://www.integratedreporting.org/</a>
International Organization for Standardization (ISO 26000)	2010	<a href="https://www.iso.org/iso-26000-social-responsibility.html">https://www.iso.org/iso-26000-social-responsibility.html</a>
Sustainability Accounting Standards Board (SASB)	2011	<a href="https://www.sasb.org/">https://www.sasb.org/</a>
The OECD Guidelines for MNEs	2011	<a href="https://www.oecd.org/corporate/mne/">https://www.oecd.org/corporate/mne/</a>
International Sustainability Standards Board (ISSB)	2021	<a href="https://www.ifrs.org/groups/international-sustainability-standards-board/">https://www.ifrs.org/groups/international-sustainability-standards-board/</a>



### STATUS QUO AND FUTURE OF SUSTAINABILITY REPORTING IN THE EUROPEAN UNION

Table - Comparison of NFRD vs CSRD in EU source: <https://bit.ly/3N6qsUU>

3

Criteria	The Non-financial reporting directive (NFRD) directive 2014/95/eu	The Corporate Sustainability Reporting Directive (CSRD)
Which companies are concerned?	Large "public interest entities" with >500 employees: <ul style="list-style-type: none"> <li>Listed companies</li> <li>Banks &amp; Insurance companies</li> </ul>	All large companies meeting at least 2 out of 3 criteria: <ol style="list-style-type: none"> <li>&gt;250 employees and/or</li> <li>&gt; €40M Turnover and/or</li> <li>&gt; €20M Total Assets</li> </ol> Listed companies on EU regulated markets (SMEs get 3+ years to comply) – except listed micro-companies (less than 10 employees or below €20M in turnover).
Timeline	In application since 2018	Application on 1 January 2024 for the 2023 financial year. <ul style="list-style-type: none"> <li>Concerned companies will have to submit their report in compliance with the CSRD by 2023.</li> <li>For SMEs, more detailed reporting requirements and delayed timelines are available.</li> </ul> Different phases will develop the reporting: <ul style="list-style-type: none"> <li>FY 2023: the first set of Sustainability Reporting Standards (draft standards open mid-2022)</li> <li>FY 2024: the second set of Sustainability Reporting Standards</li> </ul> Adoption of the EU-Directive in member states legislation: December 1, 2022.
Number of companies affected by the regulation	11000	49 000 - covering 75% of total EU's companies turnover.
Scope of reporting requirements	Companies are to report on the following <b>five dimensions</b> : <ul style="list-style-type: none"> <li>Environmental protection</li> <li>Social responsibility and treatment of employees</li> <li>Respect for human rights</li> <li>Anti-corruption and bribery</li> <li>Diversity on company boards (age, gender, educational and professional background)</li> </ul> Companies need to report the following items <b>on each of the four dimensions</b> : <ul style="list-style-type: none"> <li>Policy</li> <li>Outcomes of policy</li> <li>Risks</li> <li>KPIs</li> </ul>	<b>Additional requirements on:</b> <ul style="list-style-type: none"> <li>Double materiality concept: <ul style="list-style-type: none"> <li>Sustainability risk (including climate change) affecting the company.</li> <li>Companies' impact on society and environment.</li> </ul> </li> <li>Process to select material topics for stakeholders</li> <li>More forward looking information, including targets and progress thereon</li> <li>Disclose information relating to intangibles (social, human and intellectual capital)</li> <li>Reporting in line with Sustainable Finance Disclosure Regulation (SFDR) and the EU Taxonomy Regulation</li> </ul>
Reliability of reporting (Third party assurance)	Non-mandatory	Mandatory (planned end of 2022) <b>Reporting must include:</b> <ul style="list-style-type: none"> <li>Integration in auditor's report</li> <li>Involvement of key audit partner</li> <li>Scope to include EU Taxonomy and process to identify key relevant information.</li> </ul>
Where to report?	Included in <b>the Annual report</b> . The sustainability report can be disclosed separately with a clear reference to the financial report and management report.	Included in <b>the Management report</b> A single report in "digital machine- readable format".
Reporting format	<ul style="list-style-type: none"> <li>Online</li> <li>PDF format</li> </ul>	Electronic format (in XHTML format in accordance with ESEF regulation).
Alignment to other EU Legislations	<ul style="list-style-type: none"> <li>The EU Taxonomy and its objectives</li> <li>FY2021: climate change mitigation and adaptation.</li> <li>FY2022: all environmental objectives.</li> </ul>	<ul style="list-style-type: none"> <li>EU Taxonomy: All companies concerned by the CSRD will have to report on their alignment with the EU Taxonomy.</li> <li>SFRD: The indicators of the standards will be aligned with the reporting of the CSRD.</li> <li>It takes into consideration other frameworks: TCFD, GRI, SASB.</li> </ul>