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ENVIRONMENTAL AND FINANCIAL RAMIFICATIONS OF CARDBOARD PACKAGE RECYCLING – A REVIEW AND FRAMEWORK

Collins C. NGWAKWE[1]*

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Abstract

This paper presents a literature analysis of the financial and environmental Implication of cardboard packaging recycling and proposes a framework in the end. Therefore, the paper aims to demonstrate the literature evidence of the application of product take back, recycling and reusing, which serves a dual advantage of environmental protection and economic benefit to the company. The paper's approach applied the inductive research approach, which engaged in a critical review of the literature to unveil patterns and/or themes around cardboard packaging recycling. Findings from the review lead to five main headings namely eco-efficiency, industrial symbiosis, extended producer responsibility, stakeholder theory and activity-based costing. The paper contributes by using these themes to develop a "confluence theory for package recycling". This proposed theory holds practical and research significance in furthering advocacy for environmental sustainability through corporate environmental responsibility in managing cardboard wastes. The financial implications resonate with theoretical applications in environmental management accounting scholarship. Overall future research agenda is highlighted for future empirical research application.

Keywords: Waste costing; eco-efficiency; industrial symbiosis; recycling; product-take-back; packaging; environmental management accounting.

1. Introduction

Accounting is intricately connected to industrial eco-efficiency and corporate environmental sustainability strategies (Tiyas & Imronudin, 2024). Global advocacy is on the rise for corporate environmental responsibility, such as through recycling and waste reduction. It might seem though that the cost of engaging in industrial environmentally friendly operations is gargantuan and best fit for large capital industries. This paper demonstrates the contrary by showing that even a medium size industry in a developing country can engage in cardboard packaging recycling and waste reduction whilst

[1]*Graduate School of Leadership, Faculty of Management and Law, University of Limpopo, Webster Street, Polokwane 0699, South Africa. Email: collins.ngwakwe@ul.ac.za*
** Corresponding author.*

remaining financially afloat. Therefore, this paper offers an insight into the financial and environmental implication of industries' cardboard packaging recycling. An inward proactive strategy through packaging take-back, recycling and re-using is a veritable environmental management strategy that a company can apply in saving the environment from pollution and increasing the revenue and environmental image of company (Cervantes, 2024).

Different research on packaging recycling have been conducted in many countries (Belle, Hirtz, & Sängerlaub, 2024). The existing research package recycling has a largely common feature of adopting a single mono-theoretical base. In addition, many of this existing research have mostly been done in developed countries. This research brings a novelty and contributes by adopting a different stance in two ways. The research adopts a confluence theoretical basis and proposes a confluence theory of packing recycling – this is lacking in the existing literature. Again, the research is conducting in a developing country in a company with a medium capital base. This is to show that irrespective of a company's location and capital base, it can still engage in recycling to reduce environmental pollution.

Accounting as an aspect of corporate information system has a significant role to play in assisting with corporate environmental management strategy such as in recycling. The 21st century is an era of sustainable development advocacy, which requires a convergence of disciplines and theories to influence pragmatic corporate environmental responsibility. This aspect of corporate citizenship can be beneficial so the environmental and to the industry. However effective corporate environmental management such as packaging recycling can only yield corporate and environmental dividend if a practical hands-on approach is adopted rather than mere rhetoric's. Prior research by Rodrigue, Magnan & Cho (2013) affirms that companies that move away from environmental symbolism to substantive environmental management would experience improved pollution prevention. Similarly, although prior research have had mixed findings regarding the financial benefits of recycling, some researchers have found that companies that engage in packaging recycling experience some cost savings and revenue advantage (Mukalo & Halysh, 2025). Albeit the positive benefits, other researchers have found non or negative financial benefits of recycling (Tonjes & Mallikarjun, 2013). Hence the problem of this paper lies in the aforesaid mixed findings; the problem is also heightened by lack of this form of research (with a confluence theoretical approach).

Based on the foregoing, this paper is inclined on two main research questions namely: whether there is financial implication of packaging recycling and if environmental accrue from packaging recycling. Based on the aforesaid questions, this paper aims to achieve two objectives namely: to examine the financial imperative of packaging recycling and to examine the environmental implication of packaging recycling.

2. Literature review

Cardboard packaging recycling is an important corporate environmental management tool, which serves a dual purpose of both resource efficient and environmental responsibility – with potential attendant financial benefits. The guidelines of the OECD extended producer responsibility (EPR) regulations by OECD (2018), acts as a catalyst that drives EPR advocacy in other regions of the world. For instance, in South Africa, the extended producer responsibility is guided by the National Environmental Management: Waste Act (NEMWA). In the UK, the EPR is guided by the Environment Act of 2021 and the related Waste Packaging Regulation of 2024. In the United States, each state has its own regulation that guides EPR. In China, EPR is guided by the Circular Economy Promotion Law of 2008. EPR in the EU is guided by the Waste Framework Directive and the revised EU Packaging Directive. In Australia, EPR is guided by the Recycling and Waste Reduction Act 2020 (Cth). In Brazil, EPR is guided by the National Solid Waste Policy (PNRS), Law 12.305 of 2010. India regulated the EPR through its Plastic Waste Management Rules of 2016. Similarly, in Nigeria, the EPR is regulated and guided by a national gazette, which established the National Environmental Standards and Regulations Enforcement Agency (NESREA, 2019). These state regulations regarding EPR attest to the importance of industrial packaging recycling on environmental protection and corporate environmental legitimacy.

To achieve desired sustainability, industries must account for mutual ecological and economic compatibility of their processes and operations (Ulgiati & Brown, 1998). A growing area of attention in industries' environmental accounting is on how businesses manage their wastewater; this is pertinent because industrial wastewater constitutes a big source of pollution to land and rivers around industries areas (Yang et al., 2009). Although a huge ecological and economic benefit has been found accruable from industrial wastewater recycling (Xu, 2019), a concern in some industries, is that at the end of recycling, there is still waste to handle (Suez, 2020). Accordingly, the problem that warranted this study is that factory waste water recycling produces solid residue at the end of waste recycling (Mwizerwa et al., 2020). For low capital industries in developing countries, it is capital intensive to manage the two process that has to do with the management of solid residue (Sridhar & Hammed, 2014), which is either to recover it or to destroy it (Suez, 2020). Given their low capital base, many industries in developing countries follow a disturbing route of disposing solid wates by dumping them in the country sides or in nearby rivers, which causes environmental contamination (Kanu & Achi, 2011). Hence the process of wastewater treatment often results in shifting of waste from the factory to the environment and society (Mwizerwa et al., 2020). The scenario renders the target environmental friendliness of wastewater treatment somewhat unaccomplished as the industries eventually pollute through the wastewater recycling and often pay fines that result from illegal dumping of solid residue. It is under this circumstance that industries should consider strategic ecological symbiosis.

Baskar, Begum and Sundaram (2006) examined the viability of applying textile industry wastewater treatment generated sludge in clay brick manufacturing. They find that

application of up to 9% textile waste water sludge in brick manufacturing produces quality bricks and highlights that measures can be taken to increase the percentage sludge application to more than 9% percentage. Accordingly, related research provides further research confirmation that the usage of up to 20% of sieved textile wastewater textile sludge does produce quality brick (Palanisamy, 2011). Other researchers have studied the effect of addition of textile wastewater sludge as brick material, findings showed that up to 15% textile sludge can constitute effective addition to materials to produce quality bricks (Begum, Gandhimathi, Ramesh & Nidheesh, 2013). In their study, Heniegal et al (2020) found that clay bricks what contain up 5% of recycled wastewater sludge does contribute in quality brick and reduction in environmental pressure from wastewater.

2.1. Environmental implications of packaging recycling

Bassi et al. (2020) examined the environmental consequences of packaging recycling by applying the life cycle analysis approach. Their findings show that management of packaging waste constitute an environmental burden but that benefits may outweigh the burden if companies improve their collection or take back rate of the packaging waste and by minimising processing losses of packaging materials along the chain of recycling. Bassi et al. (2020) highlight finding secondary usage of recycled packaging can improve the environmental benefits of packaging waste recycling. Related research by Ross and Evans (2003) analysed the environmental impact of recycling and re-using of packaging to ascertain whether recycling and reusing would propel a significant reduction in the quantity of packaging waste that go to the landfill and to what extent such would enhance a reduction in environmental burden of packaging waste. Their findings show that packaging recycling and reusing enhances a reduction in environmental burden in Australia. Santana et al (2020) conducted a lifecycle assessment of bread production including the packaging in Cuba; after a rigorous analysis; they found that bread production and its packing affects the environment with the main impact being on humans and the ecosystem because the bread making process elicits inorganic respiration and acidification, which results from old technology. However, their comparative study indicates that the application of new bread making technology enhances greater environmental compatibility.

2.2 Industrial symbiosis

The concept of symbiosis invokes the notion an practice of eco-system independence, which subsists and transcends living and non-living things. But when applied within the realm of environmental sustainability, the concept goes further beyond to accrue benefit to both members of the same ecosystem and beyond. Hence the positive ripple impact of environmental industrial symbiosis is multifaceted and contributes abundantly to the actualisation of overall sustainable environment and sustainable economic growth and development.

In company eco-system environmental performance, industrial symbiosis denotes the wider array of strategies in which businesses work together to share resources, which *comprises inter alia* waste, by-products, and excess energy, to advance limited resource efficient operations and to reduce the extent of waste generations from operations, which eventually enhances overall corporate environmental responsible performance. The attendant resource collaboration process aims among others, to function toward the transformation of waste into a valued productive resource for application in another industry; this flow thus fosters additional impetus to corporate sustainability performance and overall circular economy.

Accordingly, industrial symbiosis may be accomplished through the following approaches (Islam et al, 2016; Scafà et al, 2020):

Resource Sharing: Resource Sharing is the process of conservation and resource efficiency where industries corporations involve non-discarding of resources but to apply them into other manufacturing processes of other products.

Waste as a Resource: Environmentally conscious companies would contribute to the reduction of reliance on virgin raw materials and the minimization of waste generation. Hence, one company's waste, becomes a raw material to be used by another company.

Collaboration: Industrial symbiosis involves resource partnership amongst different industries where they engage in the identification and implementation relevant resource sharing opportunities.

Environmental Benefits: The accruing waste reduction and attendant collective resource efficiency, industrial symbiosis assists corporations to comply with related environmental regulations and lower their general corporate environmental impact.

Economic Benefits: Productive resource sharing cooperation may lead to savings in cost, improved profitability, and the creation of new business sales niche opportunities for the companies that cooperate in industrial symbiosis.

As an instance few examples where symbiosis may translate to economic benefit includes but not limited to:

- The waste heat from a power plant can be connected to heat-up a nearby located greenhouse to reduce the level of energy consumption in the closely located greenhouse.
- The waste slag from steel mill's may be usable by civil engineers and builders as a building material, which helps in reducing potential landfill waste dumping by steel mills. This helps in overal saving on virgin raw material consumption.
- The wastewater from a food processing plant could be put into treatment plant and reused in irrigation process, this would helop in the reduction of water consumption in farms and associated wastewater disposal costs.

2.3 Financial implications of packaging recycling

In research on economic viability of packaging waste recycling, Bassi et al. (2020) found that little or no profit exists in certain packaging waste recycling and laments that the lack of profit may exacerbate the spate of exporting of packaging waste to other countries where the environmental management of such wastes may not be guaranteed. Lack of profit from packaging recycling may also be a demotivation for some managers to enter into waste packing recycling as managers are attracted to waste management when there is a likelihood of financial benefit. Although, voluntarism has been insinuated as a push, but economic utility of revenue with cost savings does prove to be the utmost motivation in certain cases that pummel managers toward product related environmental responsibility such as packaging recycling (Ervin et al, 2013). A positive financial outcome contributes to waste packaging recycling, for instance, a focus of extended producer responsibility (EPR) is mainly to provide desired economic incentive for companies to engage in improved environmentally friendly product design and operations (Mayers, 2007).

2.4 Eco-efficiency

Whilst development, industrialisation and the concomitant economic growth is celebrated, it has however brought ineffable environmental degradation (Sampath, Pyeman & Othman, 2024). In response, eco-efficiency came to the fore as one amongst other tools to transform unsustainable economic development to sustainable development (Morgavi, 2014). Hence, eco-efficiency has become a new business precept that guides companies toward producing goods by using lesser resources and creating little or no waste and pollution. This goal has thus created a new managerial philosophy of sustainability, which is couched on economic and environmental efficiency (Gutowski, 2010).

2.5 Activity-based costing

Activity-based costing, which is popularly referred to as the ABC in accounting acronym is a costing accounting technique which assigns overhead costs and other production indirect costs to identified products, units, departments or services that drive the incurrence the costs. Managerial accountants prefer the ABC for most effective and efficient cost attribution and performance evaluation. It is specifically preferred to the traditional cost accounting system because it uses causative activities to trace overhead costs to the actual cost driver. Hence, ABC is a veritable costing technique for environmental accounting such as recycling costing, waste costing carbon costing, pollution prevention and investment costing and analysis – etcetera. It is therefore pertinent that ABC is a tool that should enable the actualisation of environmental sustainability operations such as industrial symbiosis, extended producer responsibility, eco-efficiency to deliver value for corporate stakeholders.

Kren (2018) directs research attention on how the ABC is an important component of management control system (MCS) which, assists in the isolation of costs and cost

savings. Prominent scholars in the area of sustainability accounting has opined that management accounting control tools enhances corporate sustainability innovation and opportunity identification (Arjaliès & Mundy, 2013).

Bebbington et al (2019) recommends that accounting should pursue accountability that is related to the anthropocene. Simply put, anthropocene refers to how human affects the environment; so applying Bebbington et al (2019) recommendation in industry accounting requires that cost allocation regarding waste costs should reflect accountability of the responsible industry division or department. The costing accounting system to achieve waste cost responsibility is the Activity Based Costing (ABC) (Hsieh Tsai & Chang 2020; Tsai & Hung, 2009). The Activity Based Costing concept is recognized by researchers as one of the accounting-based approaches that offer a joint function of helping to solve industry ecological problems and as well provide solution to cost allocation (Tsai et al, 2012).

2.6 Stakeholder theory

Corporate environmental responsibility has widely been analysed under the lens of the Stakeholder theory (Waheed, Shahid Khan, Warraich & Ali, 2024). The Stakeholder theory, which was developed by Edward Freeman opine that the long-term success of the business corporation can be achieved when the business balances its considerations beyond the shareholders. Corporate longevity is contingent upon the satisfaction of all stakeholders, who are not limited to the financial shareholders (Waheed, Shahid Khan, Warraich & Ali, 2024; Morrison, Alshamari, & Finau, 2024). Scholars have thus found that corporate environmental accountability rests within the ambit of Stakeholder Theory (Shi, 2025). Accordingly, the Stakeholder Theory is an intricate part of corporate cardboard recycling strategies given the impact of recycling on business stakeholders including environmental protection.

3. Method

The paper applies and inductive approach through the review of literature which culminates to the development of a theory. Adoption of inductive approach in literature review-based research employs a pattern and/or theme-based review to understand related issues that subsist in the literature around the phenomenon which the researcher seeks to understand the literature complementarities toward the final development of a theory or framework. This is proceeded by the development of theory or conceptual framework at the end of the literature review research (Sabharwal & Miah, 2022; Soiferman, 2010).

4. Results: Theoretical framework development

According to Wiegmann (2019), a research should be rooted in a theoretical context. The concept of package recycling criss-crosses the disciplines of accounting, management, and environmental sustainability. Therefore, in order to situate this paper

aptly on the intersection of accounting and ecology, the author formulates a 'confluence theory of waste packaging recycling'.

Therefore, the theoretical framework of this paper recognises that accounting as a discipline has intricate connection with contemporary industry expectations of balancing economic goal with environmental sustainability (Bebbington et al, 2019; Tsai et al, 2012).

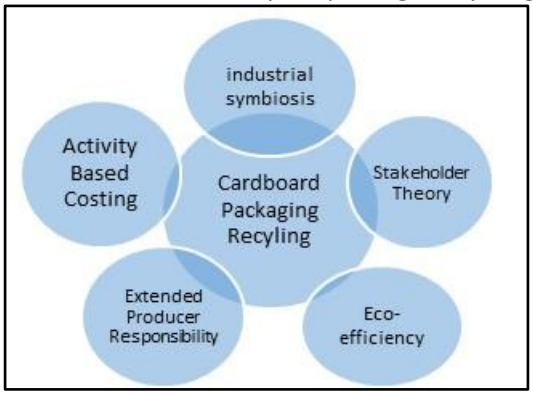
Consequently, the theoretical rooting of this paper is founded on a confluence of five theories namely , industrial symbiosis, industrial eco-efficiency, Extended Producer Responsibility activity based costing, and stakeholder theory. Whilst the first three of the theories sit within the purlieu of industrial ecology, the last two theories are founded on accounting theoretical Lense which accentuates the interconnectivity between ecological responsibility and accounting as corporate financial information provider.

Put together, this paper demonstrates that certain industrial packaging waste management may lie within a confluence of five theories in the realm of environment and accounting as illustrated in Figure 1. The number of theories brought together in this suggested confluence theory is not sacrosanct though, rather it is meant to create an agenda for other researchers to articulate more theories to this confluence to bolster further discussion and engagement around this important concept of accounting and environmental convergence. This paper thus contributes to existing literature on environmental accounting and management by initiating (for further debate) the theory of confluence to the sphere of environmental management accounting research. The 'confluence theory of waste packaging recycling' is novel because extant research has not pinned down the interaction between business environmental management and economic aspirations within a fulcrum of philosophical convergence which is inextricable given the 21st century's convergence of disciplines, processes, skills and technology to achieve a dual goal of economic efficiency and environmental sustainability.

Many theoretical approaches (apocalyptic and utopian) have been applied in prior studies on recycling (Marald, 2002; Lewison et al, 2019). However, this study adopts a slightly different theoretical stance by suggesting that accounting perspective of packaging recycling research may not aptly be inclined on one theoretical stance – rather accounting perspective is more flexible given that accounting provides accountability to all disciplines and professions of human endeavour. For instance, in his investment theory of creativity, Sternberg (2006) indicates that understanding creativity requires more than one theoretical basis; he argues that creativity requires a system of theories. Hence, Sternberg (2006) used a confluence of theories to analyse creativity. Similarly, accounting related packaging recycling research may not comprehensibly be understood from one theoretical standpoint; therefore, this paper suggests that

accounting-related packaging recycling research can best be situated in a confluence of theories. Accordingly, this paper makes a novel theoretical contribution to packaging recycling research by proposing and discussing a confluence theory of packaging recycling. The idea is that packaging recycling lies at the confluence of a system of theories that pervades environment, business, and accounting. This theoretical approach is pertinent because in studying a multidisciplinary phenomenon such as recycling, it might appear asymmetric if the theoretical support fails to draw a variegated synergy from sustainability, business and accounting. Furthermore, the confluence approach to this paper is a further indication that although accounting and environment had been divergent disciplines in some decades ago, but the 21st century sustainable development advocacy has orchestrated a convergence of antecedent divergent disciplines to foster desired sustainability of business operations (Jackling & De Lange, 2009). To this end, Rice et al (2012) rightly opined that a confluence approach is apposite for uniting two previously disciplines. Indeed accounting and environmental discipline was divided before the current epoch of sustainability; for instance, the controversy that erupted during the days of Hetch Hetchy valley environmental movement in the USA was a stark divide between political economy (rooted in economic wealth interest) and the environmentalists, whose core concern was environmental preservation – without economic wealth attachment (Moseley, 2009). However, the contemporary dispensation of cross-disciplinary tolerance is bridging previous divergence that created a limitation in balanced integration of environmental values with economic values (Rawluk et al, 2019). Based on the identified themes in the foregoing literature, this paper formulates a "confluence theory for packaging recycling", which is proposed under the convergence of five concepts which this paper refers to as the 'ASIEP' as a short form.

Figure 1 Confluence theory for package recycling



Source: Author's Creation

Therefore, ASIEP theory represents a confluence of five theories, referred in this paper where:

A = Activity based costing
S = Stakeholder theory
I = Industrial symbiosis
E = Eco-efficiency
P = producer responsibility – extended producer responsibility)

5. Conclusions

Different research which focusses on industrial recycling of cardboard packages and their attendant implications for environmental responsibility and economic performance of the business corporation is ongoing within the academic and research community. The previous research contributes fundamental advocacy to global aspirations for environmental conservation and protection for long-term sustainable development (Marinova, 2022; Plotkina, Rabeson & Bambauer-Sachse, 2025). Therefore, to contribute to the existing research on sustainability implications of cardboard packaging recycling, this paper set out to review the literature on the environmental and financial implications of cardboard package recycling and to propose a framework. To achieve the aim of this paper, the author applied a critical literature review with a combined environmental aspects of package recycling literature and financial aspects. The literature was climaxed with the development of a confluence theory for package recycling. This theory contributes a new insight to the existing literature for practical and theoretical development of corporate environmental accountability and management and the attendant contribution to sustainable economic development.

The paper's contribution of a confluence theory for package recycling brings to the fore an inalienable interdependence of corporate environmental responsibility and environmental accounting discipline. The paper's new theory is rooted in Figure 1 framework which creates a weaving together of previously disparate disciplines and or paradigms, which currently fuse together to achieve a single goal congruence of environmental sustainability. The theory contribution, which is represented in Figure 1 demonstrates the modern link between industrial symbiosis, extended producer responsibility, eco-efficiency, stakeholder theory and activity-based costing. These philosophies and/or paradigms operate in tandem with each other to catalyse theoretical and practical realisation of the central focus of action, which is cardboard packaging recycling. The Confluence theory for package recycling is represented by an acronym referred to in this paper as "ASIEP", which is a short name for Activity based costing, Stakeholder theory, Industrial symbiosis, Eco-efficiency, extended producer responsibility. Given that this paper has not applied the proposed theory to an empirical research analysis, it is suggested for empirical substantiation by future researchers who may expand the ideas and for the engagement of scholars in the intersciplinary debate on business, accounting, recycling and environmental sustainability.

References

Aralias, D. L., & Mundy, J. (2013). The use of management control systems to manage CSR strategy: A levers of control perspective. *Management Accounting Research*, *24*(4), 284-300.

Baskar, R., Begum, K. M. M. S., & Sundaram, S. (2006). Characterization and reuse of textile effluent treatment plant waste sludge in clay bricks. *Journal of the University of Chemical Technology and Metallurgy*, *41*(4), 473-478.

Bassi, S. A., Boldrin, A., Faraca, G., & Astrup, T. F. (2020). Extended producer responsibility: How to unlock the environmental and economic potential of plastic packaging waste?. *Resources, Conservation and Recycling*, *162*, https://doi.org/10.1016/j.resconrec.2020.105030

Bebbington, J., Österblom, H., Crona, B., Jouffray, J. B., Larrinaga, C., Russell, S., & Scholtens, B. (2019). Accounting and accountability in the Anthropocene. *Accounting, Auditing & Accountability Journal*. https://www.emerald.com/insight/content/doi/10.1108/AAAJ-11-2018-3745/full/html

Begum, B. S. S., Gandhimathi, R., Ramesh, S. T., & Nidheesh, P. V. (2013). Utilization of textile effluent wastewater treatment plant sludge as brick material. *Journal of Material Cycles and Waste Management*, *15*(4), 564-570.

Belle, J., Hirtz, D., & Sängerlaub, S. (2024). Expert Survey on the Impact of Cardboard and Paper Recycling Processes, Fiber-Based Composites/Laminates and Regulations, and Their Significance for the Circular Economy and the Sustainability of the German Paper Industry. *Sustainability*, *16*(15), https://doi.org/10.3390/su16156610.

Cervantes, M. A. (2024). Managers' environmental commitment towards the adoption of environmental strategies: Exporting Ecuadorian SMEs. *European Public & Social Innovation Review*, *9*, 1-23.

Ervin, D., Wu, J., Khanna, M., Jones, C., & Wirkkala, T. (2013). Motivations and barriers to corporate environmental management. *Business Strategy and the Environment*, *22*(6), 390-409.

Gutowski, T. G. (2010). The efficiency and eco-efficiency of manufacturing. *International Journal of Nanomanufacturing*, *6*(1-4), 38-45.

Heniegal, A. M., Ramadan, M. A., Naguib, A., & Agwa, I. S. (2020). Study on properties of clay brick incorporating sludge of water treatment plant and agriculture waste. *Case Studies in Construction Materials*, https://doi.org/10.1016/j.cscm.2020.e00397

Hsieh, C. L., Tsai, W. H., & Chang, Y. C. (2020). Green Activity-Based Costing Production Decision Model for Recycled Paper. *Energies*, *13*(10), 2413.

Islam, K., Rahman, M. F., & Islam, K. (2016). Industrial symbiosis: A review on uncovering approaches, opportunities, barriers and policies. *Journal of Civil Engineering and Environmental Sciences*, *2*(1), 011-019

Jackling, B., & De Lange, P. (2009). Do accounting graduates' skills meet the expectations of employers? A matter of convergence or divergence. *Accounting Education: an international journal*, *18*(4-5), 369-385.

Kanu, I, & Achi, O. K. (2011). Industrial effluents and their impact on water quality of receiving rivers in Nigeria. *Journal of applied technology in environmental sanitation*, *1*(1), 75-86.

Kren, L. (2018). Activity Based Management (ABM) and control system design. *Accounting and Finance Research*, *7*(2), 1-61.

Lewison, R. L., Johnson, A. F., Gan, J., Pelc, R., Westfall, K., & Helvey, M. (2019). Accounting for unintended consequences of resource policy: Connecting research that addresses displacement of environmental impacts. *Conservation letters*, *12*(3), e12628.

Marald, E. (2002). Everything circulates: agricultural chemistry and recycling theories in the second half of the nineteenth century. *Environment and history*, 8, 65-84.

Marinova, V. (2022). Sustainability of cardboard packages. Известия на Съюза на учените-Варна. Серия Икономически науки, 11(3), 53-63.

Mayers, C. K. (2007). Strategic, financial, and design implications of extended producer responsibility in Europe: A producer case study. *Journal of Industrial Ecology*, *11*(3), 113-131.

MORGAVI, M. M. H. (2014). Is eco-efficiency enough for sustainability?. *International Journal of Performability Engineering*, *10*(4), 337.

Morrison, L. J., Alshamari, A., & Finau, G. (2024). Interrogating the environmental accountability of foreign oil and gas companies in Basra, Iraq: a stakeholder theory perspective. *Meditari Accountancy Research*, *32*(1), 207-233.

Moseley, W. G. (2009). Beyond knee-jerk environmental thinking: Teaching geographic perspectives on conservation, preservation and the Hetch Hetchy Valley Controversy. *Journal of Geography in Higher Education*, *33*(3), 433-451.

Mukalo, Y., & Halysh, V. (2025). APPROACHES TO ENSURING RESOURCE EFFICIENCY IN THE PRODUCTION OF PAPER AND CARDBOARD. *Herald of Khmelnytskyi National University. Technical sciences*, *349*(2), 278-284.

Mwizerwa, I.T., Wang, Y., and Chen, X. (2020) A Systematic Review on Anaerobic Textile Industrial Wastewater Treatment. Journal of Environmental Accounting and Management 8(1), 73-91

NESREA (2019) National Environmental Standards and Regulations Enforcement Agency(https://www.nesrea.gov.ng/extended-producer-responsibility/

OECD (2018). Extended producer responsibility.http://www. oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm

Palanisamy, V. (2011). Utilization of textile effluent waste sludge in brick production. *International Journal of Sciences: Basic and Applied Research*, *4*(1), 1-10.

Plotkina, D., Rabeson, L., & Bambauer-Sachse, S. (2025). The role of green brand image in explaining European consumers' reactions to different types of sustainable packaging. *Journal of Retailing and Consumer Services*, *84*, 104228.

Rawluk, A., Ford, R., Anderson, N., & Williams, K. (2019). Exploring multiple dimensions of values and valuing: a conceptual framework for mapping and translating values for social-ecological research and practice. *Sustainability Science*, *14*(5), 1187-1200.

Rice, S., Trafimow, D., Keller, D., & Bean, N. (2012). Confluence theory: uniting two houses divided. *Theoretical Issues in Ergonomics Science*, *13*(4), 411-429.

Rodrigue, M., Magnan, M., & Cho, C. H. (2013). Is environmental governance substantive or symbolic? An empirical investigation. *Journal of Business Ethics*, *114*(1), 107-129.

Ross, S., & Evans, D. (2003). The environmental effect of reusing and recycling a plastic-based packaging system. *Journal of Cleaner Production*, *11*(5), 561-571.

Sabharwal, R., & Miah, S. J. (2022). An intelligent literature review: adopting inductive approach to define machine learning applications in the clinical domain. *Journal of Big Data*, *9*(1), 53. https://doi.org/10.1186/s40537-022-00605-3

Sampath, H. R., Pyeman, J. A., & Othman, N. (2024). Nexus of Industrialisation and Environmental Degradation In Newly Industrialised Countries. *Journal of Sustainability Science and Management*, *19*(11), 223-233.

Santana, K. D., Cacas-Ledon, Y., Salabarria, J. L., Perez-Martinez, A., & Arteaga-Perez, L. E. (2020). A life cycle assessment of bread production: A Cuban case study. *Journal of Environmental Accounting and Management*, *8*(2), 125-137.

Scafà, M., Marconi, M., & Germani, M. (2020). A critical review of symbiosis approaches in the context of Industry 4.0. *Journal of Computational Design and Engineering*, *7*(3), 269-278.

Shi, X. (2025). A Novel Approach to Achieve Sustainable Development: Analysis of Industry 4.0 Framework, State-of-the-Art Technologies, and Sustainability Dimensions Based on Stakeholder Theory and Practices. *Sustainable Development*.

Soiferman, L. K. (2010). Compare and contrast inductive and deductive. *Research Approaches, sl: University of Manitoba*.

Sridhar, M. K. C., & Hammed, T. B. (2014). Turning waste to wealth in Nigeria: An overview. *Journal of Human Ecology*, *46*(2), 195-203.

Suez, (2020). Sludge and by-product management https://www.suez.com/en/our-offering/local-authorities/what-are-you-looking-for/water-management/sludge-and-by-products-management

Tiyas, D. C., & Imronudin, I. (2024). The influence of eco-efficiency, green accounting, and corporate social responsibility (CSR) on the financial performance of manufacturing companies listed on indonesia stock exchange. *Proceeding ISETH (International summit on science, technology, and humanity)*, 474-484.

Tonjes, D. J., & Mallikarjun, S. (2013). Cost effectiveness of recycling: A systems model. *Waste management*, *33*(11), 2548-2556.

Tsai, W. H., & Hung, S. J. (2009). Treatment and recycling system optimisation with activity-based costing in WEEE reverse logistics management: an environmental supply chain perspective. *International journal of production research*, *47*(19), 5391-5420.

Tsai, W. H., Shen, Y. S., Lee, P. L., Chen, H. C., Kuo, L., & Huang, C. C. (2012). Integrating information about the cost of carbon through activity-based costing. *Journal of Cleaner Production*, *36*, 102-111.

Ulgiati, S., & Brown, M. T. (1998). Monitoring patterns of sustainability in natural and man-made ecosystems. *Ecological modelling*, *108*(1-3), 23-36.

Waheed, A., Shahid Khan, M., Warraich, M. A., & Ali, M. A. (2024). Environmental policy vs. environmental innovation: An examination of policies disclosure on Sustainable Development from stakeholder theory perspective. *Sustainable Development*, *32*(3), 2506-2516.

Waheed, A., Shahid Khan, M., Warraich, M. A., & Ali, M. A. (2024). Environmental policy vs. environmental innovation: An examination of policies disclosure on Sustainable Development from stakeholder theory perspective. *Sustainable Development*, *32*(3), 2506-2516.

Wiegmann, P. M. (2019). Introduction: Rooting the Study in the Theoretical Context. In *Managing Innovation and Standards* (pp. 1-19). Palgrave Pivot, Cham.

Xu, J. (2019). Water Pollution Control and Sewage Recycling of Agricultural Aquaculture. *Revista de la Facultad de Agronomia de la Universidad del Zulia*, *36*(3).

Yang, Z., Wang, Y., Shen, Z., Niu, J., & Tang, Z. (2009). Distribution and speciation of heavy metals in sediments from the mainstream, tributaries, and lakes of the Yangtze River catchment of Wuhan, China. *Journal of hazardous materials*, *166*(2-3), 1186-1194.