

Appendix A

Table 1. Operationalization of the role of circular economy in the agro-industry sector

Variable	Dimension	Indicator	Reference
Circular Economy Practices	Reduce (CE1)	- Reduce the use of natural resources - Reduce energy consumption - Reduce the use of raw materials	(Rao, et al., 2024; Morseletto, 2020, Reike, et al., 2018)
	Recycle (CE2)	- Utilize recycled resources in production processes - Process materials to obtain equivalent quality, whether high or low	(Pagotto & Halog, 2015; Morseletto, 2020)
	Recovery (CE3)	- Recover energy by burning residual raw materials: non-recycled waste used as an energy source or biochemical compound	(Rao, et al., 2024; Morseletto, 2020; Potting, et al., 2017)
	Repurpose (CE4)	- Repurpose unused products/raw materials into new products with different functions: e.g., turning by-products into nutrients (fertilizer, feed)	(Alzaabi, Chia, & Show, 2023; Morseletto, 2020; Tully & Ryals, 2017)
Sustainability Performance	Environmental Performance (Planet) (SP1)	- Soil health - Water footprint - Chemical usage - Biodiversity	(Gbejewoh, et al., 2021; Yin, et al., 2023)
	Economic Performance (Profit) (SP2)	- Return on investment - Cost minimization - Customer satisfaction	(Gbejewoh, et al., 2021; Yin, et al., 2023)
	Social Performance (People) (SP3)	- Workforce productivity - Labor regulations - Community welfare - Job creation	(Kravchenko, et al., 2019; Gbejewoh, et al., 2021; Iofrida, et al., 2024)
Creating Shared Value	Redefining Products and Markets (CSV1)	- Provide products or services that meet social needs	(Porter & Kramer, 2011; Li, et al., 2023)

Variable	Dimension	Indicator	Reference
		- Engage in industry poverty alleviation programs	
	Redefining Productivity in the Value Chain (CSV2)	- Reduce logistics costs - Adopt environmentally friendly equipment - Implement energy-efficient practices to reduce emissions and environmental footprints - Conduct employee training programs	(Porter & Kramer, 2011; Li, et al., 2023)
	Enabling Local Cluster Development (CSV3)	- Commit to university-industry collaborations for research on industrial development - Support suppliers (e.g., farmers) - Collaborate with local communities to promote local development	(Porter & Kramer, 2011; Li, et al., 2023)