SAFETY IMPERATIVES OF CIRCULAR ECONOMY

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DURING

THE SAFETY ENGINEERING INSIGHT: EXPERT DISCUSSION SERIES BY NISafetyE FELLOWS

UNDER THE DISTINGUISHED CHAIRMANSHIP OF

ENGR. SEUN FALUYI, FNSE, FNISafetyE – THE DISTINGUIHED NATIONAL CHAIRMAN, NISafetyE

DATE:
THURSDAY, MARCH 27, 2025

TIME:
5:00 PM

VENUE:
ZOOM

Abstract

Circular Economy (CE) loses it meaning without Safety. In fact `How safe is Circular Economy?' is a subject of great discourse by some schools of thought. If all the safety questions are not properly addressed and the outlined six safety dimensions are not properly investigated, then CE loses its meaning.

Keywords: closed – loop system, circular economy, risk mitigation, industry 4.0, safety.

1.0 INTRODUCTION

The principle of Circular Economy (CE) is based on material re-use in order to avoid or minimally limit waste; Husovic, Novakova, Sujanova and SIskova (2019).

The world's cities generated 2.01 billion tonnes of solid waste in 2016, translating to 0.74kg per person per day. By 2050, this 2016 baseline would increase by 70% to yield 3.40 billion tonnes; World Bank (2018).

By shifting from the traditional lincar "take – use – dispose" approach to a closed loop model, systems of manufacturing can obviously mitigate risks connected with hazardous waste generation and disposal; Nwankwo, Nwakamma, et al (2024)

Closed loop systems prioritize waste reduction, resources efficiency, and continual use of materials within the loop, while fostering a culture of preventive measures to eliminate/reduce accidents and to improve overall safety.

Reliance on virgin materials are reduced to curb emissions/pollution and minimize resource depletion.

The principle Circular Economy is shown in Figure 1.1 below

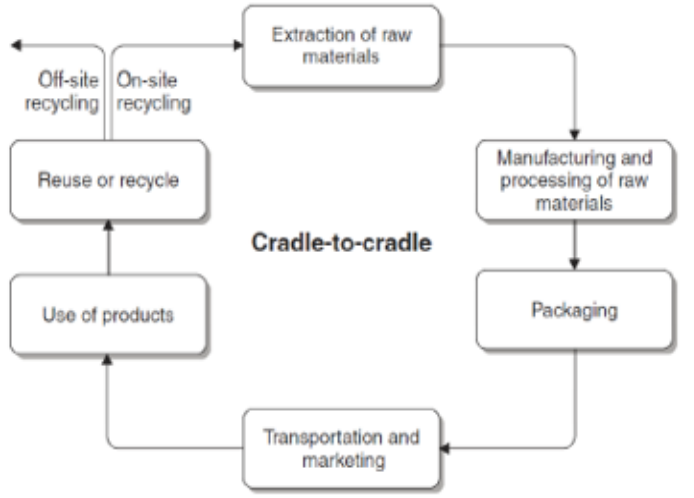


Figure 1.1: Cradle to cradle diagram. Source: Husovic, Novakova, et al. (2019)

Circular Economy gives priority to the reuse and recycling of resources so as to reduce waste and promote sustainable consumption.

From Industry 4.0 point of view, the nine technologies that are transforming industry production are shown in Figure 1.2 below.

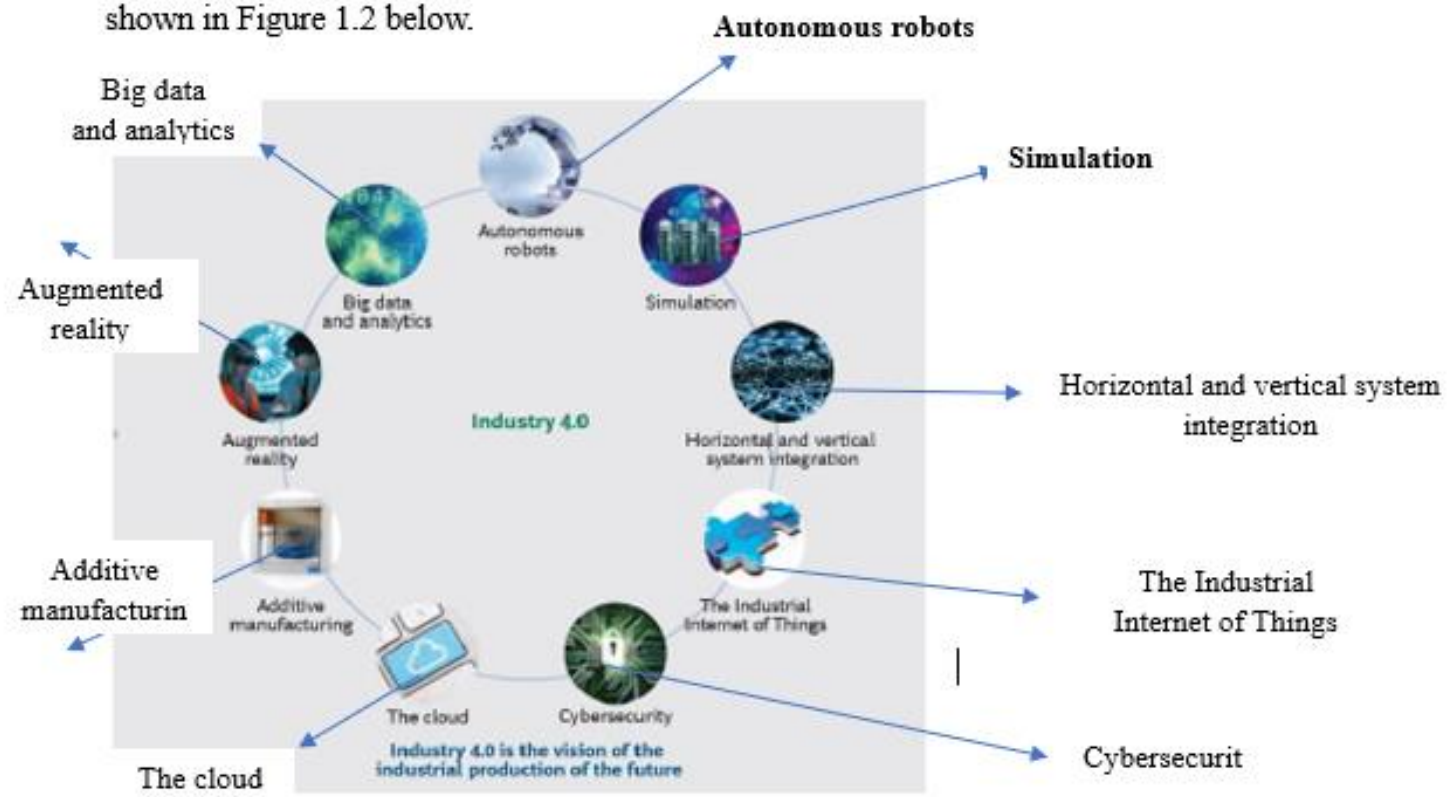


Figure 1.2: Nine technologies that are transforming industrial production Source: Husovic, Novakova, et al (2019)

Recycling process can be revolutionized through the application of the above 9 technologies; Husovic Novakova , et al (2019) in the following ways:

i. Cities could more effectively manage waste applying smart systems and learning systems

ii. Smart objects based on RFID technologies will be applied for example in the area of material sorting

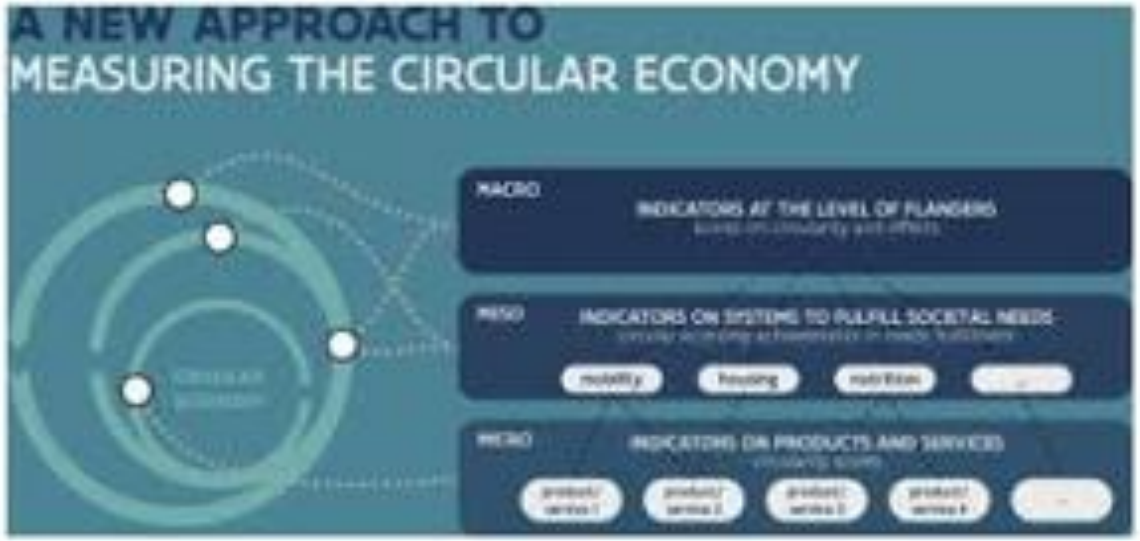
iii. Data about the materials will be collected in databases

iv. Analytical tools will be used for the optimalisation of the materials and waste flows.

2. 0 KEY POINTS ON THE VALUE OF SAFETY IN CIRCULAR ECONOMY

To ensure the well-being of people and the environment, safety is very imperative in CE. Examples are:

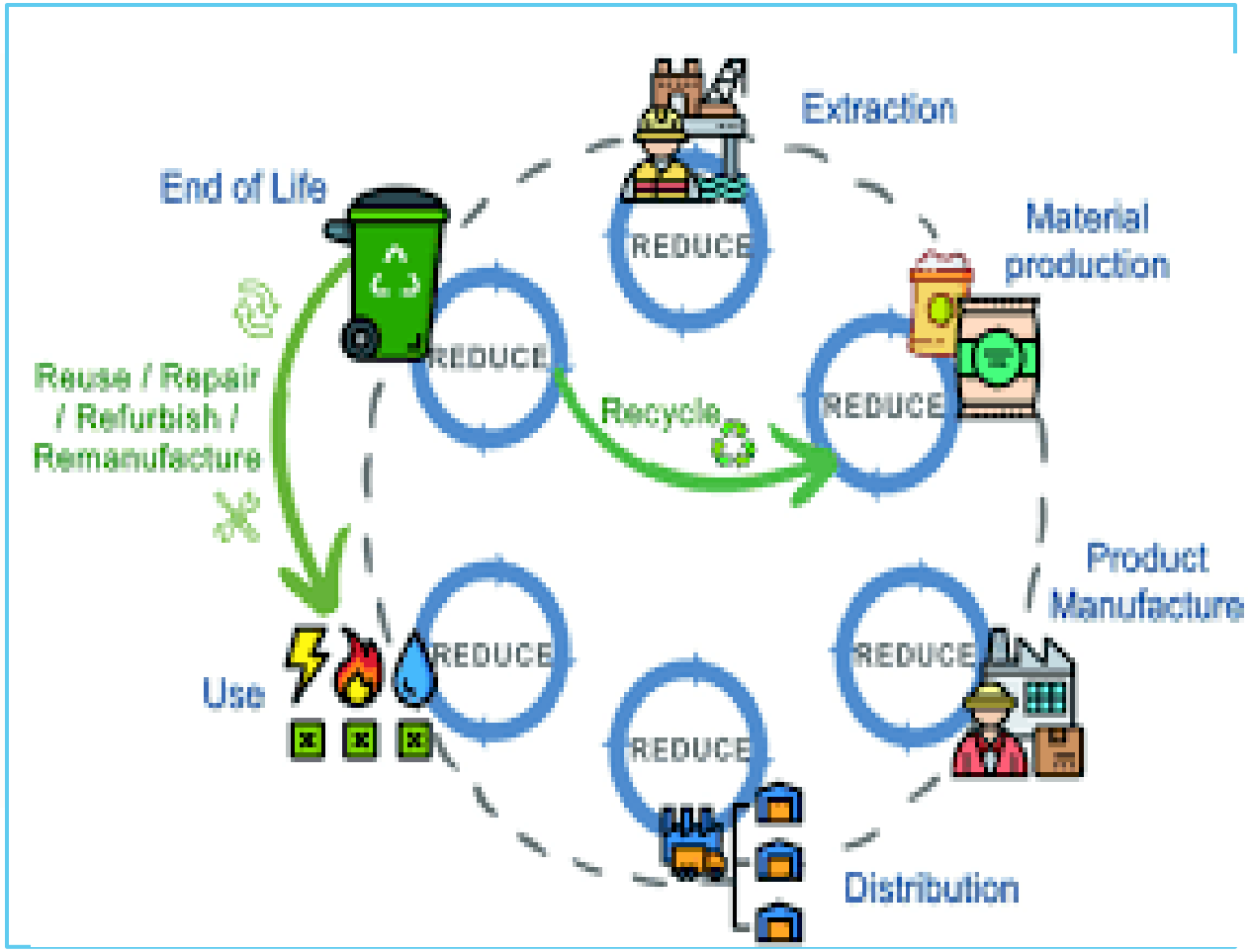
i. **Continuous Monitoring and Improvement**: Regular monitoring and evaluation of CE practices are necessary to identify areas for improvement and ensure ongoing safety.



Source: ScienceDirect.com

ii. Toxic Substance Management: CE should prioritize the reduction and elimination of toxic substances in products and production processes

iii. Product End-of-Life Management: Companies should design and implement safe end-of-life management strategies for their products.



Source: https://www.google.com/search?sca_esv=7c0335b6038f02f9&sxsrf=.....

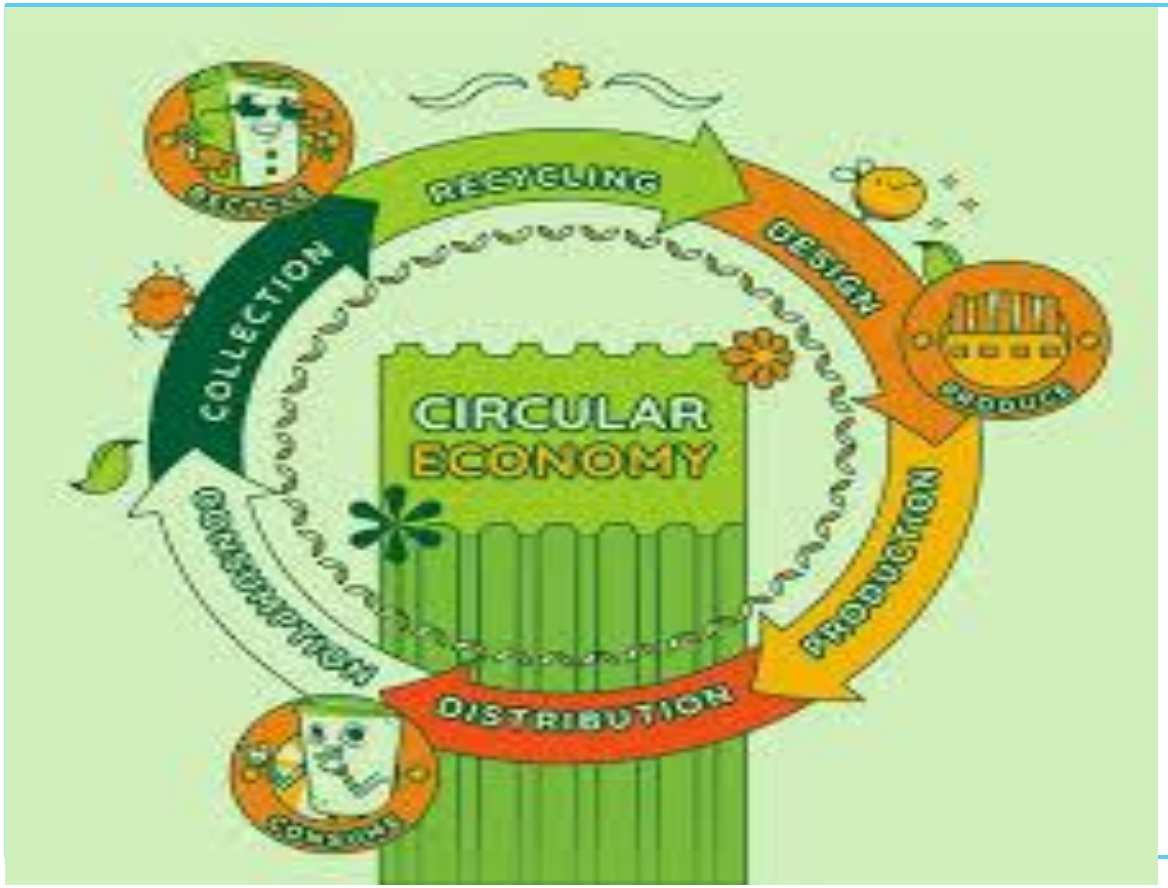
Iv. Stakeholder Engagement Collaboration with stakeholders, including consumers, workers, and communities, is essential for identifying and addressing safety concerns in CE.

Source: https://www.google.com/search?q=images+of+Stakeholder+Engagement+in.....

v. Waste Management: Effective waste management is critical in CE to prevent environmental pollution and ensure human safety.

Source: Shutterstock.com

vi. Design for Safety: Products and services should be designed with safety in mind, considering the entire lifecycle, from production to reuse and recycling.



Source: https://www.google.com/search?q=images+of+Design+for+Safety+in+....

Vii. Regulatory Compliance: Businesses must comply with relevant regulations and standards to ensure safety in CE practices.

Source: FasterCapital.com

3.0 ADVANTAGES OF ATTACHING GREAT VALUE TO SAFETY IN CE

i. **Increased Efficiency and Cost Savings:** Implementing safe CE practices can lead to efficiency gains and cost savings through reduced waste and improved resource utilization.

Resource Efficiency and Waste Management

ii. Source: FasterCapital.com

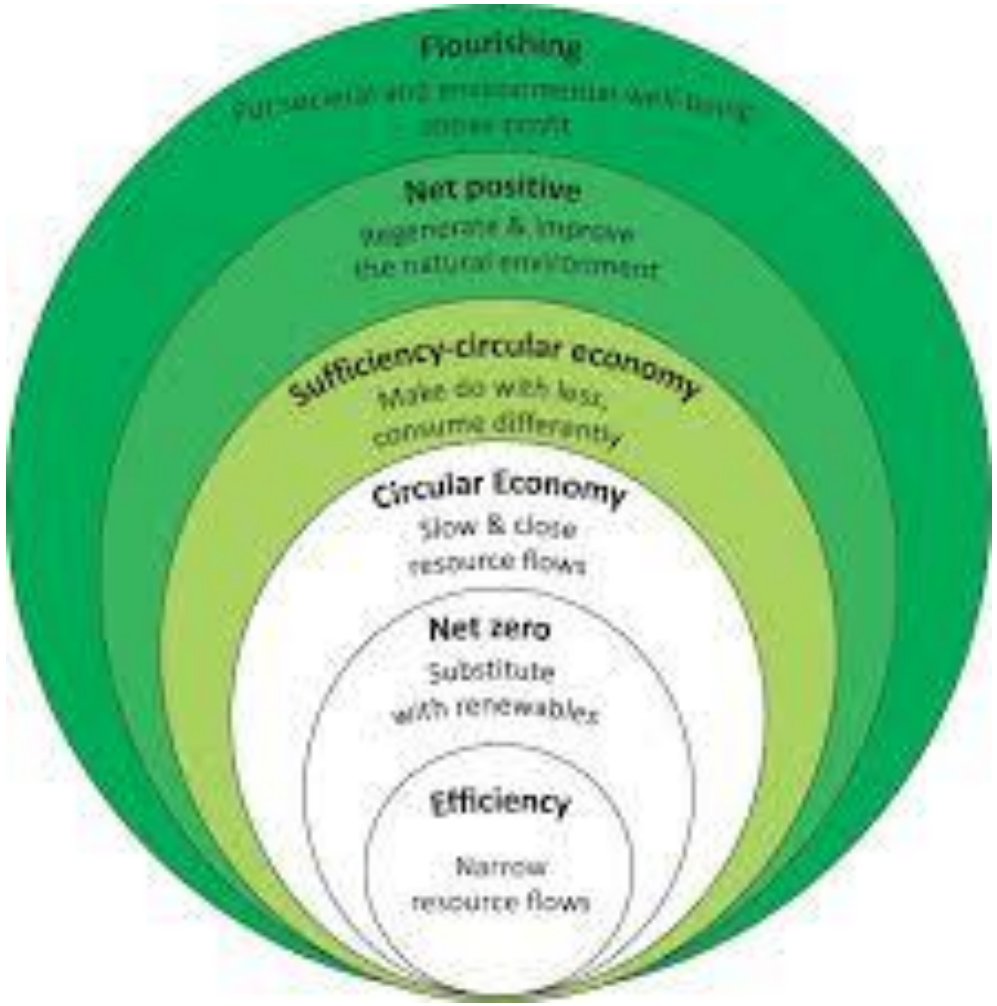
ii. Improved Human Health: Safe CE practices reduce exposure to hazardous materials, promoting human health and well-being.

Source: https://www.google.com/search?q=images+of+Improved+Human+Health+in+.....

iii. Reduced Environmental Pollution: Effective waste management and reduction of toxic substances minimize environmental pollution.

Source:https://www.google.com/search?q=images+of+Reduced+Environmental+Pollution+.....

iv. Enhanced Business Reputation : Effective waste management and reduction of toxic substances minimize environmental pollution.



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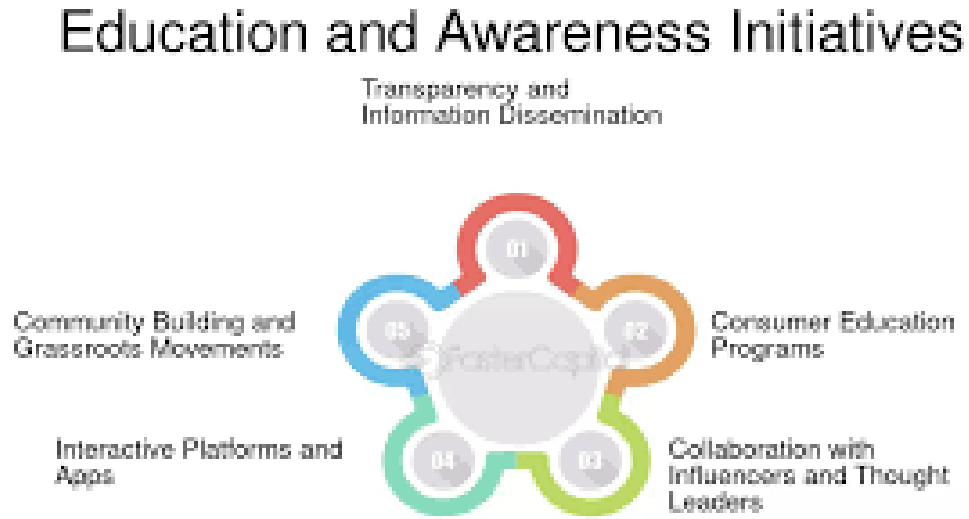
4.0 OPPORTUNITIES AND CHALLENGES

i. **Technological Innovation:** Developing new technologies and materials can help address CE safety challenges and create opportunities for sustainable growth.

Source: https://www.google.com/search?q=images+of+Technological+Innovation+with+.....

ii. Education and Awareness: Raising awareness and educating stakeholders about CE safety imperatives is crucial for successful implementation.



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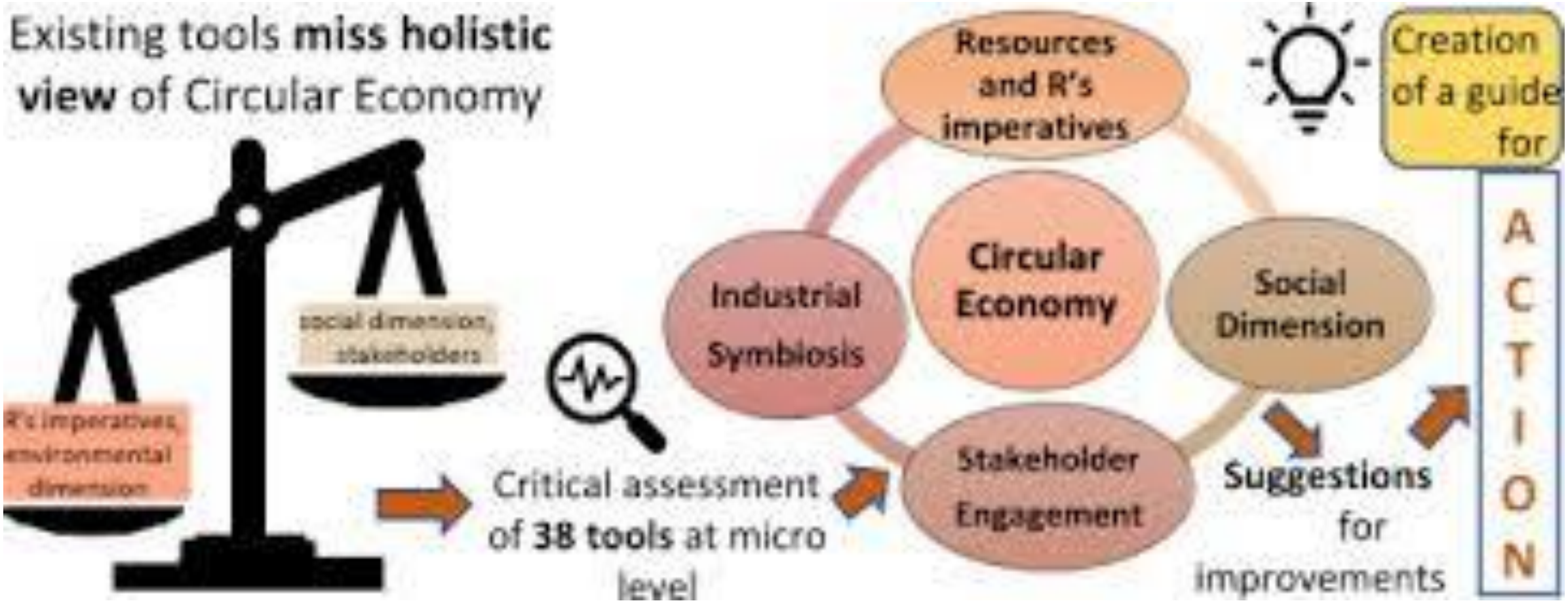
iii. Lack of Standardization: The absence of standardized CE practices and regulations can create challenges for businesses and stakeholders.



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5.0 IF SAFETY IS NOT PRIORITIZED IN CE

If safety is not given priority in CE the economic, social and environmental values could diminish; Chen, Yildizbasi and Sarkis (2022). Investigating how safe CE is, can be through the following questions:

- What are the issues related to both formal and informal CE activities?
- What are the equity concerns of safety in the CE?
- What kind of safety and health problems are organizations and individuals facing?
- What are the potential ways to improve safety in the CE?
- What outcomes are there with various CE safety events and mitigation?
- Who is responsible for the safety of the CE?
- What are the social, environmental, and economic impacts of safety issues in the CE?
- What factors influence CE safety across the various CE activities?

5.1 SAFETY DIMENSIONS REQUIRING INVESTIGATIONS

From Chen, Yildizbasi and Sarkis (2022) the six basic CE Safety dimensions requiring investigations are outlined thus:

1. From the external perspective, rules and guidelines for safe CE activities need development. Since CE activities are relatively immature and undergoing rapid change-regulation and control will typically lag. The absence of safety norms and regulations for CE increases safety risk. For instance, inconsistent Lithium – lon battery (LIB) labelling results in a lack of knowledge about battery design, resulting in insufficient information for CE activities.
2. Greater pressures exist for expanding End - of - life (EOL) capacity in collection, transportation, storage, and disposal. Regulatory standards pertaining to safe storage-including studies on ambient temperature and humidity, facilities, staff, and equipment-are needed.
3. Human resources training safely manage EOL products. CE is very manual at many stages, human resource involvement is critical; hence safety training is needed; Arshad et al., (2022). As mentioned, CE workers are usually ignorant of the technology and product. For example, during EOL battery disassembly, operators might not aware that the energy in EOL LIB may accidently produce explosions and fire. Workers may suffer health injuries from chemicals during LIB recycling.

4. CE activities dealing with chemicals are harmful to humans and the environment. Assessment and evaluation CE activity chemical wastes and management are lacking. For instance, EOL LIB recycling uses chemicals to separate out recyclable materials, how to best manage these chemicals safely needs to be carefully considered and studied.

5. Manufacturers may neglect safety for financial gain. To increase economic efficiency, management may overlook staff safety training, insufficiently supply functional safety protection gear, and lack proper emergency handling capabilities—due to lack of safety knowledge. An organization's exclusive focus on CE's economic benefits and disregard for safety can result in a rise in safety mishaps. These negative safety events can cause financial losses and increase liability risk.

6. Secondary—extended product—uses must also be considered. Remanufactured, reused, and recycled products and materials should go through extensive safety testing, where safety concerns are minimized during usage. The safety of the CE is negatively impacted by safety events involving items with secondary uses. The safety of reused, remanufactured, and repurposed LIB has come under greater scrutiny as fire and explosion concerns may arise; (Hua et al., (2021).

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Safety and Environmental Sustainability goals in manufacturing are parts and parcel of circular economy (closed loop systems). Value is created by manufacturers, wastes are reduced, resource efficiency is prioritized while a safer and more sustainable future is ensured. Policy support, consumer engagement innovation, continuous improvement within the manufacturing sector and collaboration would engender safer circularity.

6.2 RECOMMENDATIONS

The implementation of CE principles to achieve safety and environmental sustainability goals especially in manufacturing would require companies to adopt a total concept approach involving policy support, collaboration, consumer engagement, continuous improvement and technology.

The following recommendations are therefore provided:

1. Investment in research and development so as to figure out materials, processes and technologies that yield risk free resource efficiency and waste reduction
2. Policy support, government incentives and regulations promoting the adoption of CE practices while ensuring innovation and encouraging investment.
3. Benefits of circular products and services should be conveyed to consumers through marketing campaigns and educational programs.
4. Circular business models such as product – as – a – service, remanufacturing and sharing of platforms that prioritize risk education, resource efficiency, waste reduction etc. should be implemented.
5. CE should be inculcated in supply chain management practices like optimizing material sourcing, waste reduction and promotion of resource efficiency through the value chain.

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THANK YOU