UMT PRESS

Planetary Sustainability
Journal Homepage: https://journal.umt.edu.my/index.php/planetsust/
eISSN: 3009-0105
DOI: http://doi.org/10.46754/ps.2026.07.005

OPTIMISING THE POST-CONSUMER PLASTIC CLOSED-LOOP ECONOMY APPROACH FOR EMERGING NATIONS: A SYSTEMATIC LITERATURE REVIEW

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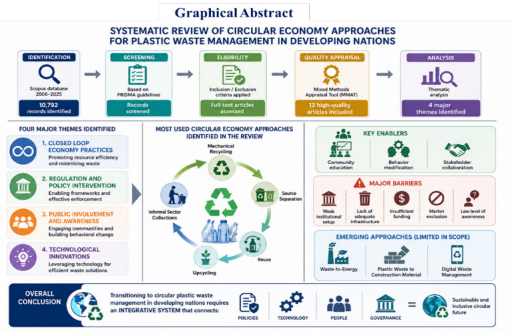
HIGHLIGHTS

- Systematic literature review using the PRISMA methodology was carried out on the circular economy solutions for plastic waste management in developing countries.
- Four main themes emerged: Closed-loop economy methods, policy and regulation, citizen engagement, and technological advancement.
- Mechanical recycling, source separation, reuse, upcycling, and informal waste management are the major circular economy methods that are being practiced today.
- The challenges of weak institutional set-up, lack of infrastructure, financial constraints, market constraints, and lack of public knowledge persist to date.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article History:
Received: 20 February 2026
Revised: 30 June 2026
Accepted: 9 July 2026
Published: 15 July 2026

Keywords:
Plastic waste, circular economy, recycling, developing countries, sustainability, systematic literature review

Abbreviations:
AI: Artificial Intelligence
CT: Can't tell
CE: Circular Economy
CIC: Community Information Campaign
EPR: Extended Producer Responsibility
ISSRC: Innovations in Source Separation and Refuse Collection
LCA: Life Cycle Assessment

ABSTRACT

A systematic review of the literature on the application of circular economy approaches for plastic waste management in developing nations was conducted. Based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) methodological guidelines and Scopus, articles between 2006 and 2025 have been screened, appraised using the Mixed Methods Appraisal Tool, and thematically analysed. Out of 10,792 articles, 13 articles of high quality passed the inclusion criteria set by the researchers. This study found four major themes, which are: Closed loop economy practices, regulation and policy intervention, public involvement and awareness, and technological innovations. This paper finds that mechanical recycling, source separation, reuse, upcycling, and informal sector collections of plastics are the most used circular economy approaches. The review further highlights that community education, behaviour modification, and stakeholder collaboration are necessary in improving waste segregation and involvement in the

LDPE: Low-density Polyethylene
MFA: Material Flow Analysis
MT: Metric Tonne
MMAT: Mixed-method Appraisal Tool
MMT: Million Metric Tonnes
MX: Mixed Method
PET: Polyethylene Terephthalate
QA: Quality Assessment
QL: Qualitative
QN (DC): Quantitative Descriptive
QN (NR): Quantitative Non-randomised
SIBC: Social Impact and Behavioural Change
SLR: Systematic Literature Review
SPS: Sustainable Packaging Solutions
STBC: Socially Transformative Behaviour Change
PAC: Public Awareness Campaigns
URT: Unconventional Recycling Technologies

recycling process. Nevertheless, implementation is hampered by factors including weak institutional setup, lack of adequate infrastructure, insufficient funding, market exclusion, and low level of awareness among the people. Waste-to-energy approach, plastic waste to construction material, and digital waste management are some of the new emerging practices highlighted in the review as possible alternatives but yet limited in scope. All in all, the findings of this review indicate that the move towards circular plastic waste management in developing nations will have to involve an integrated system which incorporates governance, policies, technology, and people.

Introduction

Plastics have become essential materials and is widely used in goods and services that enable people to go about their day-to-day lives. The low cost, high durability, light weight, malleability, and easy manufacturing processes have made plastics appealing substitutes for other materials in many fields. Plastics can be shaped into various things, from ordinary household items and packing materials like Polyethylene Terephthalate (PET) and Low-density Polyethylene (LDPE) to specialised goods such as waste bins, plastic building blocks, and electronics parts. All this has greatly enhanced people's lives and led to the extensive use of plastic products around the world (Horton *et al.*, 2017).

The accelerated rise in plastic usage is being matched by an exceptional rise in the production of plastics globally. According to a constant timeline, global plastic production rose from about two Mt in 1950 to approximately 400 Mt annually in recent years due to factors such as population growth, urbanisation, economic growth, and shifts in the lifestyle of consumers (Ahmed *et al.*, 2020; Sinan & Bubshait, 2022). There have also been forecasts predicting that there will be an additional surge in plastic production over the next few decades such that its production could be quadrupled by 2050 if the trend persists (Nyakuma & Ivase, 2021; Onyekachi & Chukwuemeka, 2022). Despite the significant contribution that plastics make to economic activities, plastic wastes generated end up in either landfills or in the natural environment.

Increased plastic manufacture and use have serious implications for environmental sustainability. This has led to growing concerns across the globe especially in developing nations due to poor waste management infrastructure. As indicated by the (Amankwa *et al.*, 2021). According to the Organisation for Economic Co-operation and Development (OECD) roughly 22% of global plastic waste is poorly managed and improperly disposed of via open dumping and burning activities by African nations OECD (2022). The contribution of African countries to plastic waste management challenges remains huge, accounting for up to 15 (Amankwa *et al.*, 2021). Amongst the African nations contributing

to increased plastic waste burden include South Africa with 9.0 Mt, Egypt with 4.0 Mt, and Nigeria with around 2.3 Mt of plastic waste (Amankwa *et al.*, 2021). Mismanaged plastic waste negatively impacts ecosystems, biodiversity, and health and livelihood of individuals. Predicted scenarios suggest that there will be more plastic than fish by 2050, and that coastal regions will accumulate significant quantities of plastic waste (Okeke *et al.*, 2022; Shomuyiwa *et al.*, 2023).

In order to effectively manage increasing plastic waste generation, there is an urgent need to move away from the linear "take-make-dispose" approach toward adopting the Circular Economy (CE) concept that entails efficiency and minimisation of waste and recycling. CE is considered a sustainability paradigm whereby growth of economies is decoupled from the exploitation of resources and negative impact on the environment (Geissdoerfer *et al.*, 2017). This paradigm also emphasises maximisation of the value of resources through reducing, reusing, and recycling, which are at the core of the conceptual framework of CE-based plastic waste management (Kirchherr *et al.*, 2017).

A great deal of opportunity lies in adopting CE principles in managing plastics as they are likely to contribute to creating value and minimising adverse effects on the environment, in addition to minimising use of raw materials (Ellen MacArthur Foundation, 2015). There is also an urgency in taking necessary steps to prevent the growing accumulation of plastics (Geyer *et al.*, 2017).

The effective execution of CE is made possible through collaboration among stakeholders from the government, industry, and society, together with innovations and transformations (Prieto-Sandoval *et al.*, 2018). Moreover, policies, funding, and changes in behaviours are necessary in managing plastic wastes using CE, especially in developing countries where there are institutional limitations (Nikiema & Asiedu, 2022).

Although the significance of circular models is being recognised, some knowledge gaps still exist concerning the ways to manage plastic waste in developing economies. Indeed, there is insufficient information about behavioural motivations, intervention mechanisms, and possible solutions specific for certain regions, including Africa, and Nigeria in particular. Thus, it is crucial to explore ways to improve current practices related to plastic waste management and recycling, based on scientific studies and experience of other countries. It would be appropriate to focus on providing evidence-based plastic waste management techniques that might be beneficial for addressing the problem of environmental pollution, improving sustainability, and gaining economic benefits from the use of plastic waste resources. Thus, the goal of the present study is to conduct a systematic review of the literature on circular models of plastic waste management to understand the existing practices, challenges, opportunities, and possible directions for future research on this topic.

Methodology

Systematic Reviewing Procedure for Article Selection

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines technique was applied according to the requirements and guidelines for systematic reviews and meta-analyses. The paper used the systematic literature review technique proposed by Tranfield *et al.* (2003) for conducting an exhaustive literature review. Systematic literature reviews necessitate a large database with numerous publications and efficient search techniques for sophisticated and logical expression (Mesa *et al.*, 2021; Wijewickrama *et al.*, 2021; Saarani *et al.*, 2022). This study used a

research database to conduct a systematic review of the literature on plastic waste management. The review method consisted of identification, screening, eligibility, as well as data abstraction, plus the preparation stage (Shaffril *et al.*, 2018).

Formulation of Research Questions

The study employed an integrative review process to synthesise and analyse different study designs for the research question and review aim (Snyder, 2019). The research question was developed with a PICO framework modified to where "P" stands for population, "I" for the phenomenon of interest, and "Co" for setting, adapting the traditional Patient/ Population, Intervention, Comparison, and Outcome (PICO) to highlight context instead of comparison (Nishikawa Pacher, 2022). This modified framework is focused on the citizens of developing countries, with emphasis on plastic waste management issues and sustainable economic solutions in resource poor environments. Shaffril *et al.* (2021) noted that there is a requirement to develop a specific review question to guide research. The main research question that they respond to is: "What circular economy practices are being used to address plastic waste management issues in developing countries?" This review utilised the Scopus database, accessed in October 2025, to synthesise and aggregate suitable studies against established inclusion and exclusion criteria.

The search was restricted to studies published between 2006 and 2025 because the review process had commenced before manuscript preparation excluding non-English language articles. Articles were selected if they directly analysed plastic waste without referring to it incidentally. Of these, 13 published articles were included under review discussion excluding other documents and references. This study provides an outline of current international English language articles for scholars, government, and non-governmental organisations globally (Petticrew & Roberts, 2006). It draws on the systematic literature review method, which is an aggressive compilation and processing of data to exclude prejudice and ascertain gaps and avenues for future research. Moraes *et al.* (2021) introduce that systematic reviews reduce faults and increase replicability. There is not much in the existing literature concerning environmental sustainability of plastic waste with holistic views and appropriate solutions to facilitate a circular economy. The review seeks to identify, critically assess, and suggest solutions to priority environmental challenges posed by plastic waste and hence bridging an imperative knowledge gap.

Structured Searching Methods

This flowchart presents an in-depth workflow used in the Systematic Literature Review (SLR) process of study selection for plastic waste, circular economy, and closed-loop economy in developing countries. Each stage depicts unambiguous criteria and systematic exclusion that is indicative of best scholarly standards.

Identification

This study employed a systematic review, beginning with a comprehensive keyword identification strategy. To maximise the retrieval of relevant articles concerning circular economy, plastic waste, and developing nations, we expanded our search beyond primary keywords.

Based on the recommendations from Page *et al.* (2021) and Shaffril *et al.* (2021), the search is broadened by incorporating alternative words and variations. Alternative words were identified using tools like thesauruses and Google translation suggestions, yielding terms such as plastic waste, closed-loop economy, and developing economies. Additionally, the keywords derived from previous studies to ensure thoroughness.

To refine our search and improve accuracy, rephrase, combined primary keywords with their identified Alternative word using Boolean operators within the Scopus database, as detailed in Table 1. Researchers began by searching within the Scopus database and returned an initial count of 10,792 records. A follow-up time filter was then applied to narrow down records to those published between 2006 and 2025, removing 4,075 records. This step ensured that only the most recent and relevant research is kept, keeping currency within the literature review.

Table 1: Advanced searching keywords

Internet Databases	Advanced Searching Keywords
Scopus	TITLE-ABS-KEY ((“circular economy” OR “closed-loop economy” OR “closed-cycle economy”) AND (plastic* OR polymer*) AND (waste* OR garbage* OR trash* OR rubbish OR residue* OR waste product* OR litter* OR scrap* OR disposal*) AND (“developing* OR economy*) AND (nation*))

Screening

The remaining studies, 6,717, proceeded to screening. Records not dealing with sciences were excluded, and this removed 6,168 items. In this case, the objective was to have purely scientific contributions that were applicable to the research problems. After this, 549 records were retrieved, but only articles and reviews were retained, with another 65 items being excluded as shown in Figure 1. Polanin *et al.* (2019) emphasised that the purpose of screening is to reduce the number of studies requiring review, enabling reviewers to handle them more efficiently.

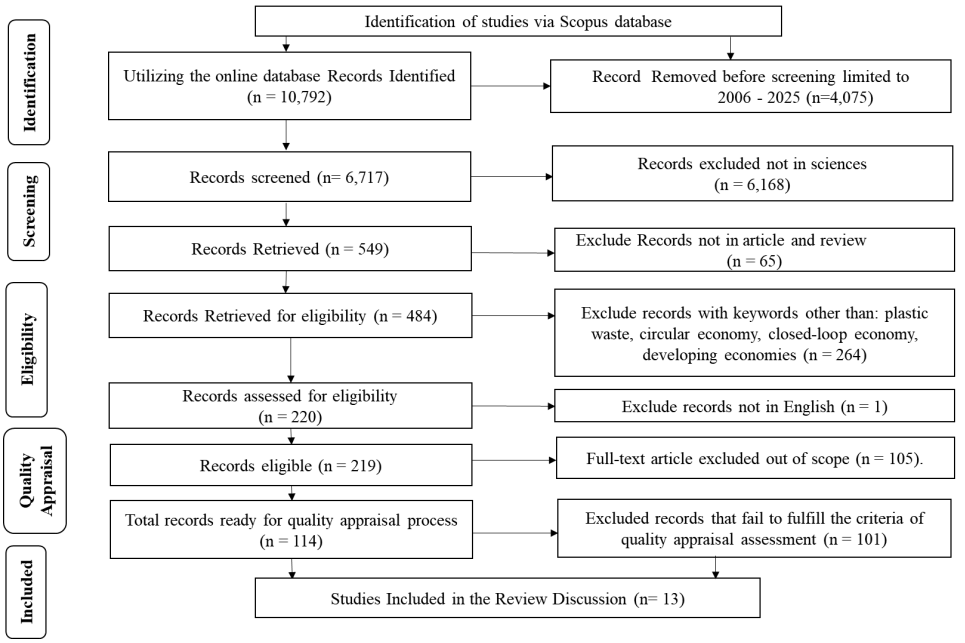


Figure 1: The SLR method’s phases

Eligibility

Then, 484 records were screened for eligibility based on certain keyword terms: Plastic waste, circular economy, and closed-loop economy within developing economies. Records lacking these keywords (264) were eliminated to reduce thematic irrelevance. Afterwards, the full review was performed on 220 records, leaving one record that was removed because of non-English language, further improving accessibility and clarity for reviewers.

Following the verification of eligibility stage, all of the research papers from the prior screenings were carefully evaluated. It entails meticulously reviewing the article's title, abstract, and complete manuscript to exclude publications that did match the inclusion requirements. A large number of the publications were eliminated because they were irrelevant for developing nations, were not centred on the circular economy's solution for controlling recyclable materials and were not accessible in their entirety. This step effectively filters out non-relevant studies.

Quality Appraisal

Here, both the scope and quality of the full-text articles were strictly assessed. 105 articles were excluded out of 219 eligible articles since they were not of scope. Hence, 114 records underwent quality appraisal, confirming their appropriateness and good methodology and 91 were below the standards of quality appraisal set for the review.

A crucial step in systematic reviews involves critically evaluating the included studies. This process thoroughly assesses each study to confirm its reliability, validity, worth, and trustworthiness (Shaheen *et al.*, 2023). Mixed-method Appraisal Tool (MMAT), this approach followed the method suggested by Pace *et al.* (2012), this instrument assesses five types of research method: Mixed-method research, randomised trials with controls, observational studies, non-numerical research, and numerical research.

The MMAT test proved helpful in identifying key elements regarding study effectiveness, notably in terms of the method or technique. It emphasised the importance of developing carefully designed research questions to obtain comprehensive and useful findings (Pluye *et al.*, 2011). The design emphasised the need to choose acceptable qualitative data gathering procedures that are aligned with the study goals. MMAT also emphasised the importance of integrating uniformity between qualitative information sources, collection techniques, and results processing and interpretation within quantitative studies, the review standards includes whether measurement were appropriate, analyses were adequate, population represented an average of the larger population, and the methodology for sampling was in line with the study aims, also an MMAT provided helpful information toward establishing mixed-methods approaches, determining the efficacy of different types of research designs, successfully bringing together both qualitative and quantitative variables, and tackling design discrepancies that guarantee the effectiveness of mixed-methods research from both approaches. and analytical perspectives.

Table 2 displays the quality appraisal of the included studies. The literature search method includes a quality assessment of selected publications, which were graded independently against quality criteria. The author carefully reviewed and analysed the papers to objectively evaluate the accuracy of the responses presented. Weights were allocated to each publication based on the assessment, demonstrating the approach and the theoretical consistency that characterised the chosen articles. The weights were determined using the quality criteria and standards specified in Table 3 (Shaffril *et al.*, 2021).

Table 2: Quality appraisal of included studies

No.	Study	Country	MMAT Category	S1	S2	QA1	QA2	QA3	QA4	QA5	Include
1	Chilote and Dhakal (2025)	Nigeria	MM	Y	Y	Y	Y	Y	CT	Y	Yes
2	Bening *et al.* (2022)	Ghana	QD	Y	Y	Y	Y	Y	CT	Y	Yes
3	Kombiok and Naa Jaaga (2023)	Ghana	QD	Y	Y	Y	Y	Y	CT	Y	Yes
5	Gwada *et al.* (2019)	Kenya	QD	Y	Y	Y	Y	Y	CT	Y	Yes
6	Henry *et al.* (2006)	Kenya	MM	Y	Y	Y	Y	CT	CT	Y	Yes
8	Mulindwa *et al.* (2023)	Rwanda	QD	Y	Y	Y	Y	Y	CT	Y	Yes
9	Dangi *et al.* (2011)	Nepal	QD	Y	Y	Y	Y	Y	CT	Y	Yes
10	Ferronato *et al.* (2019)	Bolivia	MM	Y	Y	Y	Y	CT	CT	Y	Yes
11	Ngoc and Schnitzer (2009)	Vietnam	MM	Y	Y	Y	Y	CT	CT	Y	Yes
12	Bandara *et al.* (2007)	Sri Lanka	QD	Y	Y	Y	Y	Y	CT	Y	Yes
13	Manaf *et al.* (2009)	Malaysia	MM	Y	Y	Y	Y	CT	CT	Y	Yes
14	Godfrey and Oelofse (2017)	South Africa	MM	Y	Y	Y	Y	Y	CT	Y	Yes
15	Oelofse and Strydom (2010)	South Africa	MM	Y	Y	Y	Y	CT	CT	Y	Yes

Note: MM = Mixed-method; QD = Quantitative descriptive; Y = Yes; N = No; CT = Can't tell
Source: MMAT (2018)

Consistent with Hong *et al.* (2018), MMAT was used descriptively rather than as a numerical scoring instrument. Each criterion was assessed as 'Yes' (Y), 'No' (N), or 'Can't tell' (CT). The appraisal informed interpretation of evidence rather than determining inclusion solely through aggregate scores.

Assessment Framework and Criteria

All studies within the review was appraised against five quality assessment criteria (QA1–QA5), derived from well-established methodological appraisal tools, to ensure clarity, validity, and rigour for qualitative, quantitative, and mixed-methods studies. A systematic quality assessment tool was applied in order to maintain methodological quality and consistency. The standards examined various elements in relation to study type: Rationale and integration in mixed methods; strategy, data collection, and credibility in qualitative studies; sample adequacy, measurement validity, and appropriateness in analysis in quantitative (descriptive) studies; and participant representativeness, data completeness, and control of confounding variables in quantitative (non-randomised) studies.

Table 3: The MMAT criteria used to assess the approach and logical quality for the selected papers

Research Design	Assessment Criteria
Quantitative descriptive	S1 = Are there clear research questions? S2 = Do the collected data address the research questions? QA1- Is the sampling strategy relevant to address the research question? QA2 – Is the sample representative of the target population? QA3 – Are the measurements appropriate? QA4 – Is the risk of non-response bias low? QA5 – Is statistical analysis appropriate to answer the research question?
Mixed-method	S1 = Are there clear research questions? S2 = Do the collected data address the research questions? QA1 – Is there an adequate rationale for using a mixed methods design? QA2 – Are the different study components effectively integrated? QA3 – Are the outputs of the integration adequately interpreted? QA4 – Are divergences and inconsistencies between quantitative and qualitative results adequately addressed? QA5 – Do the different components adhere to the quality criteria of each tradition of the methods involved?

Source: Hong *et al.* (2018)

Overall, QA1 addressed clarity of research, QA2 methodological transparency, QA3 quality of analysis, QA4 coherence of logic, and QA5 study strengths, limitations, and ethics consideration, S1 and S2 screening questions

Final Inclusion

This process produced the inclusion of 13 high-quality, subject-specific studies in the coverage of the SLR. This advanced selection set ensures that the literature review is based on firm evidence from the discipline, capturing new results, sound methodologies, and actually related issues.

Methodological Approaches of the Reviewed Studies

The methodological analysis of the 13 included studies found that four major methods were used in the research, which include household survey, waste characterisation, mixed-methods case studies, and systems analysis/economic modelling (Table 4).

Table 4: The methodological analysis of the 13 included studies found that four major methods

S/No	Author/Year	Country	Core Focus	Method	Key Findings (Summary)
1	Chilote and Dhakal (2025)	Nigeria	Sustainable plastic waste management in higher education institutions	Mixed methods (questionnaires and interviews)	Low levels of plastics recovery were reported; awareness and deposits programmes were suggested to increase recovery rates and recycling
2	Bening *et al.* (2022)	Ghana	Economics of plastic waste recycling	Quantitative economic modelling	The informal recyclers play an important role in the collection of plastics. Proper financing can make the process of recycling more efficient
3	Kombiok and Naa Jaaga (2023)	Ghana	Household plastic waste disposal behaviour	Household survey	While awareness of environmental impact did not necessarily mean that people disposed of their waste properly

4	Dangi *et al.* (2011)	Nepal	Municipal waste generation and composition	Waste characterisation study	The majority of waste was made up of organic elements, with recyclable polymers being misused
5	Gwada *et al.* (2019)	Kenya	Household plastic waste generation and composition	Waste audit and survey	A large amount of household waste was made up of plastics, and there was still no source segregation
6	Henry *et al.* (2006)	Kenya	Municipal solid waste management challenges	Mixed-methods case study	Waste management performance was hampered by poor collection efficiency, insufficient funding, and fast urbanisation
7	Ferronato and Torretta (2019)	Bolivia	Integrated municipal waste management	Case study	The effectiveness of waste management was hampered by institutional flaws and poor infrastructure
8	Mulindwa *et al.* (2023)	Rwanda	Circular economy practices in waste management firms	Cross-sectional survey	Although adoption of circular economy concepts was growing, it was still limited by financial and technical constraints
9	Ngoc and Schnitzer (2009)	Vietnam	Sustainable urban waste management	Mixed-methods case study	Sustainable waste management required integrated planning and stakeholder involvement
10	Bandara *et al.* (2007)	Sri Lanka	Municipal solid waste composition	Quantitative field study	While plastics continued to be inadequately managed, a high organic content indicated significant composting potential
12	Godfrey and Oelofse (2017)	South Africa	Development of recycling systems	Sectoral empirical analysis	Through official backing and involvement from the informal sector, the recycling industry grew significantly
13	Oelofse and Strydom (2010)	South Africa	Impact of waste legislation on recycling	Mixed-methods case study	Recycling operations were encouraged by regulatory interventions, but implementation issues remained

Household Survey Studies

Household surveys have been used most frequently in the reviewed literature as a research technique. Such investigations focus on public knowledge about recycling and waste management, waste disposal practices, and involvement in waste management and recycling programmes. Household surveys have been utilised by Kombiok and Naa Jaaga (2023) in Ghana, Mulindwa *et al.* (2023) in Rwanda. With the help of such an approach, researchers managed to measure the level of household knowledge, attitudes, and practices concerning waste management and recycling.

Waste Characterisation and Field Measurement Studies

Various studies have used waste characterisation techniques that comprised direct sampling, sorting, and measurement of municipal solid waste streams. This method was applied by Gwada *et al.* (2019) in Kenya, Dangi *et al.* (2011) in Nepal, and Bandara *et al.* (2007) in Sri

Lanka. Such studies have generated empirical data on waste composition. Similarly, studies conducted in Ghana, provided information on the proportions of organic waste, plastics, and recyclable materials, which are necessary for designing recycling and resource recovery programmes.

Mixed-methods and Case Study Research

The number of mixed methods studies among those reviewed was considerable. Mixed-methods approach refers to the integration of quantitative and qualitative methods like survey, interview, observation, document analysis, etc., used to explore technical, social, and institutional aspects of the waste management system. Examples include studies by Chilote and Dhakal (2025) in Nigeria, Bening *et al.* (2022) from Ghana, Henry *et al.* (2006) from Kenya, from Rwanda, Ferronato and Torretta (2019) from Bolivia, Ngoc and Schnitzer (2009) from Vietnam, from Sri Lanka, Manaf *et al.* (2009) from Malaysia, Godfrey and Oelofse (2017) and Oelofse and Strydom (2010) from South Africa.

Economic Modelling, Benchmarking and Systems Analysis Studies

There were fewer instances where authors made use of economic modelling, benchmarking, and systems analysis for evaluating waste management performance and circular economy implementation. In the case of Bening *et al.* (2022), economic modelling were used to make an evaluation of the costs and benefits associated with plastic recycling systems in Ghana, while Godfrey and Oelofse (2017) made use of sectoral systems analysis to analyse the growth of recycling systems in South Africa.

Overall Methodological Trends

On the whole, quantitative descriptive techniques were the most frequently employed methodologies in the reviewed research papers, being represented by six research papers, whereas the number of mixed-methods approaches has amounted to seven studies. In particular, household surveys and waste characterisation techniques have been extensively used since they represent an easy and cost-effective way of measuring the volume of waste generation and recycling. At the same time, mixed-methods case studies were the most frequently employed methodologies to reveal various complexities related to the functioning of the systems under analysis.

Quality Assessment of Included Studies

Following identification, screening, and data extraction stages of the systematic review, a rigorous quality appraisal was conducted to examine the methodological quality and trustworthiness of the research studies covered in this review. Conducting a quality appraisal is a crucial part of the systematic review process since it ascertains that the synthesised evidence emanates from research studies of an acceptable level of research quality and transparency.

Scoring Procedure and Inclusion Criteria

Based on the recommendations provided by the Mixed-methods Appraisal Tool (MMAT), no overall numerical rating was assigned to any of the studies included in this review. Each of the included studies was appraised based on the five methodological quality criteria corresponding to their design, and the findings were reported for each criterion separately. Studies that met the majority of the criteria, were determined to have adequate methodological quality and were selected for further analysis, while those with significant flaws in methodology were critically assessed. This process followed MMAT recommendations, which state that instead of calculating one score, a detailed assessment of the methodological quality of the studies should be provided (Hong *et al.*, 2018).

Evaluation of Included Studies

The quality assessment of the 13 studies included in the review was performed according to the Mixed-methods Appraisal Tool (MMAT). The assessment included Quantitative Descriptive (QD) and Mixed Methods (MM) studies, according to the MMAT criteria. Overall, the included studies have proved to be of satisfactory methodological quality and thus can be used in this review.

Out of 13 studies, six studies were quantitative descriptive studies, and seven mixed-methods studies. All the studies fulfilled the screening criteria (S1 and S2) as they had clearly formulated research questions, and the collected data adequately addressed the research question. Moreover, all studies met the first three criteria of methodological quality assessment (QA1–QA3) as they had appropriate sampling, measurement, and correspondence between research questions and gathered data.

As to the quantitative descriptive studies, all thirteen studies met QA1–QA4 criteria meaning that the sampling procedures were valid, the samples were representative, the measures used in the studies were appropriate, and the risk of non-response bias had been sufficiently managed. Nevertheless, it could not be established whether the statistical analyses used by the authors were appropriate because this criterion was rated as Can't Tell (CT) in most studies. Regardless of this problem, the studies met high methodological standards and could be considered as valid sources for analysis. Among them there were studies carried out in Ghana, Kenya, Rwanda, and Sri Lanka (Bandara *et al.*, 2007; Gwada *et al.*, 2019; Dangi *et al.*, 2011; Bening *et al.*, 2022; Kombiok & Naa Jaaga, 2023; Mulindwa *et al.*, 2023).

Generally, the methodological quality of the mixed-methods studies was found to be satisfactory. Seven out of seven mixed-methods studies satisfied QA1–QA3, implying that they were justified in their use of mixed methods approach, achieved successful integration of qualitative and quantitative parts, as well as provided coherent interpretation of integrated findings. Two studies fulfilled QA4 requirements and adequately addressed inconsistencies and divergences of qualitative and quantitative findings (Godfrey & Oelofse, 2017; Chilote & Dhakal, 2025). As regards the other mixed-methods studies, QA4 and QA5 had to be rated as Can't Tell (CT), since not enough methodological information was provided about the way divergences between the data strands had been managed and criteria of quality had been followed in each component.

Thus, based on the MMAT criteria, it can be concluded that the methodological quality of reviewed studies was moderate to high with no failings in core appraisal criteria. Therefore, all 13 studies were included in the final synthesis.

Thematic Evaluation and Information Extraction

The present study adopts a comprehensive and empirical appraisal approach that integrates qualitative, quantitative, and mixed-methods designs (Cynthia L. Russell, 2005; Dhollande *et al.*, 2021; Cronin & George, 2023). Through an integrative review, the study aggregates and synthesises evidence from diverse sources to provide a global perspective on the topic (Schick-Makaroff *et al.*, 2016) This combined approach allows the incorporation of additional relevant data beyond primary research, enhancing theory development and model typology (Dhollande *et al.*, 2021). To allow for continuous and extensive data analysis from different primary sources, the study employs new mixed-method and qualitative synthesis designs (Schick-Makaroff *et al.*, 2016; Younas *et al.*, 2022).

A Review of the Descriptive Data

The selected literature sources covered a large geographical area and serve as a general descriptive base in order to explore the processes of plastic waste management, the problems associated with them, and the transition to a CE model in developing and emerging economies. In general, the dataset is characterised by the prevalence of studies conducted in Africa and Asia, as well as in Latin America.

The case in Africa is such that there are studies coming from Nigeria, Ghana, Kenya, Rwanda, and South Africa which collectively contribute a sizeable portion of the evidence base in this continent. In Nigeria, the work of Chilote and Dhakal (2025) deals with the current dynamics related to waste management. Similarly, studies conducted in Ghana where there are several studies (Bening *et al.*, 2022; Kombiok & Naa Jaaga, 2023). These are all indicative of the continuous scholarly effort devoted to issues like informal sector inclusion, collection inefficiencies, and governance gaps in urban municipal waste systems. The Kenyan evidence base has a longer history going back from Henry *et al.* (2006) and Bandara *et al.* (2007) up until Gwada *et al.* (2019). This demonstrates the evolution from baseline assessments to structured waste valorisation and management. In Rwanda, the contributions from Mulindwa *et al.* (2023) illustrate CE-related shifts, especially in policy-making and institutionalisation. Finally, in South Africa, there are Oelofse and Strydom (2010) and Godfrey and Oelofse (2017) which illustrate advanced waste governance systems within Africa.

From Asia, the four countries that provide cases for various stages of the evolution of waste management are Nepal, Vietnam, Sri Lanka, and Malaysia. The selected article from Nepal is Dangi *et al.* (2011) that highlights the move from baseline waste characteristics analysis to more modern governance and sustainability initiatives. The articles on Vietnam (Ngoc & Schnitzer, 2009) follow the same pattern of transition from baseline waste composition to integrated solid waste management systems. For Sri Lanka, the article offers some early evidence regarding waste composition and disposal in urban municipalities: Bandara *et al.* (2007). In Malaysia, contributions are provided by Manaf *et al.* (2009).

While there are fewer studies on Latin America, they are still significant comparative studies regarding CE transition in developing countries. The example from Bolivia includes Ferronato and Torretta (2019). which focuses on the problems associated with inequalities between the rural and urban areas and infrastructure issues related to waste management.

In terms of methodology, most of the included studies are descriptive and cross-sectional, where some have used mixed-methodology in order to incorporate quantitative data on waste composition and qualitative information on governance issues. The earlier studies such as (Bandara *et al.*, 2007) were mainly concerned with waste characteristics and management procedures while later studies (Mulindwa *et al.*, 2023) were inclined towards circular economy, recycling, and governance mechanisms.

However, the overall review of the included studies reveals that the bulk of the evidence has been generated in Sub-Saharan Africa and South Asia, with contributions also seen from Latin America. The development of the literature reveals an evident move from basic waste characterisations to advanced circular economy research that has policy applications. However, there are huge discrepancies in methodological rigor and systems implementation.

Results and Discussion

A Comprehensive Explanation and Detail for the Chosen Research

The Systematic Literature Review (SLR) was the only source that provided data for the synthesis of themes. Extra literature, which was published beyond the scope of this study, was employed only for the purpose of providing context.

The SLR presents a systematic way of identifying, assessing, and synthesising the empirical evidence on the topic of CE practices in the management of plastic waste in developing countries. The systematic literature review is one of the most rigorous literature reviews that enable integration of data obtained from various sources and provide an overall perspective on the research topic and emerging trends in the literature (MacKenzie *et al.*, 2012). At the conclusion of the screening and selection process, thirteen studies were selected for further thematic analysis. Four key themes have been identified through thematic analysis: (i) closed-loop economy, (ii) regulations/policy intervention, (iii) public participation/awareness and (iv) technological innovations. Therefore, moving towards circularity involves not only the recycling of plastic waste, but multiple coordinated interventions by the government, technological innovation, market dynamics, and behavioural changes. It can be clearly seen in Figure 2 below that the thirteen studies cover eleven developing countries across three continents.

Figure 2: Geographical distributions of chosen papers

Evidence on African countries includes Nigeria, Ghana, Kenya, Rwanda, and South Africa. Evidence on Asian countries is provided by Nepal, Vietnam, Sri Lanka, and Malaysia, and that on South American countries includes Bolivia and Ecuador. In spite of the existing variations among the studied countries in terms of economic, institutional capabilities, and infrastructure for waste management, a common set of barriers which impede the adoption of the

principles of circular economy can be detected. This includes inadequate waste collection facilities, insufficient recycling facilities, ineffective environmental regulations, shortage of funds, and poor public participation in plastic recovery and recycling. Despite the fact that certain barriers exist in all the studied countries, the results demonstrate significant diversity in the way of CE implementation. Countries with better institutional and waste management infrastructures, such as Malaysia and South Africa, have adopted quite an advanced approach to the implementation of CE concepts including formal recycling programmes, policy measures, and adoption of technologies. For countries with less capability, community engagement, sensitisation campaigns, and cooperation with the informal sector become an efficient strategy of CE implementation.

This variance shows how much the transition into a circular economy model depends on the local socio-economic conditions, regulation, and resource potential. Furthermore, cross-country analysis demonstrates the necessity of applying a holistic strategy in managing plastic waste in closed-loop models taking into account all four themes mentioned above. Closed-loop models cannot be effectively implemented without regulatory framework and its enforcement, while innovation cannot be realised without proper public education. At the same time, citizen participation is most effective with enabling policies and easy access to the recycling process. Separate strategies are unlikely to cause substantial improvements in plastic waste management outcomes. Generally speaking, it may be concluded that developing countries pursue similar goals in transitioning into a circular economy but differ in their readiness to implement these strategies. The cases discussed in this paper become valuable sources of practical experience for policy-makers because they show how the existing linear systems (take-make-dispose) can be transformed into more efficient circular systems. Although interventions in developed and emerging markets may appear to be efficient, they should be modified in accordance with the local situation.

Systemic Barriers to Circular Economy Transition

Conclusion from all the thirteen papers reviewed above reveals that there are some barriers for the application of circular economy strategies in developing countries, which arise from multiple interrelated factors. Apart from technical barriers, these barriers include institutional and policy barriers, economic and financial barriers, technological and infrastructure barriers, organisational and business barriers, knowledge and information barriers, socio-cultural barriers, supply chain and market barriers, and context specific barriers in developing countries. From the reviewed papers, it is evident that these barriers operate synergistically.

Institutional and Policy Barriers

Several recurring themes emerged in the literature, such as failures on institutional and regulatory levels. Some papers pointed out that there are no holistic policies for circular economy, poor integration of policy instruments, and poor implementation of environmental policies among the barriers to efficient management of plastics.

According to the findings of a study conducted in Nigeria, present waste policies focus only on the methods of waste collection and disposal without considering waste reuse and recycling (Anyakora, 2019; Kehinde *et al.*, 2020; Uche, 2023). This problem is also noted by Truong and Vu (2019) regarding the inconsistency of governmental commitment to implementing these policies. This problem is supported by the results of the research of Kirchherr *et al.* (2017), who state that government and regulatory barriers are one of the major barriers to a circular economy.

Economic and Financial Barriers

Financial constraints also form another important obstacle hindering the introduction of the circular strategy. As claimed by the researchers, money should be allocated for investing in the development of facilities and equipment associated with recycling and implementing circular business models, but the cost of these investments exceeds the financial capacity of many firms.

As noted by Duru *et al.* (2019) and Behuria (2021) financial constraints, lack of investment options, and reliance on inexpensive raw materials reduce the economic feasibility of recycling processes. The absence of economic instruments, like tax breaks or subsidies, also hinders the participation of the private sector in the process. These obstacles overlap with those indicated by Rizos *et al.* (2016).

Technological and Infrastructure Barriers

The challenges brought about by technological constraints and inadequate infrastructure have been identified as some of the barriers in achieving circular transition. Many developing countries lack recycling centres, sorting machines, reverse logistics, and infrastructures to manage their waste. The challenges brought about by poor waste collection practices and poor functioning recycling centres have been brought to light by Aderoju *et al.* (2019), Dilkes-Hoffman *et al.* (2019), and Iheukwumere *et al.* (2019). Inadequate design of products has also been cited as an obstacle towards adopting the circular strategy.

Organisational and Business Barriers

Transitioning from a linear system to a circular way of conducting business operations requires extensive organisational change because of change resistance and weak management ability that could hinder the transition. As noted by Kehinde *et al.* (2020) and da Silva *et al.* (2022), organisations lack adequate strategic commitment, technical capabilities, and human resources to implement their circular strategies. The innovations can be seen as risky by organisations since they pose uncertainties in terms of profit-making. This is consistent with the findings of (Baars *et al.*, 2022).

Knowledge and Information Barriers

Ignorance and inadequate understanding of the principles behind CE have been noted in some studies. The benefits of CE to the environment and economy are generally not well-known. Shortcomings in the realm of environmental education, public enlightenment, and professional training have been reported by Oyebode (2018), Gidigbi *et al.* (2020), and Uche (2023). There are also deficiencies in data collection on waste generation and recycling, which can hinder decision-making processes. There is inadequate information sharing among all stakeholders.

Social and Cultural Barriers

The important point to consider here is that social attitudes and norms are significant determinants that impact the implementation of CE. Many scholars pointed out that societal attitudes and consumption practices are still aligned with linear economies. Dumbili and Henderson (2020) brought into consideration the fact that inappropriate behaviours and low public participation can negatively influence waste sorting and recycling practices. Similarly, Onyekachi and Chukwuemeka (2022) argued that consumers' tendency towards new products will act as an impediment to CE practices. Kirchherr *et al.* (2017) also identified cultural issues and lack of consumer participation among other CE challenges.

Supply Chain and Market Barrier

In order to ensure the effective operation of circular economy processes, there must be efficient coordination between the involved actors on the value chain. However, the lack of integration in supply chains and the poor market structure were among the obstacles highlighted in the examined articles. According to da Silva *et al.* (2022) and Lazo *et al.* (2024), underdeveloped secondary markets, uneven quality, and instability of demand prevent investments in recycling activities. Moreover, poor systems of reverse logistics and poor cooperation of all stakeholders constitute obstacles to having an effective circular supply chain. Thus, companies might be reluctant about the viability of using recycled material.

Context Specific Barriers in Developing Countries

As indicated by the literature review, the analysed states face particular problems which add to obstacles in implementing CE strategies. Such problems include urban sprawl, demographic increase, poverty, and competing development priorities. Research on Nigeria highlighted the critical role of the informal sector in recycling activities (Anyakora, 2019; Duru *et al.*, 2019). The informal recyclers make a considerable contribution to the recycling processes, but their role is not taken into account when making policies. Moreover, additional challenges include political instability, the absence of appropriate municipal infrastructure, and a dearth of scientific development and innovation as additional obstacles.

Overall, these findings suggest that the strategies related to the circular economy that have been developed for developed countries need to be modified to fit the socio-economic conditions of developing states.

Synthesis of Systemic Barriers

Barriers to CE transition through synthesised information are quite interdependent in nature. Weak institutions affect the ability to invest, thereby affecting funding availability. Limited funding results in a lack of infrastructure and innovations. Limited infrastructure makes it difficult to create a market environment, while limited awareness and socio-cultural barriers prevent citizens from engaging in circular practices.

Therefore, a piecemeal strategy will not have much effect. There is a need for a systemic approach involving different strategies such as policy changes, economics, innovation, collaboration, capacity building, and citizen engagement in order to transition into CE. Such a systemic approach is particularly important for developing nations because of the context involved.

Economic Means for A Circular Economy

Green management of plastic waste in developing countries entails massive investments, supported through foreign aid and public–private partnerships. Inclusive and economically sound systems like in Colombia enhance environmental and social performance. A circular plastic economy is only possible through system transformation avoiding excessive plastics, promoting reuse, and ensuring circulation. Collaborative initiatives such as the Plastics Pact demonstrate effective cooperation among governments, businesses, and citizens (Lisiecki *et al.*, 2023; Moise & Tresa, 2023).

Barriers mentioned in the studies include poor infrastructure and policy fragmentation. The supplementary literature further confirms the above findings (Milbrandt *et al.*, 2022). Lack of infrastructure, lack of regulation, and lack of coordination continue to be the impediments. Policy fostering openness, material standardisation, and reduced tariffs on

green products will initiate CE adoption and encourage economic possibilities (Browning *et al.*, 2021).

Community involvement is essential collaboration among governments, businesses, and local communities to enhance recycling facilities and technologies like biodegradable packaging (Kato Jumba K, 2025). Integration of waste pickers into CE frameworks, as in Brazil and India, enhances livelihoods and formalises informal recycling (Nahman, 2010; Ellen MacArthur Foundation, 2015). Transitions to CE at the system level require strong governance, legal safeguards, and participatory mechanisms, as in the cases of Bogotá and Colombia (World Bank Group, 2022; Reis-Filho *et al.*, 2025). A socially inclusive CE ultimately depends on coherent policies, investments, and cooperation between communities to achieve sustainability and equity (Barford & Ahmad, 2021).

Circular Economy and Sustainable Development

The circular economy aims to eliminate plastic waste through the use of resource efficiency, waste minimisation, and environmental protection (Morseletto & Piero, 2020; Babaremu *et al.*, 2022). Plastics drive economic growth but pose issues of an environmental and social concern. Table 5 shows circular economy methods being implemented to address plastic waste management issues in some developing nations

One of the primary objectives of this systematic literature review is to determine which Circular Economy (CE) techniques are used in order to deal with problems associated with managing plastic wastes in developing countries. As seen from the 13 selected studies, developing countries have employed a variety of CE techniques to solve problems of plastic waste leakage into the environment and to gain economic value through efficient use of resources.

Among all other CE activities, the most common CE practice found in the literature review is the mechanical recycling of plastics that entails the process of collecting, segregating, cleaning, and recycling of plastic waste back into raw materials. Research findings from Nigeria, and South Africa show that recycling continues to play an essential role in CE since it helps in extending the life cycle of materials while also reducing dependency on new plastic materials (Oelofse & Strydom, 2010; Chilote & Dhakal, 2025).

Another notable CE approach noted is that of source separation and segregation of wastes. Several studies conducted in Kenya, Nepal, Sri Lanka, and Malaysia highlight the significance of source separation in improving collection efficiency and effectiveness of the recyclable materials in the household or community (Henry *et al.*, 2006; Bandara *et al.*, 2007; Manaf *et al.*, 2009; Dangi *et al.*, 2011). Segregation is very effective in avoiding contamination of recyclable plastic material and increasing the quality of the recycled products making recycling economically sustainable. These results provide empirical evidence in support of the circular economy concept of retaining value in the production and consumption process as much as possible.

Table 5: Circular economy methods being implemented to address plastic waste management issues in some developing nations

Circular Economy Method	How it Works	Countries/Notes	Source(s)
Source Separation and Waste Segregation	Recycling efficiency and recovery rates are increased when households segregate recyclable plastics from mixed municipal waste	Malaysia, Kenya, Nepal, and Sri Lanka. often recognised as the cornerstone of CE systems	Henry *et al.* (2006); Bandara *et al.* (2007); Manaf *et al.* (2009); Dangi *et al.* (2011)
Community-Based Collection Systems	Recyclable plastics are gathered by neighbourhood associations, cooperatives, and local groups and directed toward recycling markets	Kenya, Rwanda, Ghana, and Nigeria. encourages the development of jobs and the diversion of waste	Gwada *et al.* (2019); Bening *et al.* (2022); Mulindwa *et al.* (2023); Chilote and Dhakal (2025)
Informal Sector Integration	Waste pickers create value from waste and support jobs by recovering plastic items for recycling and resale	South Africa, Vietnam, Ghana, and Ecuador. The most common method of recovery is still informal recycling	Ngoc and Schnitzer (2009); Godfrey and Oelofse (2017); Ferronato and Torretta (2019); Kombiok and Naa Jaaga (2023)
Mechanical Recycling	Collected plastics are sorted, cleaned, shredded, and reprocessed into secondary raw materials for manufacturing.	Nigeria and South Africa. The most prevalent CE approach found in all the research	Oelofse and Strydom (2010); Chilote and Dhakal (2025)
Plastic Reuse Systems	Reusing plastic goods and packaging several times before discarding them lowers the need for virgin materials	Nepal prevalent in informal markets and low-income neighbourhoods	Dangi *et al.* (2011)
Upcycling and Value-Added Products	Waste plastics are converted into more valuable goods like furniture, crafts, building supplies, and paving blocks	South Africa, Nigeria, and Rwanda generates financial incentives for the recovery of plastic	Godfrey and Oelofse (2017); Mulindwa *et al.* (2023); Chilote and Dhakal (2025)
Waste-to-Energy (WtE)	Plastics that cannot be recycled are transformed into energy by co-processing, pyrolysis, or burning	South Africa and Bolivia. suggested in areas with inadequate recycling markets	Godfrey and Oelofse (2017); Ferronato and Torretta (2019)
Circular Business Models	Businesses build value chains for the collection, recycling, remanufacturing, and resale of products made from recycled plastic	Ghana, Rwanda, and Nigeria. A new approach to CE that encourages green entrepreneurship	Bening *et al.* (2022); Mulindwa *et al.* (2023); Chilote and Dhakal (2025)

Extended Producer Responsibility (EPR)	Take-back and recovery programmes hold producers accountable for post-consumer plastic waste	South Africa and Nigeria increasingly encouraged by national policies	Godfrey and Oelofse (2017); Chilote and Dhakal (2025)
Plastic-to-Construction Materials	Recovered plastics are combined into bricks, pavers, roofing sheets, and road construction materials	South Africa and Rwanda transforms low-value waste into items that may be sold	Godfrey and Oelofse (2017); Mulindwa *et al.* (2023)
Public Awareness and Environmental Education	Reduction, reuse, recycling, and involvement in collection programmes are all promoted by education efforts	Nigeria, Malaysia, Sri Lanka, Nepal, and Kenya. determined to be essential for changing behaviour	Henry *et al.* (2006); Bandara *et al.* (2007); Manaf *et al.* (2009); Dangi *et al.* (2011); Chilote and Dhakal (2025)
Policy and Regulatory Interventions	Material recovery and waste reduction are promoted by landfill restrictions, recycling laws, CE norms, and plastic bans	South Africa, crucial enabler of the CE transition	Godfrey and Oelofse (2017)

Moreover, the importance of community-based collections and the contribution of the informal sector in promoting circularity have been discussed in the review. In most developing nations, waste collections, and material recoveries are undertaken by the informal sector such as informal waste pickers and community cooperatives. Studies carried out in Ghana, Kenya, Bolivia, Vietnam, and South Africa show that these groups are highly involved in the recovery of recyclable plastics and the supply of materials to recycling industries (Ngoc & Schnitzer, 2009; Godfrey & Oelofse, 2017; Ferronato & Torretta, 2019; Gwada *et al.*, 2019; Bening *et al.*, 2022; Kombiok & Naa Jaaga, 2023). This indicates that integrating the informal sector into formal waste management programmes can be an effective strategy for attaining circular economy objectives.

Further studies also highlighted the development of plastic reuse, upcycling, and value-adding manufacturing processes. The reuse process, which is common in Nepal and Malaysia, entails extending the lifespan of plastics by using them multiple times before disposal (Manaf *et al.*, 2009; Dangi *et al.*, 2011). In the same way, upcycling activities in Rwanda, Nigeria, and South Africa involve converting plastic waste into something of greater value including paving blocks, construction materials, furniture, and other items for domestic use (Godfrey & Oelofse, 2017; Mulindwa *et al.*, 2023; Chilote & Dhakal, 2025).

Further, it is evident that there is increasing interest in plastic to construction materials technologies and Waste-to-Energy (WtE) technologies. For instance, studies conducted in Rwanda and South Africa have shown that recovered plastics are increasingly used in bricks, paving stones, roofing materials, and other products in road construction, thus creating alternative markets for recovered plastics (Godfrey & Oelofse, 2017; Mulindwa *et al.*, 2023). Similarly, there have been efforts to use waste-to-energy technologies, such as pyrolysis and co-processing, as means to deal with non-recyclable fractions of plastic waste in Bolivia and South Africa (Godfrey &

Oelofse, 2017; Ferronato & Torretta, 2019). While these technologies present resource recovery opportunities, some studies warn that their implementation may be hampered by high capital cost and technical issues.

In addition to technological approaches, the review highlights the significance of policies, governance, and behavioural changes for successful implementation of the circular economy approach. Public campaigns and education, environmental education, and community involvement initiatives were repeatedly recognised as the key motivators for promoting sustainable waste management practices in Kenya, Nepal, Sri Lanka, Malaysia, and Nigeria (Henry *et al.*, 2006; Bandara *et al.* 2007; Manaf *et al.*, 2009; Dangi *et al.*, 2011; Chilote & Dhakal, 2025). Moreover, the research conducted in South Africa, Nepal, and Nigeria stresses the growing role of policy tools, such as Extended Producer Responsibility (EPR), recycling regulation, plastic bags, and circular economy approach in general (Dangi *et al.*, 2011; Godfrey & Oelofse, 2017; Chilote & Dhakal, 2025).

In summary, the research results show that the developing world is slowly moving away from the use of linear waste management strategies towards a more circular system. Nonetheless, the degree of application differs between countries. Although recycling and informal-sector waste recovery are the common CE activities used in the management of plastic waste, other innovative solutions like upcycling, construction from plastics, circular businesses, and waste-to-energy solutions are gaining popularity. From this synthesis, it is clear that for developing countries to have an entirely circular plastics economy, they will need technological advancements, policies, collaboration among stakeholders, participation of citizens, and more involvement of the informal sector in waste management. This clearly meets the research objectives by showing how different yet interrelated CE strategies are being applied to manage plastic waste in developing countries.

Circular Economy Methods

To achieve the second aim of research that intended to find out the circular economy strategies used in municipal solid waste systems in developing countries, it was found that there was a mixture of strategies including policy strategies, technological strategies, behavioural strategies, and resource efficiency strategies. This was because of the shift from the linear waste management system to the circular waste management system.

Transitioning to a circular economy supports Sustainable Development Goal 12 through promoting sustainable consumption and production. In contrast with the linear "make-use-dispose" system, it focuses on product renewal and restoration to reduce plastic impacts while improving environmental, social, and economic performance (Barra, 2018). The circular economy strategy (Table 6) enhances sustainability along product life stages by promoting efficiency in the use of resources and reducing waste during procurement and production.

Table 6: Sustainable circular economy

Production and Procurement	Design for durability and minimise production waste
Consumption and use	Extend product lifespan Encourage recycling, reuse Increase collections
Collection and processing	Improve recycling systems and material recovery Develop secondary markets for recycled, after-market materials and equipment

It stresses product life extension, recycling participation, and improved collection at the consumption phase. It calls for improved recycling facilities, facility investment, and market development for recyclables at the processing phase in totality offering a closed-loop system for sustainable use of resources. Circular economy transitions from linear to a regenerative system, transforming waste into resources through the 3Rs Reduce, Reuse, and Recycle that improve waste management and public health (O. B. Ezeudu & Ezeudu, 2019; Exposto & Januraga, 2021).

Strategies Involving the Circular Economy

Implementation of eco-friendly approaches in municipal solid waste systems stresses the circular aspect of the plastic lifespan, allowing for a significant change toward sustainable resource usage along with the reduction of waste. This approach is centred on achieving circularity, which requires the examination and integration of several key sub-themes that are integral to the framework. These sub-themes are essential for ensuring that the circular economy model effectively addresses the complexities of plastic waste management while promoting sustainable practices. The analysis of these twenty-three selected articles highlights diverse circular economy strategies. Specifically, the studies focus on Material Flow Analysis (MFA), Extended Producer Responsibility (EPR), and Life Cycle Assessment (LCA).

Material Flow Analysis (MFA)

Several research papers have used MFA indirectly in their investigation of the flows of plastics in the generation, collection, recovery, and disposal processes of waste management systems in respective countries. Research work carried out in South Africa and Nigeria revealed the significance of identifying the flow of plastics for better understanding and managing of leaks and recovering resources (Godfrey & Oelofse, 2017; Chilote & Dhakal, 2025). MFA is an important CE approach as it allows quantifying the material flows for policymakers and revealing possible areas of intervention (Kullmann *et al.*, 2021).

AI-driven Waste Solutions

Although there is no information about explicit AI usage in the older literature, recent studies like Mulindwa *et al.* (2023) and Chilote and Dhakal (2025) that emphasise the increasing possibilities of using digital technology to optimise waste collection, sorting, and surveillance. According to the general literature on the topic, AI can be useful in improving waste categorisation, waste routing, and recycling (Kumar *et al.*, 2024). Therefore, AI can be considered an emerging CE technique that will help manage plastic waste in developing countries.

Extended Producer Responsibility (EPR) Schemes

One of the policy instruments that were identified to have a significant influence on creating a circular system was Extended Producer Responsibility. In studies carried out in South Africa and Nigeria, there was the need for a portion of responsibility for post-consumer plastic waste to be shared between the local governments and the producers and importers (Godfrey & Oelofse, 2017; Chilote & Dhakal, 2025). With EPR systems, producers are encouraged to produce products that can be easily recovered. OECD (2016) has stated the same.

Lifecycle Assessment (LCA)

While there was not much use of LCA explicitly in the literature, a number of authors suggested the assessment of environmental impact of plastic waste from manufacturing through to disposal. Findings from research conducted in South Africa stressed the necessity of the environmental assessment of recycling, landfilling, and waste-to-energy options (Oelofse & Strydom, 2010). LCA is one of the central instruments of CE analysis as it provides for the identification of the most sustainable alternative ways of dealing with wastes and minimises the environmental impact (Finnveden *et al.*, 2009).

Regulations and Policies

Regulations and policies on handling plastic waste differ by nation, however, they generally aim to minimise plastic waste, promote reuse and recycling, and ensure environmentally responsible disposal environmentally responsible disposal methods as shown in Table 7. Various national policies and laws regarding plastic waste management in developing and rapidly developing countries. The developing nations such as Nigeria, Ghana, Kenya, Rwanda, Ecuador, Nepal, Bolivia, Vietnam, and Sri Lanka have developed various strategies to combat plastic pollution. Nigeria's National Policy on Plastic Waste Management (2021) is founded on the Basel Convention, while Ghana's National Plastic Management Policy (2020) adopts sustainability through the use of plastic in the proper manner and disposal. Kenya has Extended Producer Responsibility Regulations (2020), Rwanda bans single-use plastics by Law No. 17/2019, and Ecuador's 2013–2014 policies guide the recycling of plastic. Nepal's various acts give waste management at local and national levels, Bolivia promotes PET bottle recycling, Vietnam bans single-use plastic cutlery, and Sri Lanka's National Action Plan (2021–2030) is on lifecycle management by the 3R principles.

Malaysia and South Africa are classified as upper-middle-income developing countries while still considered developing, have more advanced economies and infrastructure compared to the others. South Africa has a well-developed financial sector and advanced infrastructure in many of its cities. Malaysia has a very strong industrial base and is rapidly developing its high-tech industries.

Table 7: Policies and regulations

Status	Nations	References	Policy and Regulation
Developing	Nigeria	National Policy on Plastics Waste Management (2021)	Transposition of the Basel Convention of plastic waste Amendment 2021
	Ghana	Timi *et al.* (2024)	The National Plastic Management Policy, enacted in March 2020, endeavours to comprehensively regulate the use and disposal of plastics. Its primary objectives include mitigating current environmental challenges posed by plastics and fostering sustainable development practices
	Kenya	Republic of Kenya Ministry of Environment and Forestry (2020)	Extended Producer Responsibility Regulations (2020)
	Rwanda	Olayide *et al.* (2023)	Law No. 17/2019 relating to the prohibition of manufacturing, importation, use and sale of plastic carry Bags and Single-use Plastic Items
	Ecuador	Lazo *et al.* (2024)	Policies for plastics management in Ecuador (MA No. 2014-019) in 2013 and 2014
	Nepal	Lanka (2022)	Environment Protection Act 2019 and its Regulations 2020. Solid Waste Management Act 2011. Solid Waste Management Rules 2013 Local Government Operation Act 2015
	Bolivia	Carney Almroth *et al.* (2024)	Supreme Decree Nº 2887/2016 To Promote the Recycling of Food Grade PET Bottles Post-Consumer
	Vietnam	Geyer *et al.* (2015)	Restrict the provision of plastic cutlery with food deliveries (voluntary agreement)
	Sri Lanka	Luisa Schulte and Per-Olof (2024)	National Action Plan on Plastic Waste Management 2021–2030: This plan aims to manage plastic waste across its lifecycle, from importation to disposal, emphasising the 3R principles. It includes goals such as phasing out single-use plastics, reducing plastic packaging, and enhancing recycling infrastructure
Rapidly developing	Malaysia	Law of Malaysia (2017)	Laws of Malaysia Act 672 Solid Waste and Public Cleansing Management Act 2007 An Act to provide for and regulate the management of controlled solid waste and public cleansing for the purpose of maintaining proper sanitation and for matters incidental thereto
	South Africa	Witbooi (2003)	South Africa's national waste management policy underpinned by the National Waste Management Strategy (NWMS)

Source: Policies and regulations implemented by Nations in the process of change

Malaysia has Act 672 (2007), the Solid Waste and Public Cleansing Management Act 2007, in place to control solid waste and sanitation, South Africa's National Waste Management Strategy (NWMS) provides an integrated strategy for sustainable waste management. These combined policies are indicative of the new international trend of restraining plastic pollution, improving recycling mechanisms, and initiating sustainable development through legislation and regulatory instruments.

The role of the regulatory framework was always cited as an enabler in the process of implementing the CE. Research conducted in South Africa, showed that regulations on plastics, recycling goals, bans on landfills, and national CE strategies greatly impact the efficiency of waste recovery (Godfrey & Oelofse, 2017). This evidence confirms the statement of Kirchherr *et al.* (2017), who listed policy support as one of the key drivers of CE transitions worldwide.

Policies Actions to Manage Plastic Waste

Apart from the regulatory measures, the reviewed researchers have identified policy measures like collection system improvements, recycling encouragement, public private partnerships, and formalisation of informal sectors in the waste management. The case of Kenya, South Africa, and Malaysia shows that policy measures backed by the government can help to increase efficiency in the collection and recovery of plastics (Henry *et al*., 2006; Manaf *et al*., 2009; Godfrey & Oelofse, 2017).

Public Sensitisation, Participation, and Awareness

Public awareness was another common strategy reported in many studies reviewed. Research conducted in Kenya, Nepal, Sri Lanka, Malaysia, and Nigeria revealed that education of the public on waste segregation and recycling practices promotes waste management practices (Henry *et al*., 2006; Manaf *et al*., 2009; Dangi *et al*., 2011; Chilote & Dhakal, 2025).. The above observation is in line with what is stated by Geissdoerfer *et al*. (2017). They state that behavioural change is critical to achieve circular economy goals because citizens are key stakeholders in the resource recovery system.

Community Information Campaign (CIC)

The involvement of the communities through awareness campaigns was considered an effective means of ensuring participation of the community in the process of plastic waste management. Studies from Ghana, Rwanda, and Kenya indicated that involving communities ensures the participation of households in waste segregation and waste collection activities (Gwada *et al.*, 2019; Bening *et al.*, 2022; Mulindwa *et al.*, 2023).

Socially Transformative Behaviour Change (STBC)

From the reviewed literature, one can note that the efficient implementation of the circular economy concept is not limited to technical means and implies changes in social behaviour and consumption practices. Studies in Sri Lanka, Nepal, and South Africa drew attention to the importance of developing environmental awareness and decreasing the use of disposable plastic materials (Bandara *et al*., 2007; Dangi *et al*., 2011; Godfrey & Oelofse, 2017). It corresponds to the standpoint of Hobson and Lynch (2016), who claims that the circular economy depends on behavioural changes of consumers and businesses.

Advances in Technology

Innovation technology became one of the main catalysts for the promotion of the circular economy. Research works done in Nigeria,

Rwanda, and South Africa indicated that there were increasing investments in technological innovations such as recycling, material recovery, and digital waste management (Godfrey & Oelofse, 2017; Mulindwa *et al.*, 2023; Chilote & Dhakal, 2025). Technology development enhances recovery efficiency, minimises expenses on operations and adds economic value to recovered plastic materials.

Unconventional Recycling Technologies (URT)

There were other studies examining other alternatives besides conventional mechanical recycling for recycling. There were investigations carried out in Bolivia and South Africa on technologies like pyrolysis, co-processing, and waste-to-energy systems for handling low-quality and contaminated plastic (Godfrey & Oelofse, 2017; Ferronato & Torretta, 2019). Such recycling technologies help in ensuring circularity through recovery of value from materials that could otherwise end up in open dumpsites and burning.

Sustainable Packaging Solution (SPS)

The common theme in the reviewed articles has been on decreasing the formation of plastics through eco-packaging design. Studies conducted in South Africa and Nigeria stressed the significance of product redesigning for minimising materials and recycling purposes (Godfrey & Oelofse, 2017; Chilote & Dhakal, 2025). It is in line with the circular economy model advocated by the Ellen MacArthur Foundation (2015), where waste is eliminated from production through efficient packaging materials.

Innovations in Source Separation and Refuse Collection (ISSRC)

The development of source separation and collection methods has been reported in Kenya, Malaysia, Nepal, and Sri Lanka. Some of the innovations are household-level sorting methods, collection centers, cooperatives, and logistics for better source separation (Henry *et al.*, 2006; Bandara *et al.*, 2007; Manaf *et al.*, 2009; Dangi *et al.*, 2011). Source separation is critical for the functioning of a circular economy as it enhances the quality of materials for recycling and recovery.

Further Discussion

From the analysis, it is clear that efforts toward applying circular economy strategies for managing plastic waste in developing countries have made some progress, although the process is far from consistent and entirely situational. Amongst the thirteen articles reviewed, mechanical recycling and informal sector waste collection were the most prevalent methods used for waste disposal, although they were inhibited by poor institutional arrangements, lack of funding, weak infrastructure, and poor community involvement. This trend reinforces the overall assertion that circular economy changes are not technologically led but rather occur through the interactions of policy, market, governance, and society (Kirchherr *et al.*, 2017).

One of the key findings from the review is policy framework fragmentation. In some of the countries studied, there is an emphasis on the collection and disposal aspects of plastic waste policy, with little regard for reuse, recycling, and other upstream processes like extended producer responsibility (Anyakora, 2019; Kehinde *et al.*, 2020; Uche, 2023). This implies that many of the developing countries' policy frameworks are still mainly linear in nature, despite the rhetoric of sustainability. In those areas where regulations, bans and producer responsibility are more stringent, there have been higher chances of successful waste recovery and circularity (Godfrey & Oelofse, 2017; Kirchherr *et al.*, 2017). This is why it is crucial to have policy coherence in order to achieve sustainable waste management models

through a circular economy.

This review also proves that economic and financial issues continue being one of the main challenges preventing the circular economy from development. Investment is needed in recycling facilities, sorting equipment, reverse logistics networks, and other innovative solutions; however, many businesses and cities in the developing world often have no access to the necessary financing (Duru *et al.*, 2019; Behuria, 2021). Moreover, poor market demand for recycled products hampers the viability of the recovery systems and makes private entities uninterested in such projects. It means that circularity cannot be realised without creating an appropriate economic environment by providing various financial support mechanisms. Thus, economic viability becomes one of the key prerequisites.

Further challenges arise from technological and infrastructural constraints. The majority of reviewed studies identify a lack of recycling facilities, sorting techniques, and reverse logistics as major constraints that make it impossible to keep plastic material within closed loops (Aderoju *et al.*, 2019; Dilkes-Hoffman *et al.*, 2019; Iheukwumere *et al.*, 2019). While even in the case of the existence of such systems, product design, and waste contamination may lead to low quality of materials that could be recycled again. It indicates that there is a need to combine technological innovation with infrastructural development and redesigning of products. Practically it means that in the case of implementing circular economy approaches one should think not only about end-of-pipe recycling techniques but also source separation and recyclable packaging design.

Organisational readiness is another issue highlighted by the literature. The literature mentions several cases in which organisations lack the strategic will, technological expertise, and human resources necessary to adopt circular business models (Kehinde *et al.*, 2020; da Silva *et al.*, 2022). Circular economy requires changes in the production process, procurement process, and supply chain collaboration, which is risky for organisations used to the traditional business model. In a context where the return on investment in circular business models is not certain, this risk aversion might delay the adoption of such models. Hence, capacity building and organisational learning become essential in adopting CE models.

A lack of knowledge and awareness also emerges as a recurrent obstacle. As seen from the studied literature, there is insufficient public awareness about circular economy principles, and environmental education and training need improvements (Oyebode, 2018; Gidigbi *et al.*, 2020; Uche, 2023). This is important because public involvement is needed for proper waste segregation and efficient collection and recovery of materials. Lack of awareness will prevent households from segregating waste properly, while local communities can fail to promote recycling activities.

Social and cultural issues play a role in CE too. Some research indicates that consumption behaviour still demonstrates linear economics by the use of disposable items and lack of engagement in recycling practices (Dumbili & Henderson, 2020; Onyekachi & Chukwuemeka, 2022). The difficulty in maintaining source separation and recycling is associated with such behavioural patterns. For this reason, CE demands both technological and social changes. Public awareness programmes, motivational efforts to engage households, and culturally relevant messaging can contribute to changing attitudes towards recycling and reuse.

Another vital aspect of the paper under discussion is its focus on the informal sector. In many developing countries, waste pickers and informal recyclers significantly contribute to the process of material extraction, although

they are usually left out of the policy framework (Anyakora, 2019; Duru *et al.*, 2019; Gwada *et al.*, 2019). Leaving these groups outside of the policy framework results in inefficiency of waste management schemes and lack of inclusiveness. Incorporation of informal workers into the formal CE structure can increase collection efficiency, decrease poverty levels, and develop recycling chains in the local area. Thus, the circular economy in developing countries must be viewed as both an environmental and a livelihood strategy.

In summary, the study reveals that the success of circular economy adoption in developing countries is contingent on a variety of factors such as policy reforms, financing, technology, public participation, and coordination. It is unlikely for individual actions to succeed. Thus, there is a need for a holistic strategy that connects regulation, infrastructure, market, and behaviour changes in an environment that is suitable for the specific country. This point becomes more relevant due to the fact that different developing countries have varying levels of income, institutional capacity, and infrastructure in place for waste management.

Conclusions

This systematic literature review has shown that the transition towards a circular economy for circular resource management in developing countries is necessary and possible only through an integrated approach. From the evidence gathered from the reviewed studies, it can be observed that circular economy principles do not just include recycling but also the combination of closed loop systems, regulations, public knowledge, and innovations. This literature review thus concludes that plastic waste management in developing countries should move from linear to regenerative and sustainable methods.

Also, the review reveals that the critical obstacles to adopting the circular economy concept are highly interrelated. Institutional weaknesses, lack of finances, inadequate infrastructures, limited technical capacities, poor information systems, and socio-cultural barriers are mutually reinforcing. Fragmented approaches will therefore not be enough in overcoming these barriers to implementing the circular economy. Where waste management systems have been operating in developing countries where waste recycling is common practice, circular economy policies can succeed when they are tailored to local conditions and accompanied by supportive frameworks and collaboration among all actors.

The review, however, highlights some of the potential ways through which circularity can be achieved in waste management. Such include mechanical recycling, segregation at source, reuse and upcycling, community-based waste collection, extended producer responsibility, and novel approaches such as waste-to-energy and digital waste. However, there is indication from the study that these measures will yield long-term impacts when implemented within an enabling framework of governance and investments in the technology.

The novelty of this review lies in its cross-regional synthesis of circular economy practices for plastic waste management, marrying policy, behaviour, and technology through one analytical lens. Unlike other studies that examine individual interventions or a single region, this study reveals common challenges, contextual variations, and transferable strategies that can be used to inform evidence-based policymaking and innovation in low resource settings.

To underpin circular transitions, a systems thinking policy response backed by effective governance, inclusive stakeholder engagement, private sector incentives, and local context-matched technology innovation

is proposed. The government agendas must involve legislation harmonisation, investment in recycling infrastructure, and fiscal incentives for sustainable production and consumption. More research is required on the long-term economic viability, scalability, and social inclusion of CE interventions in developing countries.

In summary, the review adds to knowledge in this field through the identification of similarities among developing nations with regards to the ambition to manage plastic waste. This can be interpreted that there is a need to ensure future work and policies integrate approaches that will incorporate aspects of regulations, finance, innovation, and social engagement. It is crucial to ensure that the contributions of informal players are formalised within the process.

Acknowledgements

The authors would like to express their gratitude to the anonymous reviewers for their insightful comments and constructive feedback, which greatly improved the quality of this manuscript. We also thank the editorial and administrative staff for their valuable support and assistance throughout the peer-review and publication process.

Author Contributions Statement

All authors contributed significantly to the study conception and design, critiqued the manuscript, and approved the final manuscript for publication. They also share responsibility for the integrity of the work as a whole, so that any matters of concern regarding the accuracy or validity can be properly investigated and resolved.

Conflict of Interest Statement

All authors declare that they have no conflicts of interest.

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