

Sustainability, Circular Economy, and Creative Computing

Open Educational Materials

Content of Presentation



The Big Picture

Sustainability

Circular Economy

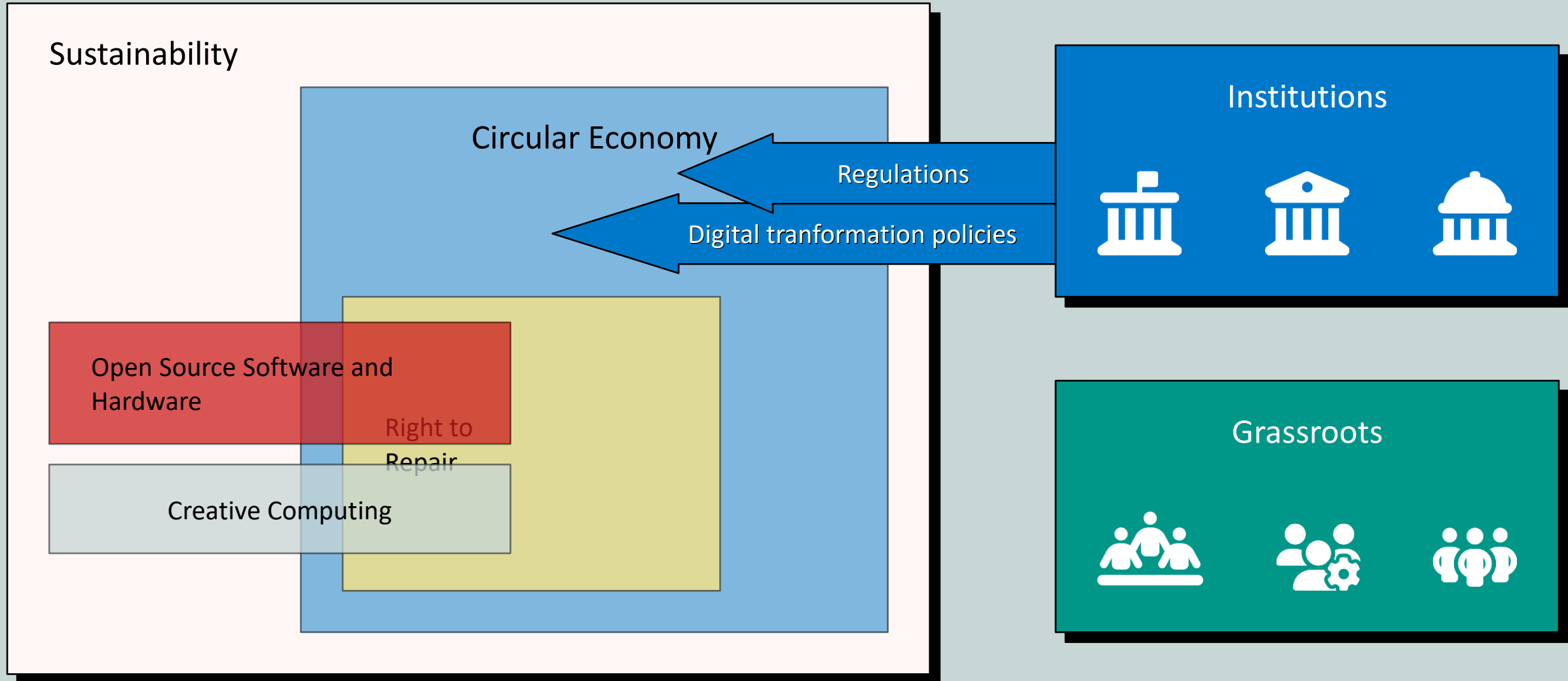
Sustainable Computing

Digital Transformation

Creative Computing

Right To Repair

The Big Picture



Sustainability

Definition of Sustainability

Meeting the needs of the present
without compromising the ability of
future generations to meet their own
needs.



World Commission on Environment and Development , 1987

Kinds of Sustainability



Environmental

It represents efforts aimed at protecting the environment by addressing issues like ozone depletion, carbon emissions, forest loss, and water and sanitation.

Economic

It involves consuming the added value (interest) without depleting the core capital.

Social

It focuses on understanding and managing business's impacts—both positive and negative—on people.

Human

It is about maintaining people's well-being, often referred to as human capital. This includes an individual's health, education, skills, knowledge, and access to services. Investing in aspects like education, health, and nutrition is considered essential for economic development.

Embrace Sustainable Choices

Suggestions from Zero Waste Alliance Ireland



Be a Guardian, Not a Consumer:

Shift people's mindsets from consumption to conservation.

Don't give in to greenwashing!

Educate yourself and others on how to avoid it.

Educate and Advocate:

Share knowledge and raise awareness about the importance of environmental protection.

Opt for eco-friendly products and support brands that prioritize environmental responsibility.

Support Conservation Efforts.

Sustainable Development Goals (SDG)



Also called the Global Goals

They serve as a universal call to action to:

- End poverty.
- Protect the planet.
- Ensure all people enjoy peace and prosperity by 2030.

The SDGs aim to:

- Eliminate poverty and hunger.
- Combat AIDS.
- End discrimination against women and girls.

The 17 SDGs are:

- Interconnected: Action in one area affects outcomes in others.
- Focused on balancing social, economic, and environmental sustainability.

Nations have committed to focusing efforts on those who are most marginalized.

Do you know all 17 SDGs?



Signs of progress can be seen in some areas, but much remains to be achieved to reach the targets.

Circular Economy

Definition of Circucal Economy

A model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended.



European Parliament

Circular Economy Activism

“6 R” principles from Zero Waste Alliance Ireland



Rethink

Refuse

Reduce

Reuse

Recycle

Repair

Sustainable Computing

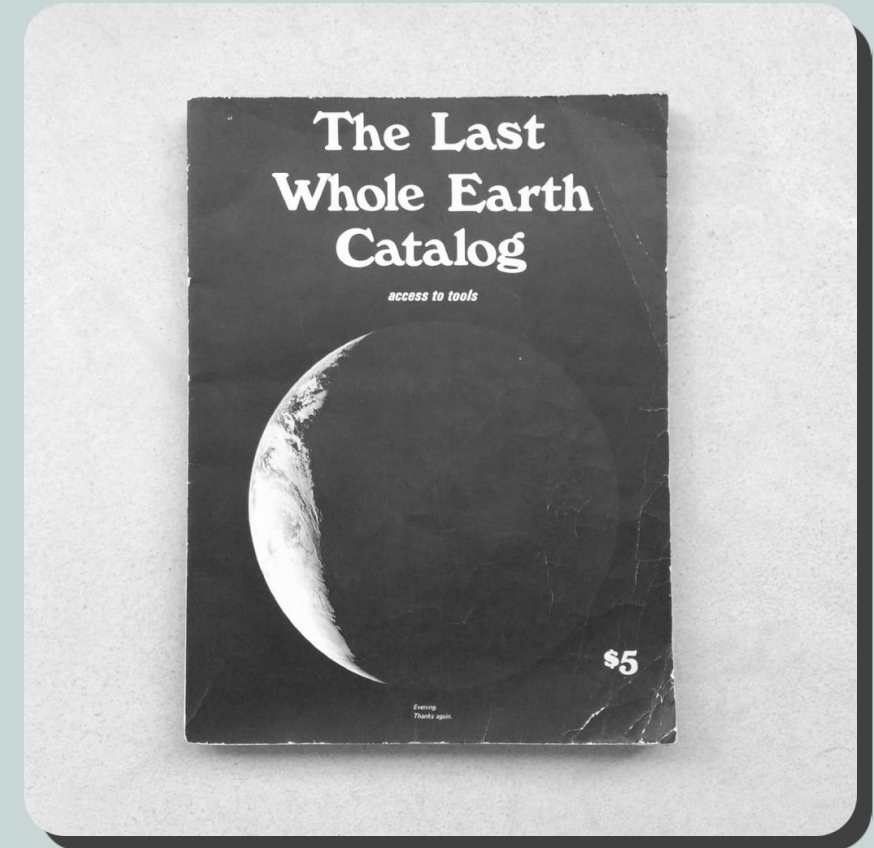
History of Sustainable Computing

Initially, a lot of focus was placed on reducing the energy consumption of computers and their components. Linking to early days through:

- Better usage, less e-waste
- More resource sharing
- Improving efficiency

Sustainable computing has expanded to include topics like:

- E-waste management
- Designing hardware for longevity and repairability
- The environmental impact of data centers
- Software development techniques that prioritize efficiency and minimize resource usage



Intro to Sustainable Computing

Definition

Integrating effective, reliable IT processes to reduce power consumption and manage environmental waste.

Goal

Minimize environmental impact, extend digital device lifespan.



Digital Transformation

aka DT

Definitions of Digital Transformation



Because the term digital transformation (DT) comes from different industries and contexts, it was used, abused, and stretched to name diverse phenomena.

A fundamental change process enabled by digital technologies that aims to bring radical improvement and innovation to an entity [e.g., an organization, a business network, an industry, or society] to create value for its stakeholders by strategically leveraging its key resources and capabilities.

Gong & Ribiere, 2021

The use of new digital technologies (social media, mobile, analytics, or embedded devices) to enable major business improvements (such as enhancing customer experience, streamlining operations, or creating new business models).

Fitzgerald, Kruschwitz, Bonnet, & Welch, 2014

The implementation of innovation and new digital technologies to affect business improvements in an organization.

G. Westerman, Bonnet, & McAfee, 2014

The application of digital technologies to fundamentally impact all aspects of business and society.

Gruman, 2016

The use of technology to radically improve the performance or reach of an enterprise.

W. Westerman, Arslan, Dorsman, & Karan, 2011

The use of digital technologies to radically improve the company's performance.

Bekkhus, 2016

Sides of Digital Transformation



Positive impact

- Different contexts
- Impact on business operations
- Improved efficiency and productivity
- Enhanced customer experience
- Increased innovation
- Cost savings
- Scalability

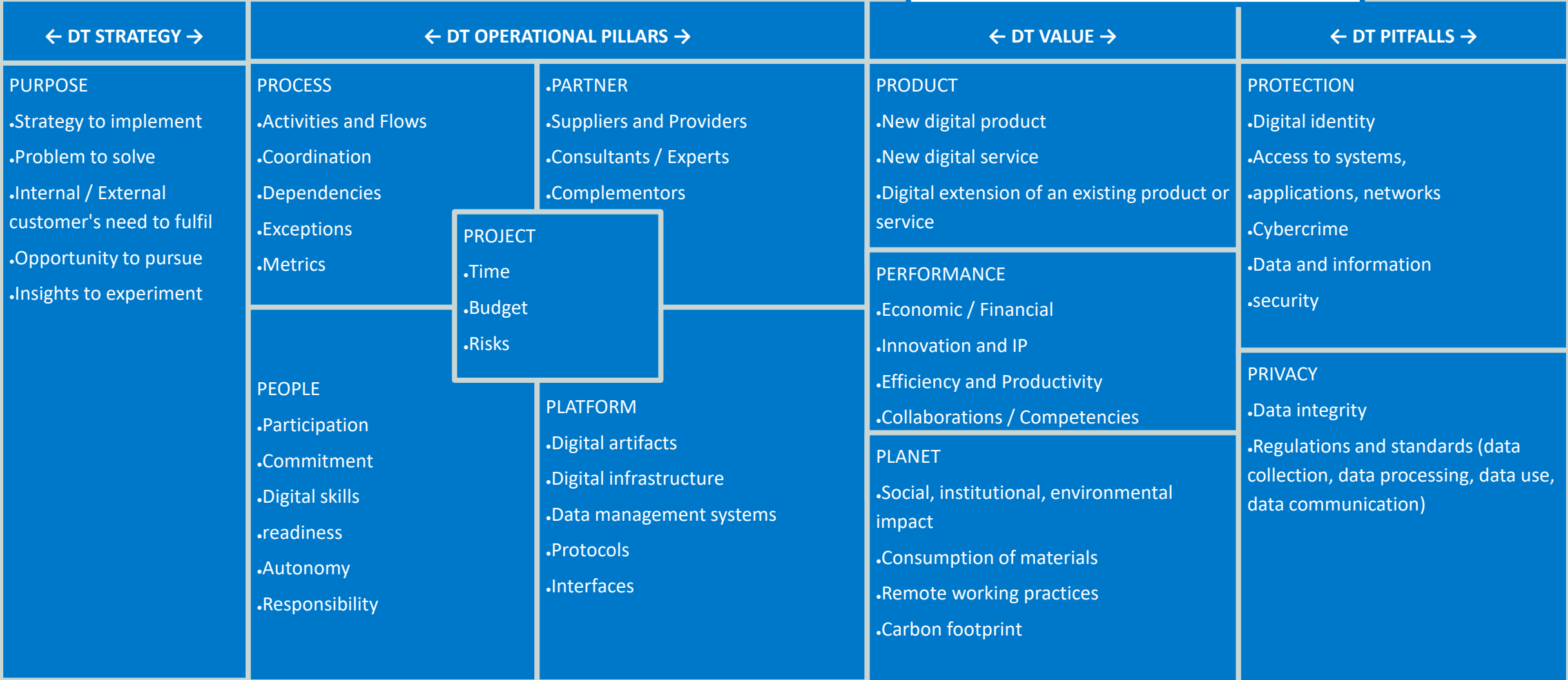
Negative impact

- Cybersecurity risks
- Skills gap
- Resistance to change
- Privacy concerns
- Disruption

Digital Transformation Canvas



Elia, Solazzo, Lerro, Pigni, & Tucci, 2024



EU Framework for Digital Transformation



Constant efforts to improve digital network infrastructures

Connectivity recognized as crucial for the implementation of emerging and advanced technologies.

The main goal of the package is to ensure **better synergy and coordination** between existing initiatives and funding programs in the EU.

Digital Transformation and Circular Economy



Digital transformation plays a crucial role in enabling and advancing circular economy initiatives, focusing on sustainable resource utilization and waste reduction.

A blend of Industry 4.0 technologies like IoT, big data analytics, cloud computing, and AI is central for implementing transformation and enabling a shift from linear to circular models focused on resource efficiency, extending product lifecycles, and closing material loops.

Research shows how digital transformation enhances the circular economy by applying strategies across product design, use, and recycling stages. This aligns with principles like reduce, reuse, and recycle, allowing businesses to innovate circular models, maximize resources, and offer personalized services.

Creative Computing

Bridging Art, Design, and Computing



Creative computing encompasses a **broad and dynamic field that merges computing with creative practices**, opening avenues in art, design, entertainment, and more.

- It leverages computer science and technology as tools for creativity, encouraging innovative thinking and the creation of digital art, interactive media, and various computational artifacts.
- It introduces computer science and computing-related fields to young people in a way that is connected to their interests and values —instead of emphasizing technical detail over creative potential.
- It also encourages young people with access to computers to participate as designers or creators, rather than consumers.

Open-Source Resources and Communities



What are Open-Source Resources?

Collaborative ecosystems where developers, designers, and enthusiasts come together to build and improve open-source software.

Managing Open-Source Communities

- Roles and Responsibilities: functions such as maintainers, contributors, and leaders

Benefits of Open-Source Resources

- Collaboration (shared knowledge and expertise)
- Diversity (contributors from different backgrounds)
- Innovation (rapid development and problem-solving)

Best Practices for Community Participation

- Active Engagement: participate in discussions and contribute.
- Respect and Kindness: treat others with respect.
- Documentation: document your work and share it.

Open-Source Resources and Communities

Some examples



Tools and Technologies



Enabling Creative Computing in Circular Economy Initiatives

Blockchain technologies could provide promising results to address the supply chain's sustainability in terms of trust, traceability, and transparency.

Augmented Reality (AR) and Virtual Reality (VR) technologies enhance user experiences and visualization. Example: Using AR to showcase circular economy practices in retail environments.

Internet of Things (IoT) devices collect real-time data for monitoring and optimizing circular processes. Example: Smart waste bins that notify collection services when full.

3D tools like Blender, Tinkercad, and **SketchUp** allow designers to create 3D models for sustainable product designs.

Collaboration platforms like GitHub and GitLab facilitate collaborative coding and version control.

The programming language Scratch developed to foster creativity and computational thinking. It allows users to create interactive stories, games, animations, and more, emphasizing the playful aspect of learning to code and engaging with digital media.

Tools and Technologies



Enabling Creative Computing in Circular Economy Initiatives

These technologies enable efficient, automated processes that **support the transition from linear to circular production** systems, enhancing sustainability and competitiveness.

This includes:

- **Artificial Intelligence and machine learning** for optimizing resource use and waste reduction.
- **High-performance computing for processing** large data sets.
- **Internet of Things** for tracking material usage.
- **Big data analytics** for insights on sustainability initiatives.
- **Blockchain** for transparency.
- **3D printing** for minimizing material waste.

For businesses aiming to embrace a circular economy, leveraging a mix of advanced digital technologies is key.

We Need

Right To Repair

Definition of Repair

Repair can be understood as a **constitutive part of humans' life on Earth**, and there are many ways to conceive and manage how repair is performed.

In opposition to maintenance, repair is **defined by the event of malfunction**, meaning it holds a reactive nature.



Hernandez, R. J.,
Miranda, C., & Goñi, J. (2020)

EU Regulation and the Right to Repair



- Common rules to promote the repair of goods for consumers proposed.
- Both within and beyond the legal guarantee.
- Makes it easier and more cost-effective to repair products instead of replacing them with new ones.

- March 2023 European Commission adopted new consumer rights.
- February 2024 European Council and Parliament accepted concept.
- Once formally adopted, Directive goes into force.



The Digital Right to Repair Coalition is an independent nonprofit organization advocating for freedom of choice and fair competition for repairing anything with a computer chip.

REPAIR CAFE

Repair Café is the perfect setting to introduce citizens to repair as a circular economy solution.

Goals:

- Repair: to bring repairing back into local society in a modern way;
- Spread: to maintain repair expertise and to spread this knowledge;
- Promote: to promote our badly needed circular economy.

What can be fixed?



Furniture upholstery.

Textiles: sewing, knitting, darning.

Jewelry.

Tool and knife sharpening.

Welding.

Garden equipment.

Electronics.

Old cameras and slide equipment.

Wooden items.

Cobbling

Toys.

Photographic and digital images.

Pottery.

IT support.

Do you know more?

Daily Habits. Small Changes. Big Impact.



Small changes in our daily habits can make a big impact on reducing waste and conserving resources.

Be the generation that steps up, takes action, and inspires real change!



Zero Waste Alliance Ireland

Credits



This material is based upon work from Grassroots of Digital Europe: from Historic to Contemporary Cultures of Creative Computing (GRADE) (Action CA21141) and supported by COST.

Links

[.Visit COST site ↗](#)

[.Visit COST Grade site ↗](#)

European Cooperation in Science and Technology (COST) is a funding agency for research and innovation networks. Our Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.