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Communicators' Perspective Vis-A-Vis Simulation Modelling of The Circular Economy for Sustainable Waste Management

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Abstract- ***This paper examined professional communicators in Imo state to determine their perspectives on the use of simulation modelling in communicating circular economy (CE) concepts, principles and practices for sustainable waste management. The specific objectives include but not limited to; examine knowledge level of communicators' on CE simulation models, ascertain communicators' perception on integrating simulation models for disseminating information on CE. The study was anchored on diffusion of innovation theory. The mixed research design comprising the survey and the in-depth interview were adopted to collect quantitative and qualitative data from participating stakeholders. Population of the study comprised communicators in Imo state which proportion is not known.Therefore sample size of 384 was derived using Cochran's sample size formula for unknown population. Sampling techniques include, purposive, convenience and snowball. Structured questionnaire and interview guide were employed as instruments for data collection.. The quantitative data were analysed using tables, frequency counts and percentage while the qualitative data were thematically analysed. Result showed moderate level of knowledge on circular economy principles and practices, little familiarity with simulation modelling, with positive perception about the integration of simulation models in communicating circular economy. However challenges perceived in adopting the innovation include but not limited to lack of skills and knowledge among Communicaton professionals and limited access to digital tools. It was recommendeded that media organisations should endeavour to employ relevant personnel and provide required digital devices to facilitate the adaptation of the initiative.***

Keywords: Communicators, Circular Economy, Resource Management, Simulation Modeling, Waste Reduction.

I. INTRODUCTION

Ineffective resource management significantly contributes to the persistent depletion of the ecosystem, escalating waste generation, increasing health risks, and continuous environmental degradation. However, Nigeria is faced with the challenge to engage in an effective nationwide campaign on circular economy as a result of varying disciplines among the stakeholders (Rajput et al, 2020). Circular economy is an economic system that centres around the regeneration of the ecosystem. it emphasizes sustainable management of materials such as plastics, textiles, electronics and food materials, energy among others. While linear economy supports heavy waste generation (Barbhuiya, et al.2024), circular economy promotes waste reduction by creating a closed-loop system.

The system as explained in Pasqualotto, et al.(2023) promotes circular practices through recyclable inputs, resource or material recovering from by-products or waste and extension of product life cycle by reusing, repairing, upgrading and reselling among others. This helps to connect product among different users encouraging access or ownership in order to increase efficiency and exploit the synergies in resources management (Gusmerotti *et al*. 2019). Every economic model thrives on collaboration among stakeholders, including businesses, media, governments, and consumers and so does circular economy.

Recognising the imperative of effective communication Esposito *et al*. (2024) Posited that the simulation models can be relied upon to inspire stakeholders engagement for circularity practices towards sustainable waste management. Communicators including experts in media studies, professional journalists, language specialists, advertising practitioners, and public relations professionals can use various media outlets, content types/styles, frames, etc to impart knowledge,

motivate action, and influence beliefs, habits, values, and other intrinsic attributes, as well as organisational performance and associated costs (Frisk & Larson, 2011; Martin et al., 2017, as cited in Parajuly et al., 2020). However, much remains unknown about how these communicators can employ simulation models when disseminating messages on the circular economy (CE) model as a sustainable resource management strategy, particularly within critical sectors of the economy in Nigeria and Imo state in particular.

The areas of these sectors as enumerated in Rajput *et al* (2020) include; agriculture, coal, oil & gas, food, drinks & tobacco, textiles, clothing & leather, wood & paper printing & publishing, manufacture of fuels. Others mentioned were Pharmaceuticals, chemicals, rubber & plastics, transport equipment, hotels & catering, public administration. electronics, education, mechanical engineering, Also included were communications motor vehicles, computing services, electricity, manufacturing, health, social work and forestry. There is a general underutilisation of algorithmic resource-flow models by communication professionals when engaging their audiences on various issues, including waste management. Consequently, it has become imperative to examine communicators particularly those in Imo state in order to determine their perspectives on integrating simulation modeling in communicating circular economy (CE) concepts for improved resource management across the production-to-consumption cycle (Pinha & Sagawa, 2020).

Empirical studies on communicators'-focused perspective on simulation modeling and circular economy is scarce. This study addresses this gap by examining communicators' knowledge, perceptions among other variables toward the use of simulation models for effective dissemination of circular economy concepts, principles, and practices, thereby providing insights to enhance communication strategies for sustainable waste management. The outcome of this study will provide a basis for popularizing circular economy initiatives, clarifying misconceptions, and promoting actionable steps that can demystify the concept for broader audiences (World Bank, 2020). By correcting misunderstandings and presenting real-world illustrations through innovative digital technologies, communicators can play a significant role in advancing the transition toward circularity (Stransact, n.d.). The findings of this study will enhance stakeholder participation in circularity-driven initiatives. Additionally, the study will contribute to the promotion of responsible production and consumption practices geared toward effective waste management.

II. STATEMENT OF THE PROBLEM

Persistent depletion of the ecosystem and widespread waste mismanagement continue to pose serious health risks and contributing to the overall environmental degradation. Although Nigeria, including Imo State, seeks to promote a nationwide circular economy campaign, achieving inclusive participation remains challenging due to the country's diverse population and the varying levels of awareness and expertise among stakeholders (Rajput et al., 2020).

In the communication field, there is limited scholarly and practical attention to the use of virtual replicas such as discrete-event simulations, agent-based models, Virtual Reality (VR), 3D Simulation and other digital modelling approaches for illustrating real-life scenarios and deepening understanding of behaviours and practices within complex systems like resource management. Furthermore, strategies for effectively communicating circular economy concepts to stimulate active stakeholder participation remain underdeveloped, creating a critical gap in efforts toward sustainable waste practices.

Therefore, this study investigates communicators' perspectives on the adaptation of simulation models as tools for disseminating circular economy information, with the aim of enhancing stakeholder engagement in sustainable waste management in Imo State.

III. THE OBJECTIVES OF THE STUDY

The main objective of this study is to examine the Communicators in relation to the adaptation of simulation models in communicating circular economy to facilitate stakeholders engagement for effective waste management. Whereas the specific objectives include to;

1. Examine communicators' level of knowledge on simulation modelling and circular economy in

relation to sustainable waste management in Imo state.
2. assess the communicators' perception about the integration of simulation models in dissemination of circular economy information in Imo state.
3. determine how existing communication patterns and simulation models can be integrated to enhance stakeholders engagement in circular economy for effective waste management in Imo state.
4. identify perceived challenges in the integration of simulation models in communicating circular economy system for effective waste management in Imo state.

IV. LITERATURE

Relevant literature that link simulation modelling to circular economy system is scarce, based on which this study resorted to literature that are most closely related to the study.

Circular Economy, Simulation Modeling and Effective Communication.

Circular economy practices are gaining momentum in Nigeria as part of the broader sustainable development goals (SDGs). The system is aimed at waste reduction, resource recovery, and sustainable production crucial for enhancing economic resilience and environmental sustainability (Rajput *et al*. 2020). Effective communication which has to do with disseminating meaningful information is vital for promoting awareness and engagement in circular economy practices. Buttressing this idea, Thompson *et al*., (2020) pointed out that Communicators can adopt simulation models to bridge the knowledge gap among stakeholders by facilitating better understanding of the circular economy principles. As a process of designing a computer model of either a real life or an imaginary system that is theoretically complex and complicated, Simulation modelling can play a critical role by enhancing understanding and accelerating action (Huakun Liu, 2022).

Simulation analysis of complex systems and providing insights into how potential outcomes of different waste management strategies can help identify effective pathways for implementing circular economy initiatives (Pinha and Sagawa, 2020). In recognition of the role of effective communication in accelerating CE adoption, a number of awareness creation initiatives for circular economy-related measures have been launched in Nigeria (Rajput, 2020). Explaining the social dynamics of modelling, Loblay et al. (2023:20-21) suggested the use participatory modelling to foster "effective communication between modellers and stakeholders as well as ensure understanding of complex issues".

Resource and Waste Management, and Circular Economy

Effective waste management aims to minimize environmental threats, waste production, and engage in environmental sustenance through environmental friendly practices including recycle, reuse, refurbish etc (European Parliament, 2023). Relatedly, circular economy goals include sustainable products creation or adequate utilization of materials or resources to reduce waste, and increase efficiency in order to address environmental, economic, and social challenges (Bandh, *et al*., ,2024). The emphasis on circular economy involves protecting the environment from hazardous waste and pollution by keeping materials in use instead of untimely ending their live span by disposing them prematurely (Slunge, *et al*., 2021). CE represents a regenerative economic framework designed to progressively separate economic growth from resource exploitation. The circular economy (CE) aims to establish a more efficient and sustainable system that minimizes waste through cradle-to-cradle principles. It can be viewed as a sustainable development strategy for tackling pressing issues such as environmental degradation and resource scarcity. Achieving the shift from a linear to a circular economy demands (Tola et al. 2023).

Empirical Studies

Esposito et el. (2024) explored the use of social media as a dialogic tool to activate circular economy engagement in order to involve all supply-chain actors on the route to a circular transition with reference to Twitter. A coding framework based on a 4-R paradigm (reduce, reuse, recycle and recover), was developed for the analysis. The elements covered include all tweets published by a sample of European agri-food companies. Findings showed showed a higher level of engagement by Agri-food companies through social media, mainly focused on “recycling” and “general circular economy” issues. generally, there was emergence of the need for awareness among social network users to enable them to be part of the circular economy transition. The finding indicated that the highest percentage of posts published by the companies' Twitter accounts was

informative rather than interactive. Moreover, from the period under study, the circular economy grew up as a major topic of debate that was instrumental for the rethinking process of the agri-food business community.

Rajput *et al*. (2020) in their study noted that there is lack of comprehensive assessments of consumer awareness on circular economy-based aspects in Nigeria. Besides, the authors assert that the "acute lack of reliable and robust studies leaning on statistically representative sample sizes on awareness of circular economy among citizens and consumers in Nigeria"(40). Many Nigerian industries have low awareness on circular economy related concepts. However, the study shows that the prevalent pattern is that informal waste-picking and recycling industry consisting of scavengers/waste pickers, intermediaries, artisans, and small-scale enterprises engage in the recovering, remanufacturing and recycling which makes assessment of general awareness and depth of awareness difficult. The authors noted that variations in resource flow and relationship with consumer will require differences in CE modelling.

Relatedly, Parajuly*et al* (2024) explored the potential of integrating lessons from behavioral sciences to facilitate circular economy in e-waste management. It employed a review of prominent behavioral theories and their application in the context of sustainable consumption and pro-environmental behaviors. The study identified opportunities for behavioral interventions in improving e-waste management and in achieving a more circular economy

Furthermore, Ezeudu and Ezeudu (2019) observed that socio-economic disadvantages, insufficient expert knowledge and lack of information hinder implementation of circular economy in low and middle-income countries. The study aimed to examine the challenges and opportunities of implementing the circularity principle at the industrial sector level of a typical developing economy such as Nigeria. Four different industries were selected for this case study—telecommunications, water packaging, pulp and paper and the food industry. These industries represent the major waste streams in an urban solid waste mix (waste electrical and electronic equipment (WEEE), plastic, paper and organic). This study discovered several factors and existing pre-conditions in place that could either foster or militate against the smooth and successful application of a CE model as a simple modification of the generic practices.

Similarly, Loblay et al (2023) did a critical literature review that synthesised the underlying knowledge, theoretical and methodological positions about the role and value of simulation modeling in the literature across various of fields such as health, social science and environmental management that engage with participatory modelling approaches. The study identified four cross-cutting narrative conceptualisations of the value of modelling across different research traditions including the following;

- Models simulate and help solve complex problems.
- Models serve as tools for community engagement.
- They serve as tools for consensus building.
- Simulation Models serve as dynamic mechanism that generate social effects.

The study observed that investigating how these values relate to one another provides for how participatory simulation modelling approaches are designed, evaluated and communicated to diverse audiences. The study recommended for a more in-depth approach to appreciate the importance of simulation modelling in driving multiple social effects.

In recognition of the unsustainable production and consumption practices within the construction industry Alazaiza et al. (2024) explored circular economy management approach for sustainable construction and demolish waste management. This study reviewed the circular economy management framework as a pathway toward sustainable handling of construction and demolition waste. The approach focuses on minimizing waste generation, encouraging the reuse and recycling of materials, and advocating for the use of sustainable resources alongside efficient waste management practices across all project phases. Key components of this approach include the integration of sustainable design and construction methods, enhancement of material recovery and recycling systems, and establishment of robust waste management structures. Achieving these objectives requires the active collaboration of all stakeholders in the construction and demolition chain, such as architects, contractors, developers, and waste management firms.

It was concluded that the circular economy management approach presents a viable strategy for advancing sustainable construction and effective waste management. By fostering responsible production and consumption patterns, it can reduce the industry's environmental footprint while delivering economic value. Nonetheless, successful implementation depends on strong policy enforcement and the commitment of all stakeholders to embrace sustainable practices.

Antikainen, et al. (2018) did a study on digitalisation as an enabler of circular economy motivated by the many challenges and gaps hindering implementation of digital technology-aided circular business models. An exploratory and qualitative study was carried out to clarify the perspectives on the challenges in order to address the gap in understanding those challenges and finding solutions to them. These include the challenges related to adopting novel business models, data collection and management, collaboration and competence requirements. The virtualization of products and processes, partnership with stakeholders and use of digitalization were found to be pivotal in adopting CE-based business models.

Okere et al.(2019) examined the potential of Waste-to-Energy (WtE) as an instrument for promoting circular economy practices. Adopting a qualitative approach, the research employed a synchronic evaluation of existing literature to assess the viability of WtE as a circular economic tool for mitigating environmental degradation. The integration of findings with detailed explanations of circular economy principles and climate mitigation strategies reveals that WtE serves as a significant indicator of sustainable development. Moreover, the bottom ash generated from combustion processes can be utilized as feedstock in the construction industry, thereby closing a potential pollution loop. Consequently, WtE is affirmed as a viable mechanism that supports the circular economy while contributing positively to climate mitigation efforts. The study therefore recommends that WtE be considered a critical component of climate change policies in developing countries, particularly in Nigeria.

Tola et al.(2023) Carried out Investigation on perspectives for the development of a circular economy model to promote ship recycling practices in the European Context. Given the European Union's (EU) legislative framework, exemplified by the Ship Recycling Regulation coupled with the observation that previous studies have primarily explored end-of-life (EoL) management and ship demolition processes, this study sought to expand existing knowledge by connecting ship recycling and life cycle management practices with circular economy principles. It also aimed to propose a conceptual framework that facilitates the efficient reuse of components and raw materials. To achieve this, scientific publications were collected, analyzed, and grouped into strategic clusters to identify current challenges, future opportunities, and possible directions for developing a circular economy model in the shipping sector. The findings offer important insights into environmental advantages, emerging business prospects, and the creation of green markets within the EU's ship recycling landscape.

V. THEORETICAL FRAMEWORK

Diffusion of innovation theory underpins this study. The theory was popularized by Everett Rogers in 1962. According to Onwubere (2014) diffusion of innovation has to do with the process involved in the Communication and adoption of new idea, practice, object or technology using appropriate channel of communication to the members of a social system within a given time. Rogers innovation-decision process includes knowledge, persuasion, decision, implementation and confirmation ((Haruna*et al*, 2023). The fact that Communicators engage statutorily in disseminating news or messages on developmental initiatives through mainstream media and on the internet supports the aptness of the diffusion of innovation theory to this study. Circular economy is an innovative approach for waste management which needs to be communicated effectively for public understanding and adoption. Hence, the re

VI. METHOD

The study employed the mixed research design consisting of the survey and the in-depth interview methods to investigate the integration of existing communication strategies and simulation models for sustainable waste management in Imo state. The population of the study consisted of stakeholders such as communicators in academics, media organisations and independent consultant whose precise population in Imo state is not known. Therefore the Cochran's formula for sample size was

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adopted to determine the representative sample size of 384 for the survey study. Whereas the in-depth interview population was guided by the principle of saturation. The multistage cluster sampling technique was employed as follows;

Stage One:
Imo state is made up of three senatorial district including Imo East(Owerri zone), Imo north (Okigwe zone) and Imo west (Orlu zone). The three of them were given equal represention.

Stage Two
There 27 local Government Areas that make up the entire Imo state, three local government areas were selected purposively from each senatorial zone. They include, Owerri North, Ngo Okpula, Ezinihitte Mbaise, Onuimo, Isiala Mbano, Obowo, Orlu, Ohaji/Egbema and Ngwerre

Stage Three
Participants were selected using convenience and snowball sampling techniques for the survey. For the in-depth interview purposive sampling method was adopted.

Quantitative and qualitative data were collected using structured questionnaire and interview guide respectively. The administration of the instrument were done by the researchers with the help of two research assistants. Distribution of questionnaire was based on 60% response rate being 640 copies of questionnaire in order to ensure the number of respondents aligns with the original sample size for reliability of the result. Data collection involved both face to face and online approach. Descriptive statistics was employed to analyse the quantitative data involving frequency count and percentage while thematic analysis was used for the qualitative data.

VII. RESULT

Analysis of data was based on valid data from 384 respondents gotten after data cleaning.

Table 1
Area of specialization

Option.	Frequency	Percentage
Print	57	15%
Broadcast	91	47%
Social media content creating	22	23%
Public relations	31	8%
Adverting	5	1%
Films		
Total	384	100%

Source: Online and field survey 2025
Analysis of data in table 1 reveals that majority (47%) of the respondents are specialists in broadcast media operations,

Table 2
Familiarity with circular economy principles and practices

Option.	frequency	percentage
Very familiar	31	8%
Moderately familiar	160	41%
Somewhat familiar	137	36%
Slightly familiar	56	15%
Total. ..	384	100%

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Source; Online and field survey 2025

Data analysis in table 2 indicates that majority (41%) are moderately familiar with circular economy principles and practices

Table 3
Level of familiarity with Simulation modelling of circular economy

Option		frequency	percentage
Very familiar	52	14%	
Moderately familiar	133	35%	
Somewhat familiar	136	35%	
Slightly familiar	63	16%	
Total	384	100%	

Source; Online and field survey, 2025.

Presentation of data in table 3 shows moderate and little familiarity with simulation modeling of circular economy among the majority (70%) of the respondents

Table 4
Reporting of CE practices- recycle, reuse etc on the media

Option.	frequency	percentage
True.	186	48%.
Partially	107.	28%
False	52	14%
Not sure	39	10%
Total	384	100

Source; Online and field survey, 2025

Data as analyzed in table4 indicates that the majority (48%) of the respondents have witnessed the reportage of circular economy practices on the media.

Table 5
Dissemination of activities of scavenger on the media

Option	frequency	percentage
True.	178	46%
Partially	134	35%
False.	30	8%
Not sure	42	1%
Total	384	100%

Source; online and field survey, 2025

Result on table 5 shows that 46% being the majority of the respondents come across and disseminate information or messages on the activities of scavengers

Table 6
Simulation models as effective means of visualizing circular economy processes on the media

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Option.	frequency	percentage
Strongly agree	91	24%
Agree	237	62%
Disagree.	38	10%
Strongly disagree	18	4%
Total.	384	100%

Source; Online and field survey, 2025

In table 6, data presentation shows that the majority (62%) of the respondents are of the view that simulation modeling can be an effective way of visualizing circular economy processes or patterns on the media.

Table 7
Simulation models possibility to enhance communication campaigns on waste management

Option	frequency	percentage
Strongly agree	87	23%
Agree	234	61%
Disagree	31	8%
Strongly disagre.	32	8%
Total	384	100

Source; Online and field survey, 2025

Result in table 7reveals that the majority (61%) believe that simulation models can enhance communication campaigns on waste management

Table 8
Simulation Modelling Support of Tech-driven Communication strategy

Option	frequency	percentage
Strongly agree	74.	20.%
Agree	251	65.3%
Disagree.	43	10.4%
Strongly disagree	17	4.4%
Total	384	100%

Source; Online and field survey, 2025

Data presentation in table 8 confirms the majority (65.3%) of the respondent's opinion that simulation modeling supports tech-driven communication strategies

Table 9
Simulation models capable of simplifying sustainability concepts for the public's better understanding

Option	frequency	percentage

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Strongly agree	86	22%
Agree	252	66%
Disagree	19	5%
Strongly disagree	28	7%
Total	384	100%

Source; Online and field survey 2025

Data analysis in table 9 is an evidence that 65.5% representing the majority of the respondents believe that simulation models can simplify sustainability concepts for the public's better understanding.

Table 10

Possibility of attracting stakeholders by Integrating CE simulation models into news and features in the form of info-graphics.

Option.	frequency	percentage
Strongly agree	164	43%
Agree	177	46%
Disagree	36	9%
Strongly disagree	7	2%
Total	384	100%

Source; Online and survey 2025

In table 10, data presentation shows that 46% being the majority of the respondents supports integration of simulation models with news and features contents as infor-graphics to attract participation in circular economy practices by stakeholder

Table 11

Use of CE simulation models as backdrops in television studies to pass information

Option	frequency	percentage
Strongly agree.	157	41%
Agree	202	53%
Disagree	21	5%
Strongly disagree	4	1%
Total.	384	100%

Source; Online and field survey 2025

Findings as presented in table 11 is an indication that the majority (53%) of the respondents support the use of the model as a backdrop in the television studio to pass information

Table 12

Perceived challenges of the adaptation of simulation modeling in communicating waste management

Option	frequency	percentage
Lack of SM skills and knowledge among		

Communicators	63	16%
Limited access to digital tools	69	18%
Amount of time required	23	6%
Lack of institutional support	31	8%
All of the above	195	51%
(Others (please kindly mention)	3	1%
Total	384	100%

Source; online and field survey 2025

Data presentation in table 12 reveals that 51% of the majority affirms that lack of skills-knowledge, Limited access to digital tools and lack of institutional support are serious challenges in adapting simulation modeling in communicating circular economy principles and practices. .

Qualitative Data

Level of knowledge on Simulation Modelling and Circular Economy

Simulation modelling of the circular economy visually demonstrate how resources are used, reused, refurbished and recycled within a production and consumption system. The models are means of concretizing abstract sustainability claims by helping stakeholders see how waste is reduced and resources are reused, repaired or recycled. Through the simulation models, stakeholders will be able to see the observable impacts of circular practices such as reduced waste, increased resource efficiency, and closed-loop systems.

Communicators' Perception of Simulation Modelling of Circular Economy

According to a television broadcaster, simulation models of circular practices can make television news attractive and catchy. Public relations (PR) practitioners in circular-based industries can leverage simulation models as an image management strategy. It can be used to highlight innovative use of resources. Public relations practitioners can use it to project their industry as the leader in sustainable practices thereby strengthening their credibility. The use of simulation models can help to clarify circular concepts in relevant fields. It can be used to deferentiate brands says the advertising agents. Stakeholders can be attracted through the use of simulation modelling both broadcast and print media to participate in the circular economy waste management strategies.

Integration of Simulation Models into Circular Economy Communication Strategies

In television broadcasting, simulation models can be used as pictorial elements in straight news packaging and news features like documentary, interview, discussion, vox pop etc to disseminate information on circular economy. They can be used in newspaper pages as visual illustrations to clarify reports relating to the circular economy. Simulation models can also be used as images in advertisement and advertorials to pass important messages on circularity practices. Public relations practitioners in circular-based Industries can integrate simulation models in their digital demonstrations and reports to explain their sustainability engagement target and achievements.

Perceived Challenges of incorporating simulation models in Communicating Circular economy

In integrating Simulation Models of circular economy system into communication strategies for promoting sustainable waste management , the following were gathered as the perceived challenges Firstly, lack of widespread awareness and understanding of what the circular economy and simulation modelling really mean among both the various stakeholders in Imo state and beyond.Many people still associate waste management with traditional linear methods, making it difficult to shift mindsets toward reuse, recycling, and sustainable consumption. Another challenge is cultural and behavioural resistance. Changing long-established habits around waste disposal requires not only information but also motivation and trust to address scepticism and apathy rooted in socio-economic realities and daily survival priorities.

Thirdly, infrastructural limitations and resource constraints, also pose a major hurdle. This is because even with good communication strategy, if there is insufficient infrastructural support such as recycling facilities or collection systems, the circular economy

messages may not translate into real action. Fourthly, coordinating among diverse stakeholders--government agencies, community leaders, private companies, and informal waste collectors, could pose a major challenge. Effective communication, on circular economy, ought to consider these relationships and address potential conflicts of interest and varying priorities.

Lastly, the issue of access to communication outlets or channels and the digital divides in some parts of Imo State with the tendency to restricts the reach and inclusiveness of circular economy messages, thereby limiting engagement with marginalized.

VIII. DISCUSSION

Communicators' Level of Knowledge on Circular Economy and Simulation Modelling

Result indicates moderate level of knowledge on circular economy practices among the majority (41%) of the respondents, findings revealed that 70% being the majority of the respondents are moderately and somewhat familiar with simulation modelling of circular economy, 48% responded haven witnessed the reportage of circular economy practices on the media. Majority 46% have come across as well as disseminated information on the scavengers' activities. The result is in line with Ezeudu who observed insufficient knowledge and lack of information hinder implementation of circular economy. The study resonates with Rajput *et al*. (2020) that found low awareness among Nigerian industries on circular economy related concepts. Finding are related to the diffusion of innovation theory with its major element as knowledge. Result is consistent with Tola et al.(2023) who sought to expand existing knowledge by connecting ship recycling and life cycle management practices with circular economy principles.

Perception about the integration of simulation models in dissemination of circular economy information

Finding showed that 62% of the respondents believe that simulation models can be used to visualise circular economy processes on the media, result revealed that 61% of the respondents are of the view that simulation modelling can enhance communication campaigns on waste management. Moreover, 65% representating the majority perceive simulation modelling as promoting technology-based communication strategies, the majority (65.5%) of the respondents believe that simulation models can simplify sustainability concepts including circular economy for the public's improved understanding. The findings corroborates Thompson *et al*., (2020) idea that Communicators can adopt simulation models to bridge the knowledge gap and improve understanding of the circular economy principles. The results aligned with Loblay et al.(2023) who informed that models stimulate and help solve complex problems. The result buttressed Huakun Liu, (2022) that models enhance understanding of complex subjects. In connection with the diffusion of innovation theory simulation models can serve as persuasion tools towards achieving stakeholders participation in circular economy model

How to Integrate Simulation Modelling into the existing communication patterns to Enhance Stakeholders' Engagement for sustainable Waste Management

Results indicated that the majority of the respondents 89% admitted that simulation models can be integrated into news packages and features. Findings revealed that 94% being the majority affirmed that simulation models of the circular economy can be used as backdrops in the television studios, pictorial elements in the print media for campaigns and advertisement. The qualitative data supports the findings. The result is linked to Loblay et al. (2023) submission that simulation models serve as mechanism that generate social effects. It is also in line with Huakun Liu, (2022) submission that simulation modelling can be embedded in media contents to facilitate action. Result aligns with Antikainen et al.(2018) conclusion that virtualization of products and processes, partnership with stakeholders and use of digitalization were found to be pivotal in adopting CE-based business models.

Perceived Challenges in Integrating Simulation Models in Communicating Circular Economy System for sustainable Waste Management

Result revealed lack of skills and knowledge, limited access to digital tools, lack of institutional support and time required for designing the model. The qualitative data buttressed the result. The result is related to Ezeudu and Ezeudu (2019) observation that certain factors can militate against the smooth and successful application of CE model towards improving the general practices. Finding is in line with Alazaiza et al. (2024) finding that collaboration with stakeholders is crucial to every strategy aimed at

facilitating adoption of circular economy principles and practices.

IX. CONCLUSION AND RECOMMENDATIONS

This study examined communication professionals in Imo State, Nigeria to ascertain their perspectives on the applicability of simulation modelling for communicating the circular economy . The result of the study revealed moderate level of knowledge on circular economy principles and simulation modelling with the respondents showing positive perception about integrating simulation models as a strategy in communicating circular economy system to foster stakeholders participation in sustainable waste management practices. However, perceived Challenges in adapting simulation models in circular economy communication were identified. In view of this, recommendations were made as follows;

• Communication professionals should endeavour to enhance their knowledge on circular economy principles, simulation modelling and waste management best practices to bridge the observed knowledge gap.

• Media organisations(private and public) should employ relevant personnel and provide digital devices necessary for the implementation of innovative ideas such as the circular economy.

• Stakeholders should pay utmost attention to both mainstream and internet-based media to gain knowledge on circular economy and to translate knowledge gained into action.

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Supplementary Information

Credit authorship Contribution Statement

Ejiogu Felicia Ijeoma: Conceptualisation, Data Curation, Review, Editing, Manuscript drafting, and Designing of instruments.

Ibe Godswill Anayo Conceptualization, Original Drafting, Methodology, , Data curation,

Mmadu Chinedu Bennett: Literature Review, Data Curation, Data Analysis.

Informed Consent Statement

Participation in the research was entirely voluntary, and informed consent was duly obtained from all participants.

Declaration of competing interest

The authors declare that they have no conflict of interests that influenced the work reported in this paper.

Data availability

Data will be made available on request.

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