

APPLYING “R” STRATEGIES TO FOSTER ENVIRONMENTAL SUSTAINABLE PRACTICES IN BIOBANKING

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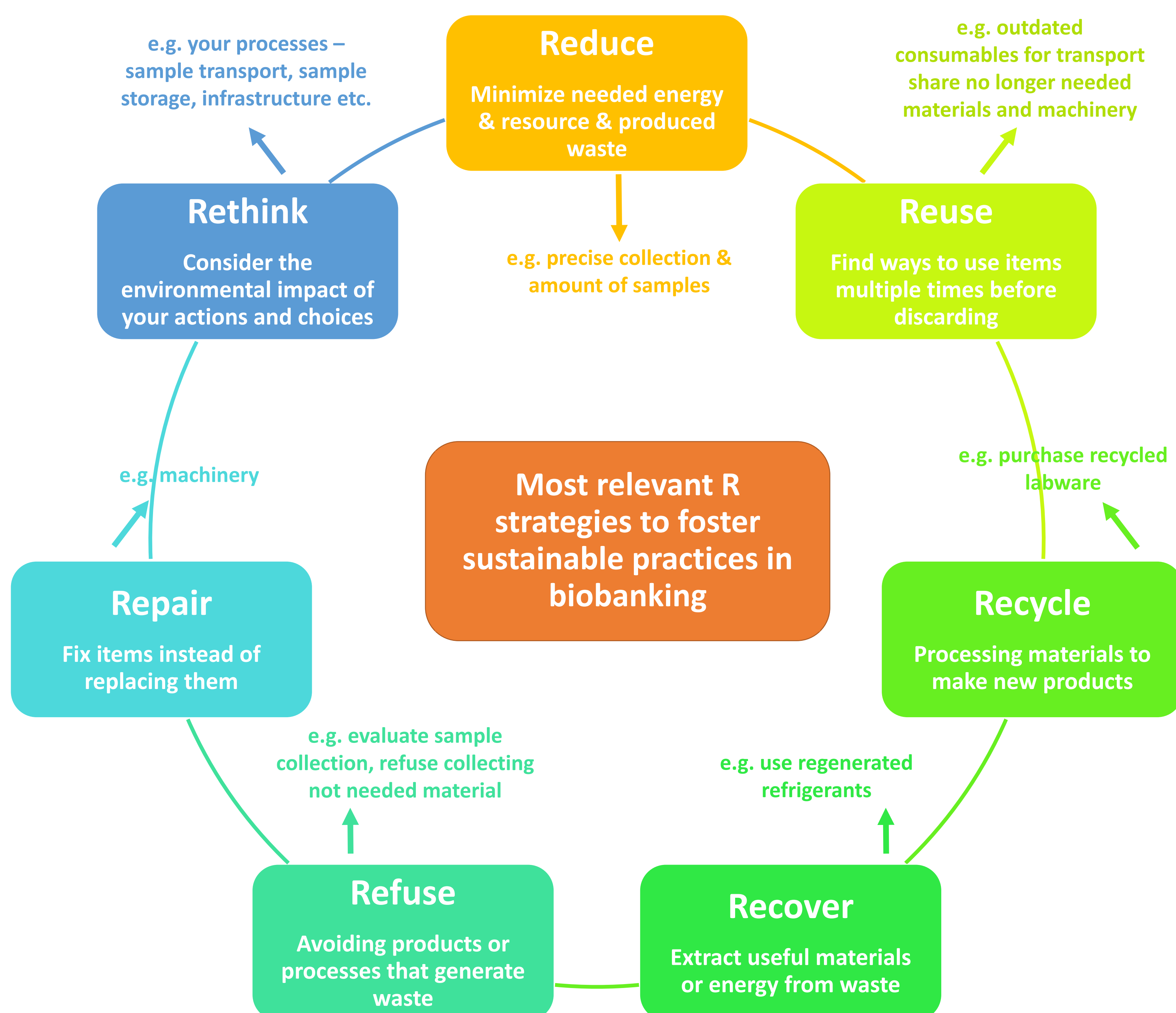
INTRODUCTION

Biobanking can generally be considered sustainable, as the logistics, storage, and retrieval of samples are centralized and highly organized. Since biobanks already hold a wide variety of samples from different sources, researchers do not need to collect new samples but can access those already stored. (Secondary use of existing samples and data.) Additionally, biobanks promote collaboration among research institutions and industries by enabling access to valuable biological data and samples. This collaborative environment reduces the duplication of research efforts, optimizes resource use, and ensures that samples are utilized to their full potential across various fields. However, biobanks still require substantial amounts of energy and other resources, which must be carefully considered.

MATERIAL AND METHODS

We adapted the framework proposed by Zorpas (1) including up to 100 potential R's strategies to find suitable sustainability measures. Through an intensive literature review and analysis, Biobank Graz - a partner of BBMRI.at, has identified several actionable improvements.

RESULTS



DISCUSSION AND CONCLUSION

Applying “R” strategies helped Biobank Graz to identify sustainability measures and save energy, resources and costs. Biobanks and related institutions can make significant strides toward sustainability, benefiting both the environment and operational efficiency.

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1 Zorpas AA. The hidden concept and the beauty of multiple “R” in the framework of waste strategies development reflecting to circular economy principles. Science of the Total Environment. 2024 Nov 20;952.

Recommendations for resource saving measures (grouped thematically)

Emission sources or activity	Recommendations for resource saving measures
Electricity	<ul style="list-style-type: none"> Implement renewable energy sources (like green energy certified with the Austrian ecolabel UZ 46 - Green Electricity / Grüner Strom UZ 46)
Freezers & cryogenic storage systems	<ul style="list-style-type: none"> Use energy efficient freezers and storage systems Perform regular maintenance (de-icing) Optimize loading (avoid empty spaces) Use space-saving techniques (e.g. condense sample tubes on plates) Refrain from storing primary tubes, such as PAXgene tubes and store e.g. isolated DNA in smaller tubes Cryotanks: Use slim towers that can host smaller boxes to use the empty space between the regular towers Raising temperature from e.g. -80 °C to -70 °C (saves up to 33 % of energy!)
Refrigerants	<ul style="list-style-type: none"> Consider the greenhouse warming potential of the used refrigerant when investing in new freezers or storage systems
LN ₂	<ul style="list-style-type: none"> Purchase CO₂ neutrally produced LN₂
Alternative storage solutions (less or no cooling)	<ul style="list-style-type: none"> Desiccation Lyophilisation/Freeze drying Encapsulation Additives that stabilize certain analytes
Samples	<ul style="list-style-type: none"> Evaluate needed sample volume and amount Dispose samples no longer needed
Consumables	<ul style="list-style-type: none"> Purchase recycled or biodegradable lab ware (e.g. tips, gloves, bags, boxes, lids, etc.) Use high density racks and trays Reuse e.g. boxes and lids for sample shipment
Sample Transport	<ul style="list-style-type: none"> Choose carbon-neutral or low-emission transport options (e.g. bicycle couriers) Transport multiple samples at once, rather than individually Collaborate with local suppliers and logistics providers who are committed to sustainability
Instruments and equipment	<ul style="list-style-type: none"> Encourage reuse of materials and equipment Evaluate if all the infrastructure and equipment is really needed at the biobank (e.g. deionized water systems, Ice machinery, cryotomes, etc.) Consider sharing of devices that are not in constant use Carry out repairs instead of exchanging the whole instrument
IT and data storage	<ul style="list-style-type: none"> Use energy efficient IT solutions and data centers Remove redundant or outdated data files Use waste heat of servers
Training for staff members	<ul style="list-style-type: none"> Train your staff on sustainability practices related to: <ul style="list-style-type: none"> IT topics (turning off computers, screens, etc.) Facility topics (efficient ventilation and heating, using of light etc.) Work efficiency with freezers, cryotanks, centrifuges, fume hoods, etc. (e.g. door opening times, etc.) Reusing and recycling Rethinking processes (e.g. paperless culture, coordinated ordering, etc.) Business travels and commuting
Commuting and traveling	<ul style="list-style-type: none"> Promote remote work and remote meetings Foster sustainable transport options (public transport, electric vehicles, biking)
Buildings	<ul style="list-style-type: none"> Install photovoltaics and/or windmills Use geothermal heat Use waste heat from e.g. serves, ultra-low freezers or other huge machinery Use energy efficient smoke extraction, ventilation and daylight technology Optimize natural lightning and use LED lightning Renovate windows, facade, basement, roofs Install electronic sun protection control