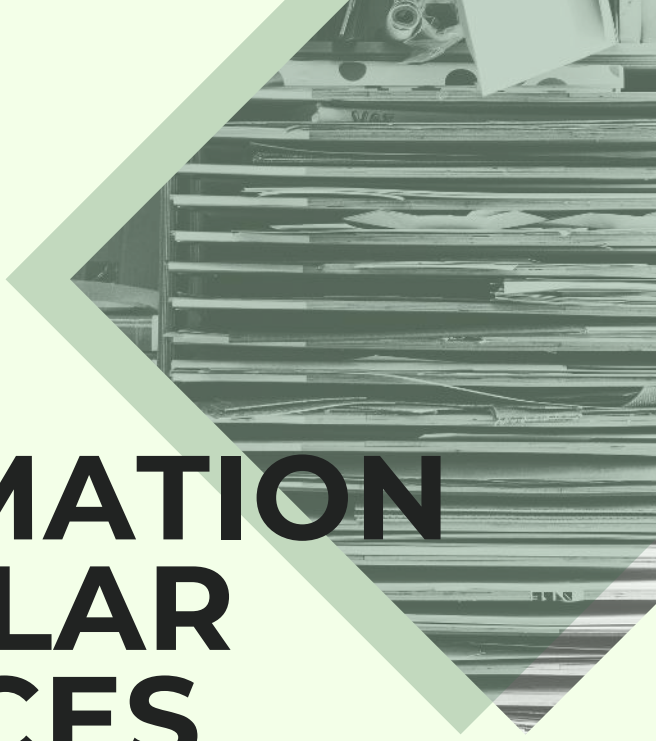

TRANSFORMATION INTO CIRCULAR MAKERSPACES

A PRACTICAL STEP-BY-STEP GUIDE FOR MAKERSPACES

2024

Interreg Baltic Sea Region
Co-funded by the European Union
CIRCULAR ECONOMY
Circular spaces

INTRODUCTION

The Baltic Sea Region is in the quest for sustainable development and environmental stewardship. The adoption of circular economy principles is not just a trend but a necessary shift to mitigate environmental challenges, promote resource efficiency, and foster innovation in this ecologically sensitive and economically diverse region. This guide, “Transformation into Circular Makerspaces: a practical step-by-step guide for makerspaces”, is designed to steer makerspaces across the Baltic Sea Region on a transformative journey towards circularity, aligning with regional ambitions for sustainability and economic resilience.

In the Baltic Sea Region, characterized by its unique environmental challenges and collaborative economic landscape, the circular economy offers a pathway to reduce environmental pressures, enhance resource efficiency, and unlock new opportunities for growth and innovation. Makerspaces in the Baltic Sea Region are well-positioned to lead the transition towards circularity. With a rich tradition of innovation and a strong community ethos, these spaces can leverage their collaborative environments to integrate circular economy principles into their operations and outputs, setting a precedent for sustainable practices in the wider business community.

In several short chapters, the guide emphasizes importance of circular economy in the Baltic Sea Region, describes Circular makerspaces and their role in the business environment of the Baltic Sea Region and provides information on current situation and opportunities of makerspaces in Baltic Sea Region to transition towards circularity. The glimpse at the overall situation and trends which allow makerspaces to see themselves as essential players in achieving circular economy goals in the region is followed by a clear roadmap – a step-by-step guide with checklists of specific actions to enable makerspaces in the Baltic Sea Region to effectively navigate the transitioning to a circular economy.

The guide elaborates on ten aspects or must-haves for makerspaces to transition into circular makerspaces. Each must-have includes a checklist of the aspect-specific actions. The checklist is followed by a list of tools and templates that makerspace can use for their convenience. The ten aspects or must-haves for makerspaces to transition into circular spaces are the following:

1. Strategy and culture for circularity;
2. Assessment and planning;
3. Education, training and business support;
4. Sourcing and material management;
5. Design for circularity;
6. Facility and operation modifications;
7. Community and collaboration;
8. Monitoring and feedback;
9. Showcasing success and innovation;
10. Policy and funding.

This guide “Transformation into Circular Makerspaces: a practical step-by-step guide for makerspaces” has been developed within the Interreg Baltic Sea Region project “Circular Spaces”. The guide is a practical and helpful tool to effectively transition to a circular economy, ensuring that their contributions to sustainability are impactful, measurable, and aligned with the Baltic Sea Region goals.

CONTENT

1 IMPORTANCE OF CIRCULAR ECONOMY IN THE BALTIC SEA REGION

The European Union Strategy for the Baltic Sea Region (EUSBSR) is one of the four Macro-regional Strategies in Europe [1]. The action plan of the EUSBSR includes 14 Policy Areas and Actions for the Strategy implementation, and several of those emphasize the circular economy as a crucial aspect for the sustainable development of the Baltic Sea region [2].

EUSBSR often refers to the EU's new Circular Economy Action Plan which is one of the main building blocks of the European Green Deal, Europe's new agenda for sustainable growth. The EU's transition to a circular economy will reduce pressure on natural resources and will create sustainable growth and jobs. It is also a prerequisite to achieve the EU's 2050 climate neutrality target and to halt biodiversity loss.

The new action plan announces initiatives along the entire life cycle of products. It targets how products are designed, promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is prevented and the resources used are kept in the EU economy for as long as possible. It also introduces legislative and non-legislative measures targeting areas where action at the EU level brings real added value.

Measures that will be introduced under the new action plan aim to:

1. Make sustainable products the norm in the EU;
2. Empower consumers and public buyers;
3. Focus on the sectors that use most resources and where the potential for circularity is high such as: electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water and nutrients;
4. Ensure less waste;
5. Make circularity work for people, regions and cities;
6. Lead global efforts on circular economy [3].

Moving away from the linear "take-make-use-dispose" model and transitioning to a regenerative growth model is essential to keep resource consumption within planetary boundaries. In a circular economy, the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste is minimized.

The current linear economy continually increases its demands of scarce natural resources. By using and consuming in a more circular way, we can substantially reduce the impacts of human economic activities on the environment, including on biodiversity [4].

More circular makerspaces offering their services and being closely linked to local communities, interest groups, students, start-ups and small and medium-sized enterprises can be important agents in achieving the goals of the Green Deal.

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[1] https://www.eusbsr.eu/about/about
[2] https://www.eusbsr.eu/action-plan
[3] https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en
[4] https://environment.ec.europa.eu/topics/circular-economy_en

2 CIRCULAR MAKERSPACES AND THEIR ROLE IN THE BUSINESS ENVIRONMENT OF THE BALTIC SEA REGION

Makerspaces are becoming increasingly common in the world, in Europe and in the Baltic Sea Region. The increase in making has resulted in discussion about environmental impact of the makerspaces and how they can support circular economy. Most makerspaces already have basic circularity awareness and knowledge and to a certain capacity they apply circular economy practices on a daily basis. To accelerate the shift towards even more environmentally sustainable practices, makerspaces should implement vision and actions to foster circularity [5].

The circular makerspaces have all the characteristics of the maker movement and additionally promotes sustainability and is more resource-oriented. The circular economy strategies such as redesign, reduce, share, reuse, refurbish, repair, remanufacture, recycle, upcycle, resource and waste management complement the five key maker movement strategies - make, share connect, learn, innovate [6].

Circular makerspaces in the Baltic Sea Region can be instrumental in driving innovation, education, and collaboration towards sustainability, thereby playing a significant role in transforming the Baltic Sea region's business environment to be more resilient, sustainable, and circular. They even may have the potential to be a driver for the transition of cities towards social inclusion and circular economy model [7].

Moving away from the linear “take-make-use-dispose” model and transitioning to a regenerative growth model is essential to keep resource consumption within planetary boundaries. In a circular economy, the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste is minimized.

Makerspaces can play a pivotal role as:

1. Innovation hubs by providing a space for experimentation and prototyping;
2. Education and skill development centres where individuals and businesses can learn about sustainable practices, circular economy concepts, and how to apply them in product design and business operations;
3. Community and collaboration centres that bring together entrepreneurs, designers, engineers, and environmental enthusiasts, fostering a community that collaborates to reach sustainable solutions;
4. Promoters of economic growth and employment by nurturing start-ups and small businesses that focus on sustainable products and services;
5. Resource efficiency and waste reduction advocates by promoting the use of recycled materials and the development of products designed for longevity, repairability, and recyclability;
6. Catalysts for transitioning towards more sustainable production and consumption patterns.

By analysing the available literature and summarizing the experiences of makerspaces in the Baltic Sea region, the functions, initiatives and practices of a circular makerspace can be clustered into six blocks.

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[5] Honkala T, Hölttä-Otto K., Kähkönen E. (2023), Towards Circular Design and Manufacturing – Lessons Learned from University-Based Makerspaces, 33rd CIRP Design Conference

[6] Metta J. & Bachus K. (2020), Mapping the circular maker movement: from literature review to a circular maker passport (Deliverable 2.1). Leuven: Pop-Machina project 821479 – H2020.

[7] Metta J. & Bachus K. (2020), Mapping the circular maker movement: from literature review to a circular maker passport (Deliverable 2.1). Leuven: Pop-Machina project 821479 – H2020.

3 CURRENT SITUATION AND OPPORTUNITIES OF MAKERSPACES IN BALTIC SEA REGION TO TRANSITION TOWARDS CIRCULARITY

The analysis of the existing situation and opportunities reflects both the potential and valuable resources as well as shortcomings and gaps of the makerspaces in Baltic Sea Region to transition to circular makerspaces.

Table 1. SWOT analysis of Baltic Sea Region makerspaces ready to begin transitioning to circular makerspaces

STRENGTHS: 1. Infrastructure and equipment for circular practices 2. Waste reduction measures 3. Resource utilization and upcycling 4. Community engagement for circular initiatives 5. Success stories and case studies 6. Local municipality and regional support 7. Strong partnerships and cooperation with stakeholders	**WEAKNESSES**: 1. Space limitations for circular projects (for activities, storage for materials) 2. Insufficient equipment for a wide range of circular economy initiatives 3. Resource constraints and funding challenges 4. Skills gaps and training needs 5. Waste management issues 6. Regulatory challenges 7. Limited circular economy knowledge among team and customers 8. Issues with material sorting and recycling 9. Lack of cooperation with companies for material support 10. Limited awareness of a circular makerspace
OPPORTUNITIES: 1. Material sharing and recycling education and initiatives 2. Reduced energy consumption 3. Cooperation for circular economy initiatives 4. Digitalization, leveraging the emerging technologies 5. Education and knowledge enhancement 6. New services and products 7. International and local collaboration 8. Funding opportunities 9. Market expansion for circular services 10. Community engagement for circular initiatives	**THREATS**: 1. Resistance to circular practices, limited awareness and understanding 2. Financial challenges for circular initiatives 3. Supply chain disruptions and resource issues 4. Regulatory changes impacting circular projects 5. Market perception shifts and competition 6. Economic fluctuations and funding challenges 7. Technological changes and digital adoption 8. Increasing competition of makerspaces and maker initiatives

4 STEP-BY-STEP GUIDE FOR MAKING THE TRANSITION TO CIRCULAR MAKERSPACE

This chapter offers a definition of circular makerspace by makerspaces in the Baltic Sea Region as well as a step-by-step guide to turning a linear makerspace into a circular makerspace. The circular makerspace definition and each aspect, practical tool and list of must-haves have been prepared by analysing the available literature and the current situation and opportunities of makerspaces in the Baltic Sea region.

The definition of circular economy makerspace:
A circular economy makerspace is a collaborative and innovative physical or virtual space that operates in alignment with the principles of the circular economy. It serves as a hub where individuals, creators, innovators, and communities come together to design, create, share, and experiment with products, services, and solutions that prioritize sustainability, resource efficiency, and extended product lifecycles. In a circular economy makerspace, the emphasis is on minimizing waste, maximizing resource utilization, and fostering a culture of reuse, repair, upcycling, and responsible consumption. The makerspace provides a platform for education, skill-sharing, and hands-on activities that promote the circular economy's core values, including reducing environmental impact, encouraging collaboration, and transforming traditional linear production and consumption models into regenerative, closed-loop systems.

A step-by-step guide includes a list of 10 must-haves in circular makerspaces. Each step includes a task check-list and practical tools and templates that can be helpful in the process. The ten must-haves are:

1. Strategy and culture for circularity;
2. Assessment and planning;
3. Education, training and business support;
4. Sourcing and material management;
5. Design for circularity;
6. Facility and operation modifications;
7. Community and collaboration;
8. Monitoring and feedback;
9. Showcasing success and innovation;
10. Policy and funding.

Ten aspects of a circular makerspace, including checklists of specific practical activities as well as tools and templates, were created by studying the available literature [8, 9, 10], using the results of workshops and SWOT analysis by the Baltic Sea Region makerspaces [11] and utilising the practical everyday experience of the experts working in makerspaces.

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[8]Honkala T, Hölttä-Otto K., Kähkönen E. (2023), Towards Circular Design and Manufacturing – Lessons Learned from University-Based Makerspaces, 33rd CIRP Design Conference
[9] Metta J. & Bachus K. (2020), Mapping the circular maker movement: from literature review to a circular maker passport (Deliverable 2.1). Leuven: Pop-Machina project 821479 – H2020
[10] Prendeville S., Hartung G., Brass C., Purvis E., Hall A (2017), Circular Makerspaces: the founder's view, International Journal of Sustainable Engineering
[11] Circular makerspace – Kaunas Lithuania; Makerspace DARE – Valmiera, Latvia; Creator Makerspace – Stavanger, Norway; Makerspace MAKER – Copenhagen, Denmark, Makerspace RADE – Ventspils, Latvia, Gewerbehof Luckenwalde – Luckenwalde, Germany

STEP 1

STRATEGY & CULTURE

A strategic commitment to sustainability thinking of makerspace leaders and team is a key to initiate changes towards circularity. This step involves defining clear strategy, staff up-skilling as well as communicating the sustainability vision to the public.

CHECKLIST:

1. Conduct a **competitive analysis** of other closely located makerspaces;
2. Co-develop a shared circular **vision and strategy** of makerspace among the team and manifesting it to stakeholders and clients from get-go;
3. **Communicate** and articulate the vision and strategy to the public;
4. Ensure **makerspace leadership** that is recognised as gatekeeper to circular practices and implementation of the vision and strategy;
5. Train and **up-skill the makerspace team** thus promoting their joining the circular commitment (topics including circular economy, practices, procurement etc.);
6. Attract and train **volunteers** that are passionate about circularity and sustainability;
7. Establish a **sustainability advisory board** consisting of stakeholders and partners to provide guidance.

Regular meetings and educational events for visitors, the maker community and the makerspace team building.

STEP 2

ASSESSMENT & PLANNING

Assessing the current situation and planning clear goals is crucial for sustainability transition. This step involves conducting an audit of current practices, resources, and waste management to understand the baseline from which changes need to be made. It also means setting clear goals for the transition towards circularity, including specific targets for waste reduction, material reuse, and sustainable sourcing.

CHECKLIST:

1. Assess the **circular maturity** of the makerspace;
2. **Inventory of current materials and their sources** as well as evaluate tools, equipment and practices and their relevance, relationship and impact to circularity;
3. Identify **sources of waste and opportunities** for improvement;
4. Define specific **sustainability goals** (e.g., waste reduction targets, percentage of materials to be sourced sustainably);

STEP 3

EDUCATION, TRAINING & BUSINESS SUPPORT

Training and education of maker community contributes hugely to their joining the circular commitment. This step involves educating the makerspace community about circular economy principles and the importance of sustainable practices, including workshops, seminars, and collaborative learning sessions. It also involves training members in skills necessary for circular practices, such as repairing, upcycling, and sustainable design.

CHECKLIST:

1. **Identify circular economy educational needs**, namely, key circular economy principles and practices relevant to makers and makerspaces for education or use a ready-made list of educational programmes' topics for makerspaces transitioning to circularity;
2. **Plan a series of programmes and training** (e.g. educational workshops and programmes, mentorship programme, business support programme, incubation of circular start-ups, seminars, trainings);
3. Develop **training materials** focused on repair, upcycling, and sustainable design or use **ready-made educational and training programmes** for makerspaces;
4. Map the **local knowledge and available experts**, know-how;
5. **Implementation** of educational programmes, workshops, mentorship and incubation programmes and trainings for makerspace target groups involving experts and co-creation between makers and experts (e.g. courses introducing tools and technologies, safety trainings, courses for basic fixing skills, break things down or tear-down courses, top ten materials courses, trade-schools).

Theoretical and practical training and workshops led by local experts.

STEP 4

SOURCING & MATERIAL MANAGEMENT

Shifting to sustainable sourcing by choosing materials that are renewable, recyclable, or reclaimed is one of cornerstones of a circular makerspace. This step includes establishing partnerships with local businesses or organizations for sourcing such materials as well as implement a system for effective management of materials, including storage, tracking, and sharing of resources to minimize waste.

CHECKLIST:

1. Establish **criteria for sustainable materials**;
   Map and build a **network of suppliers** for recycled, renewable, or reclaimed materials, including landfills. Set up a local supplier database, material **database**;
2. Implement a **material tracking and inventory system** for efficient use and sharing;
3. **Events for material management** (e.g. yard sales, selling unnecessary resources online);
4. Implement a **material recovery station**.

STEP 5

DESIGN FOR CIRCULARITY

Makerspaces are places for prototyping and currently in most cases are not seen to be geared towards manufacturing. However, circular makerspaces, experimenting with different circularity ideas could potentially offer alternative production systems and approaches founded on circularity principles. Design for circularity is an important aspect of that. This step includes encouraging and supporting projects that adopt principles of circular design, such as modularity, repairability, and upgradability, and providing tools and resources that facilitate circular design practices, such as modular components, repair kits, and design software emphasizing sustainability.

CHECKLIST:

1. **Encourage sustainability projects** that embody modularity, repairability, and upgradability;
2. Provide access to **circular design tools and resources**, including digital open-source design tools;
3. Realise **product life-cycle extension initiatives**, often community-led or co-creation based - reuse, repair, remanufacturing, refurbishment, recycling, upcycling, sharing, emotional attachment, adaptability, upgradability, industrial symbiosis events and initiatives, (e.g., repair cafes, restart parties, open door days, manufacturing to produce spare parts in low-volume, making improvements to furniture, material exhibitions)
4. Organize **circular design events, challenges or hackathons**;
5. Set up **innovation lab** to experiment with emerging technologies, approaches, materials.

Sustainable design workshops for children and adults.

STEP 6

FACILITY & OPERATION MODIFICATIONS

This step includes redesigning the space and operations to support circular practices. This might include setting up dedicated areas for material recovery, repair stations, and recycling bins. It also includes integrating energy-efficient equipment and sustainable practices into the daily operations of the makerspace.

CHECKLIST:

1. Identify necessary **facility modifications** to support circular practices (e.g., repair stations, appropriate and available storage rooms, wall of boxes, supply caves, recycling trolleys, libraries for sharing materials, electronics, co-working spaces). Work together with architects and urban planners;
2. Plan for the integration **of energy-efficient and sustainable infrastructure** and equipment (e.g. acquiring specialised machinery for recycling, up-cycling or sustainable materials experimentation);
3. Review and optimise the **appointment and entry system**;
4. Introduce a **project management platform or system** to track tasks, milestones, deadlines;
5. Establishing clear **safety guidelines**;
6. Ensure **equipment and premises maintenance** (e.g. regular maintenance checks, invest in repair and replacement of malfunctioning equipment, developing system for reporting equipment issues and for tracking maintenance, regular cleaning schedule);
7. Implement **waste sorting and recycling systems** (seek partnerships with recycling companies, appoint waste management coordinator responsible for overseeing waste reduction initiatives);
8. Install **signs and visual cues** to promote circularity (e.g. of off-cuts and valuable scrap materials stored visibly to promote using those for prototyping, used or recycled materials for free, guidelines for efficient machine and equipment use (e.g. testing the machine setting with scrap material), indication alternatives to the use of machinery, signposting to local resources and collected materials, examples of prints – size, font, density);
9. **Loaning, sharing the equipment**.

STEP 7

COMMUNITY AND COLLABORATION

Engaging community and stakeholders, creating valuable networks is key to foster their joining the circular commitment. This step includes fostering a community culture that values and practices circular economy principles. This can be through regular events focused on sustainability, community projects, and collaborative challenges. It also includes collaborating with other organizations, makerspaces, and educational institutions to share knowledge, resources, and best practices in circular making.

CHECKLIST:

1. Develop a **community engagement plan** for promoting circular practices;
2. Establish **partnerships** with local organizations, other makerspaces, and educational institutions, including cross-industry and cross-sectoral initiatives;
3. Plan **regular community events** focused on co-creation and sustainability (e.g. community projects, collaborative challenges, knowledge and best circular practices sharing events time-banking, skill sharing);
4. Initiatives to **understand local needs**, skills, knowledge, barriers, risks;
5. Develop outward looking, inclusive and **welcoming communication**;
6. Introduce **digital tools or systems to promote resource, equipment, material, knowledge, information and idea sharing,** including contributing information about makers' needs to the digital tools and system providers, providing makers with digital tool or system training, encouraging makers to use digital tools or systems.

Meetings, events, and other collaborations with local entrepreneurs, service providers, and the public to discuss topics relevant to the makerspace and the maker community in the region.

STEP 8

MONITORING & FEEDBACK

Monitoring and feedback from the maker community helps the makerspace to see progress on the way to becoming circular. This step involves establishing systems for monitoring progress towards the set goals, such as tracking waste reduction, material reuse rates, and community engagement in circular projects. It also involves seeking regular feedback from the community to understand challenges, gather suggestions, and continuously improve the circular practices of the makerspace.

CHECKLIST:

1. **Tracking progress towards sustainability goals** in line with the defined sustainability KPIs;
2. Implement a **feedback mechanism** for maker community members to share insights and suggestions;
3. Regularly **review progress and adjust practices** as necessary.

Participating in networking events and providing activities that help gather feedback.

STEP 9

SHOWCASING SUCCESS & INNOVATION

Showcasing success stories, projects, initiatives and innovations truly inspires others and demonstrates the value of circular practices. This step involves highlight successful projects and innovations emerging from the circular makerspace and sharing stories, case studies, and best practices both within the makerspace community and with a wider audience through social media, publications, and presentations at relevant events.

CHECKLIST:

1. Create clear **communication plan** to inform stakeholders, partners, investors, members, society;
2. **Identify successful projects** and innovations to highlight – create a success story or circularity flagship project portfolio (e.g. keeping some prototypes and case study materials and presentations as inspiration to others, highlighting unique offerings and community engagement as differentiators);
3. **Develop case studies or stories** showcasing circular practices (e.g. good design practices);
4. **Share achievements** through various channels (social media, newsletters, local media, events).

Inspiring meet-ups and other events with local makers.

STEP 10

POLICY & FUNDING

Many makerspaces are not financially self-sustainable; therefore, attracting additional funding and creating opportunities for implementing circular economy initiatives is very important. This step includes preparing recommendations and proactively making suggestions to local, regional and national governments about the importance of promoting the circular economy, as well as preparing project and initiative applications for local and cross-border cooperation programmes to attract funding for circular economy and sustainability activities.

CHECKLIST:

1. Maintain **close relationships with regulatory authorities** to stay informed of upcoming changes and influence policies;
2. **Prepare recommendations** and proactively making suggestions to local, regional and national governments about the importance of promoting the circular economy, about regulatory issues, necessary funding programmes for makerspaces;
3. **Involve stakeholders and policy makers** in activities with the aim of gaining their policy support for the maker movement;
4. **Apply for funding** for circular activities in makerspaces and establish a dedicated team to manage applications and project execution;
5. **Identify investors and donors** that could contribute to circularity needs of the makerspace or its clients.

Edgars Rinkēvičs, the President of the Republic of Latvia, visiting DARE - makerspace in Valmiera, Latvia.

Dace Melbārde, a Latvian cultural worker, politician, and former member of the European Parliament, gets inspired.

5 TOOLS AND TEMPLATES

5.1. CIRCULAR MATURITY TEST

The Circularity Maturity Test is a comprehensive diagnostic tool designed to evaluate the extent to which organizations and individuals have integrated circular economy principles into their operations and practices. The tool is tailored to five different target groups: makerspaces, makers, SMEs (small and medium enterprises) and start-ups, suppliers, and other relevant stakeholders. By providing a structured assessment, the tool helps identify strengths, areas for improvement, and actionable steps to advance circularity. Users who have registered in the system will have the opportunity to take the test again and compare the current and previous results, thus measuring the progress of positive changes.

How it works:

Questionnaire: Each target group completes a tailored questionnaire that addresses specific aspects of circularity relevant to their operations and practices.

Scoring: The responses are scored based on predefined criteria that reflect best practices in circular economy.

Analysis: The scores are analysed to determine the maturity level of the respondent in each assessment area.

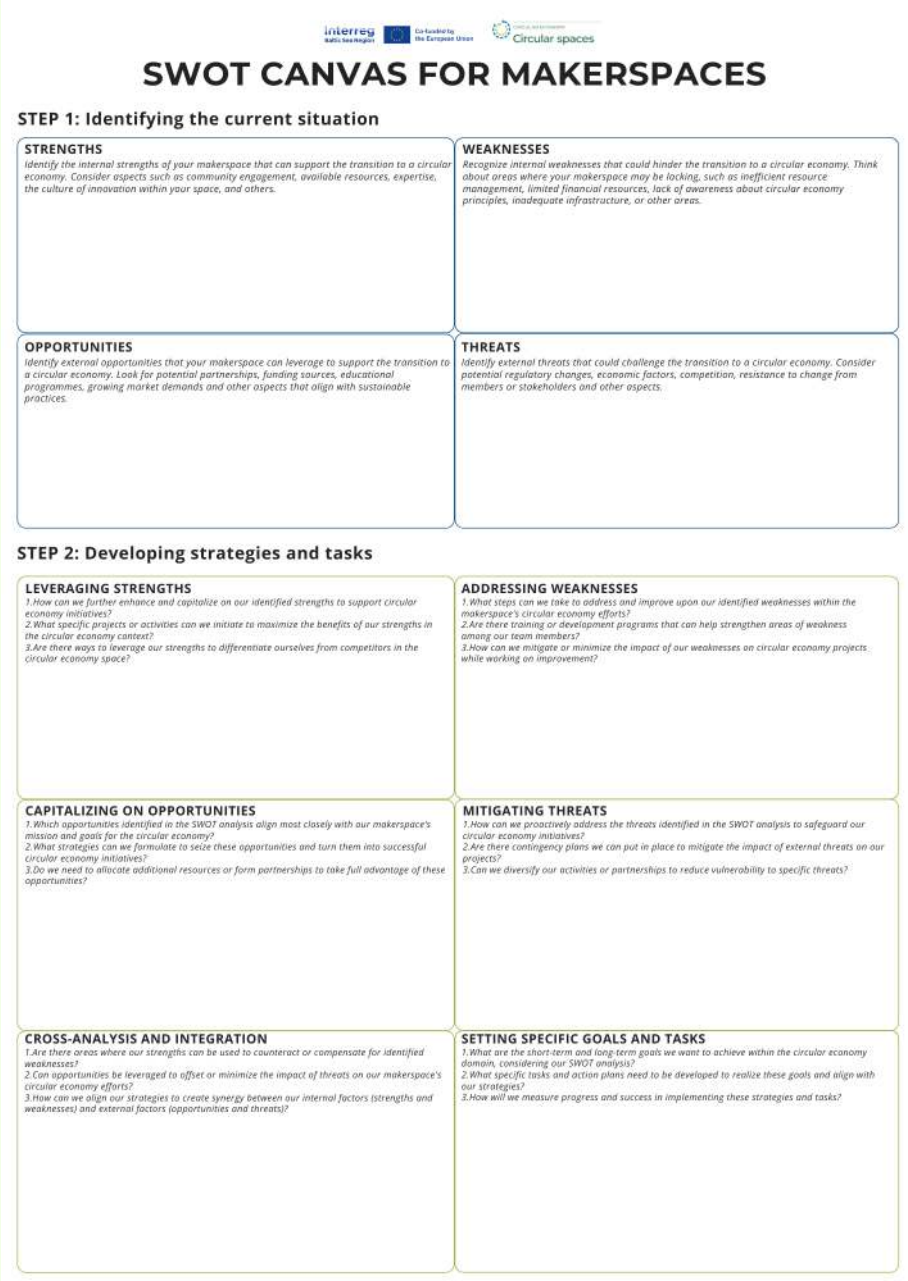
Report: A report is generated, providing insights into the current state of circularity, strengths, and areas for improvement.

Access the Circular Maturity Test here [12].

[12] Circular Maturity Test: https://makertech.com/en/circularity-test/

5.2. SWOT CANVAS FOR MAKERSPACES

This method helps to successfully assess the current situation and define opportunities for makerspaces for the transition from a linear to a circular economy. When conducting your SWOT analysis, involve key stakeholders and gather data to ensure a comprehensive understanding of the makerspace's current situation and its potential within the circular economy context. This analysis can serve as a foundation for strategic planning and decision-making. Analysing makerspaces in the context of the circular economy using a SWOT analysis can provide valuable insights. The current situation analysis and the description of makerspace opportunities is a good sequential next activity after, for example, a customer and stakeholder focus group analysis or after researching competitors and other Makerspaces.



SWOT CANVAS FOR MAKERSPACES

STEP 1: Identifying the current situation

STRENGTHS	WEAKNESSES
Identify the internal strengths of your makerspace that can support the transition to a circular economy. Consider aspects such as community engagement, available resources, expertise, the culture of innovation within your space, and others.	*Recognize internal weaknesses that could hinder the transition to a circular economy. Think about areas where your makerspace may be lacking, such as inefficient resource management, limited financial resources, lack of awareness about circular economy principles, inadequate infrastructure, or other areas.*
OPPORTUNITIES	**THREATS**
Identify external opportunities that your makerspace can leverage to support the transition to a circular economy. Look for potential partnerships, funding sources, educational programmes, growing market demands and other aspects that align with sustainable practices.	*Identify external threats that could challenge the transition to a circular economy. Consider potential regulatory changes, economic factors, competition, resistance to change from members or stakeholders and other aspects.*

STEP 2: Developing strategies and tasks

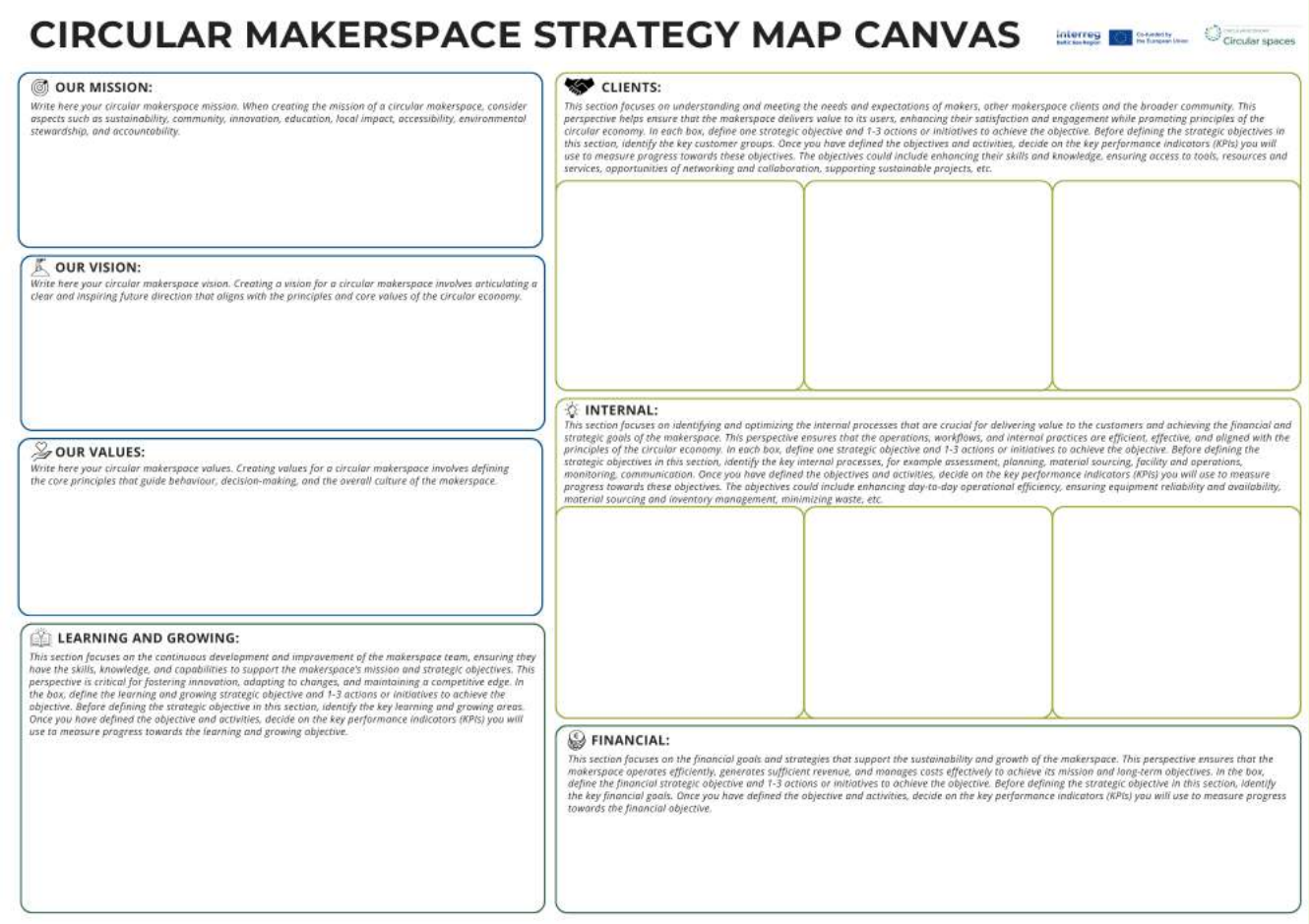
LEVERAGING STRENGTHS	ADDRESSING WEAKNESSES
1.How can we further enhance and capitalize on our identified strengths to support circular economy initiatives? *2.What specific projects or activities can we initiate to maximize the benefits of our strengths in the circular economy context?* *3.Are there ways to leverage our strengths to differentiate ourselves from competitors in the circular economy space?*	*1.What steps can we take to address and improve upon our identified weaknesses within the makerspace's circular economy efforts?* *2.Are there training or development programs that can help strengthen areas of weakness among our team members?* *3.How can we mitigate or minimize the impact of our weaknesses on circular economy projects while working on improvement?*
CAPITALIZING ON OPPORTUNITIES	**MITIGATING THREATS**
1.Which opportunities identified in the SWOT analysis align most closely with our makerspace's mission and goals for the circular economy? *2.What strategies can we formulate to seize these opportunities and turn them into successful circular economy initiatives?* *3.Do we need to allocate additional resources or form partnerships to take full advantage of these opportunities?*	*1.How can we proactively address the threats identified in the SWOT analysis to safeguard our circular economy initiatives?* *2.Are there contingency plans we can put in place to mitigate the impact of external threats on our projects?* *3.Can we diversify our activities or partnerships to reduce vulnerability to specific threats?*
CROSS-ANALYSIS AND INTEGRATION	**SETTING SPECIFIC GOALS AND TASKS**
1.Are there areas where our strengths can be used to counteract or compensate for identified weaknesses? *2.Can opportunities be leveraged to offset or minimize the impact of threats on our makerspace's circular economy efforts?* *3.How can we align our strategies to create synergy between our internal factors (strengths and weaknesses) and external factors (opportunities and threats)?*	*1.What are the short-term and long-term goals we want to achieve within the circular economy domain, considering our SWOT analysis?* *2.What specific tasks and action plans need to be developed to realize these goals and align with our strategies?* *3.How will we measure progress and success in implementing these strategies and tasks?*

Access and download the blank SWOT Canvas for Makerspaces here [13].

[13] SWOT Canvas for makerspaces: https://makertech.com/images/userfiles/circular_spaces/Guidelines/A3A4_SWOT_CANVAS_FOR_MAKERSPACES_CircularMakerspaces_(1).pdf

5.3. CIRCULAR MAKERSPACE STRATEGY MAP CANVAS

This is a strategy map canvas that will help makerspace aspiring to become circular to determine priorities, objectives of strategic dimensions and key activities to accomplish the objectives. The circular makerspace strategy map canvas was designed with inspiration from the Balanced Scorecard [14].



Download the blank Circular Makerspace Strategy Map Canvas here [15].

[14] https://www.clearpointstrategy.com/blog/full-exhaustive-balanced-scorecard-example
[15] Circular Makerspace Strategy Map Canvas: https://makertech.com/images/userfiles/circular_spaces/Guidelines/A3_Tools_and_templates_Guidlines_CircularMakerspaces.pdf

5.4. CIRCULAR ECONOMY TRAINING PROGRAMMES

A coalition of several makerspaces in Latvia, Lithuania, Germany, Denmark and Norway has developed and piloted eight training programmes on the circular economy. Training is valuable for educating and engaging all types of makers in more sustainable everyday practices. The training will also be excellent for up-skilling makerspace teams.

The topics of the eight training programmes are:

1. **Circular Economy: from linear to circular** - developed by Technical University of Applied Sciences Wildau (Germany);
2. **Waste as a resource in circular economy** - developed by Kaunas Science and Technology Park (Lithuania);
3. **Circular value chains, ecosystems and people** - developed by Valmiera County Council (Latvia);
4. **Circular business models** - developed by Ventspils High Technology Park (Latvia);
5. **Product life cycle and ecological footprint** - developed by Valmiera Development Agency, Makerspace DARE (Latvia);
6. **Design thinking for circular products** - developed by Makerspace CREATOR (Norway);
7. **Reusability, repairability, recyclability** - developed by Makerspace MAKER (Denmark);
8. **Integrating circular approaches into every day work life** - developed by Lithuanian Innovation Centre (Lithuania).

Access the educational programmes and ready-made materials here [16].

[16] Circular economy training programmes - https://makertech.com/en/circular-spaces/

5.5. DIGITAL CIRCULAR COLLABORATION PLATFORM

The Digital circular collaboration platform is designed to empower the maker community by providing a comprehensive platform that connects makers, facilitates collaboration, promotes circular economy practices, and offers educational resources. The digital tool is more than just a platform; it's a hub for innovation, collaboration, and sustainability within the maker community. By connecting makers, promoting circular economy practices, and offering valuable resources, the platform aims to foster a vibrant and resilient maker ecosystem.

The platform's key functionalities include:

1. **Makerspaces on the map** - an interactive map feature allows users to discover and connect with makerspaces around the world.
2. **Forum for makers** - the forum provides a dedicated space for makers to engage in discussions, share ideas, and seek advice from their peers.
3. **Prototyping jobs/orders** - the job board connects makers with opportunities for prototyping work.
4. **Marketplace** - the marketplace enables makers to buy and sell products and services related to their craft.
5. **Circularity labels** - to promote sustainability, our platform includes a labelling system that indicates the circularity of products and makerspaces.
6. **Circular maturity test** – a comprehensive diagnostic tool designed to evaluate the extent to which organizations and individuals have integrated circular economy principles into their operations and practices.
7. **Circular economy training materials** – comprehensive training materials to help users develop new skills and adopt circular economy practices.

Access the Digital circular collaboration platform here [17].

makertech

[17] Digital Circular Collaboration Platform - https://makertech.com/en/

6 CASE STUDIES: TRANSFORMED MAKERSPACES

6.1. MAKER (COPENHAGEN, DENMARK)

www.maker.dk

Maker is a member-based non-profit association founded in 2015 as a platform for the maker movement in Denmark and the Nordics. Since then, Maker has evolved from a traditional makerspace into an open lab and community central for entrepreneurs, start-ups and independent creatives.

Maker develops, shares and learns with its members and partners across EU, Denmark and the Baltic Sea Region projects. With research institutions, companies, makerspaces and governments, Maker focuses on sustainability and entrepreneurship - from open-source hardware to distributed design, thus transitioning into a circular space that encourages sustainable practices, material recycling, local production, and more.

Asger Nørregård Rasmussen Workshop and Community Manager, Maker

"The facility, machinery, and practice upgrades we implemented to become a circular makerspace have benefited both MAKER as an association and our member community. In our member base, we experience a significant focus on waste management, designing with waste materials, and circular design practices - design for disassembly, flat pack, bio materials, recycled materials, design for repair, and design for longevity. Having the right tools and machines for upcycling, recycling and reusing materials, as well as shared systems for discarded materials, creates a snowball effect and serves as an inspiration, knowledge sharing and capacity building within our member base."

The most valuable makerspace transition steps, according to Asger Nørregård Rasmussen:

- Strategy and Culture for Circularity
- Sourcing and Material Management
- Assessment and Planning
- Community and Collaboration

OUTLOOK BY A MAKER

Maker Niels Jyrkinewsky Mathiesen, a member of Maker

"I base my furniture project on the leftover boards from the VM Bench build as part of a Circular Spaces project training activity by Maker. Furniture cut on a CNC router often leaves a frame of scrap material, which has been the starting point for my furniture series for the tennis court. Using the leftover frames as the material gives me structural elements/profiles to incorporate into a new design directly. Thus, the entire board can produce two designs in one cut. The tennis furniture series consists of a referee chair, a bench, and a chair. Each piece of furniture gives new life to materials that otherwise would be discarded. Being part of Maker and having access to leftover materials and new waste sources is a great opportunity and has changed how I design and build products."

6.2. DARE (VALMIERA, LATVIA)

www.darevalmiera.lv

DARE is a place to indulge in creative ideas, grow one's business and learn new skills. It is all about co-creation and community of makers and entrepreneurs who support each other. DARE is a powerful regional makerspace that inspires and experiments, where ideas become prototypes and makers become start-ups. The makerspace DARE was created in 2020 by the Valmiera Development Agency in cooperation with the Valmiera County Municipality and many other partners.

Since 2023, DARE has been transforming into a circular makerspace. The changes allowed DARE to settle in more appropriate premises, acquire new equipment, expand operations, reach a wider community and implement and promote circular economy principles.

Māris Ozols
Makerspace Manager and
Technology Expert, DARE

"Becoming more circular brought about many changes for our makerspace. In addition to the new premises, equipment, training programmes, new cooperation partners, and the introduction of daily circular economy practices, I see two important benefits. The first benefit is significantly wider opportunities to reuse and recycle materials and by-products, which later often turn into locally created products or prototypes. The second benefit is the opportunity to foster circular mindsets and create a better environment around us."

The most valuable makerspace transition steps, according to Māris Ozols:

- Strategy and Culture for Circularity
- Facility and Operation Modification
- Policy and Funding
- Community and Collaboration
- Monitoring and Feedback
- Showcasing Success and Innovation

OUTLOOK BY A MAKER

Maker Karīna Vītiņa, DARE community member

"I often work in DARE together with my team. We created our product using plastic 3D printing waste accumulated in the makerspace, such as PLA plastic filament leftovers and plastic spools. To reach the final product version, we had to make a mould. The availability of equipment and technical experts' knowledge helped us achieve it. Change in the makerspace DARE inspires us. Makers have more room for creativity and experimentation. Cooperation with new partners provides access to secondary materials and by-products, thus supporting makers."

6.3. LUCKENWALDE MAKERSPACE (LUCKENWALDE, GERMANY)

www.praesenzstelle-luckenwalde.de

Luckenwalde Makerspace is a place for innovation and new ideas. Makerspace fosters the implementation of maker ideas - working individually or in teams and cooperating with specialists from many industries. The makerspace also has a co-working space and an exhibition space where makers can present their products or get to know and test other innovative technologies.

The added value of Makerspace is its close connection with several research centres and universities, especially Wildau Technical University of Applied Sciences and the University of Applied Sciences Potsdam. Makers have access to various technologies, appliances and expert knowledge, and the makerspace, through its cooperation partners, is a bridge to an even wider resource and knowledge base.

Markus Lahr
Head of Makerspace,
Luckenwalde Makerspace

"Transitioning to a circular makerspace enhances sustainability by minimizing waste and maximizing resource efficiency. It encourages innovation and creativity as makers repurpose materials while reducing costs through upcycled resources. This approach promotes community engagement through collaboration and educational initiatives, enhancing the makerspace's reputation and supporting local economic resilience."

The most valuable makerspace transition steps, according to Markus Lahr:

- Design for Circularity
- Education, Training and Business Support
- Sourcing and Material Management
- Community and Collaboration

OUTLOOK BY A MAKER

Anne Borkmann,
Luckenwalde
Makerspace power user

"I like the mix of co-working space and makerspace here. I enjoy being here on Thursdays when the two can be combined. I appreciate that I don't have to own all the technology and can find the equipment I need for my ideas here. If I have any questions, there is always someone to talk to. I learn something new every time. I also like the atmosphere – many different projects are created simultaneously. I love being inspired by the creativity of the other visitors and, of course, the staff on site. Upcycling and thinking outside the box is the hallmark of the makerspace - a place of discovery for our whole family. The children can work on their first projects and learn how to use the devices playfully. They are really proud afterwards and have lots to talk about."

Shira Karmi, maker
at Luckenwalde
Makerspace

"Circularity has empowered me to be more creative and develop my brand, "ByShira", by opening up a new world of possibilities. I've transformed discarded items into unique, upgraded pieces by repurposing pre-made clothes and giving them new life. This approach fuels my creativity and aligns with my interest in sustainability, allowing my brand to grow purposefully."

6.4. RADE (VENTSPILS, LATVIA)

www.makertech.com

Ventspils design workshop RADE is a production unit room and a makerspace where individual users and entrepreneurs create various products. The workshop has multiple production units to print photos, make stickers, create product packaging, and transfer any design to clothing, plastic, metal, wood, acrylic, and various composite materials.

RADE was created in 2021. During 2023 and 2024, it transformed and became circular by applying circular practices and introducing new equipment and educational programmes in the workshop. RADE is also the creator and key promoter of Makertech, the international digital circular collaboration platform for makers.

Nauris Boguts
Head of Ventspils design workshop RADE

"Ventspils design workshop RADE was initially intended to be a circular makerspace as it promoted equipment sharing. However, we realized how much more we can do after acquainting ourselves with the circularity step-by-step guidelines for makerspaces. We applied the circularity steps to fit our situation and have been developing circularity solutions since then. For example, we have reduced waste and given many materials a new life. The team upskilling allows us to educate and help makers and visitors. The circularity step-by-step guidelines for makerspaces have been a comprehensive and invaluable tool to guide us through this process."

The most valuable makerspace transition steps, according to Nauris Boguts:

- Community and Collaboration
- Education, Training and Business Support
- Sourcing and Material Management
- Facility and Operation Modification
- Showcasing Success and Innovation

OUTLOOK BY A MAKER

Maker Elīna Pērkona, RADE community member

"I am a maker who creates light boxes from plastic waste and a regular at the Ventspils design workshop RADE. Since I first visited Ventspils design workshop RADE, it transformed into being circular, and things are different. I see a change in makerspace's approach to how things are done and promoted to its makers. RADE is now a greener and more environmentally friendly workshop. My experience at the workshop has been truly enjoyable. The makerspace staff have supported me during all stages of creating the product. They gave valuable advice regarding technical details and making the product more environmentally friendly. Thanks to Katrīna and Nauris, who welcomed me every time."

6.5. CREATOR MAKERSPACE (STAVANGER, NORWAY)

www.creator.no

Creator Makerspace, established in 2015, is a non-profit makerspace in Stavanger. The makerspace is a prototyping workshop where people with common interests meet to work on projects and share ideas, equipment and knowledge. Creator's members are makers, hobbyists, innovators, specialists, technology experts and inventors.

The makerspace is a beacon for innovation, bridging the gap between hobbyists and professionals. The Creator's commitment is cultivating a conducive environment for creation and collaboration to generate opportunities and enhance the local economy. The makerspace aims to be an attractive meeting and work venue for makers and help create regional workplaces.

Jan Tore Usken
Makerspace Manager,
Creator

"By adopting circular practices, The Creator Makerspace creates a more sustainable, resilient, and innovative environment that resonates with creators and the broader community. We have gained several significant benefits from the transformation process. Becoming more resource-efficient allowed us to reduce our environmental footprint and cut costs. Thus, the makerspace is more affordable to creators and can extend resources for innovation. The new circular systems encourage a mindset of redesign and repurposing, sparking unique design approaches and creative problem-solving among makers, leading to novel solutions and ideas. We see that many stakeholders, especially younger creators, value sustainability. Circular practices resonate with community values. Committing to sustainability attracts wider audiences and sustainability-driven stakeholders, builds stronger community ties, strengthens the Creator's brand and reputation and positively impacts the environment."

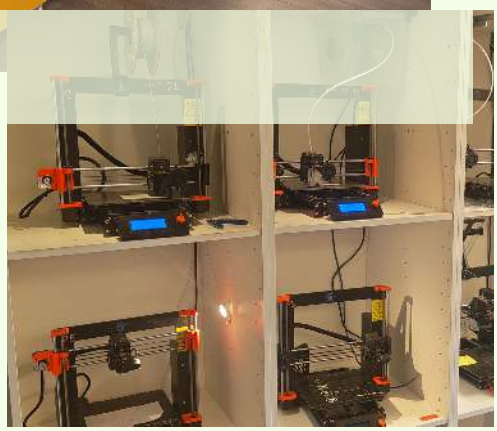
The most valuable makerspace transition steps, according to Jan Tore Usken:

- Community and Collaboration
- Strategy and Culture for Circularity
- Sourcing and Material Management
- Facility and Operation Modification

OUTLOOK BY A MAKER

Mohamed Jadaine,
CREATOR
community member

"My creative process has completely transformed since the Creator shifted to a circular approach. Now, every project starts with rethinking how to use what is already here, pushing me to innovate in ways I have yet to consider. I am not just making things - I am a part of something sustainable and impactful. Recycling waste 3D printer filament is fantastic for upcycling it for new use!"



The document "Transformation into circular makerspaces. A practical step-by-step guide for makerspaces" was developed within the "Circular Economy makerspace" project that was co-financed and supported by the Interreg Baltic Sea Region 2021-2027 Programme.

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