



Sustainable Supply Chain Resilience And Business Performance: The Role Of Circular Economy Practices In African Manufacturing Smes

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KEYWORDS

*Circular economy;
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African manufacturing;
SMEs; sustainability.*

ABSTRACT

The circular economy can promote the supply chains of manufacturing activities by retaining the material value and identify other productive inputs sources. Whether firms can coordinate recovery activities without adding extra costs or new dependencies is what dictates their contribution to a business's performance, however. This paper explores the same relationships in the context of African SMEs, via a purposeful narrative examination of academic research publications and institutional publications. To explain how resource stewardship can help in adaptation during the disruption, an analysis was made using the natural resource based view and dynamic capabilities theory. African evidence is included and explicitly conceptual connections are drawn between circular practices, sustainable supply chain resilience and business performance. The synthesis finds that possibilities for material substitution, equipment useful life extension, and supplier collaboration are potential options for resilience. Mechanisms can be weak because of uncertainty of quality, financing constraints and focused recovery networks. Other results (recovery time, frequency of deliveries, usage of resources, conditions of work) must therefore be taken into account when considering financial results. The paper suggests resilience partly mediates the linkages between circular practices and business performance, and proposes infrastructure reliability and collaborative capability as influencing constructions of resilience's strength. These propositions are not tested in this paper. A phased implementation approach, and empirical evaluation through a longitudinal research design are created to facilitate practical implementation and subsequent assessment of the approach across a variety of different African manufacturing contexts.....

1. INTRODUCTION

1.1 Background of the Study

Small and medium industries are reliant on timely supply of material, proper operation of machinery, and on stable trading partnerships, etc. Smaller production systems may be less able to absorb losses in production and compensate for the lost revenue by buying substitutes, if they are unavailable. Circular economy practices can provide an answer as materials, components and products can keep their value in successive uses. The main managerial doubt is whether the practices can make continuity and economic benefits better under operating situations conditions experienced by manufacturers in Africa.

Aspirations for circularity include waste prevention, reuse, repair, refurbishment, remanufacturing and recycling. It is important to be precise about the concept of the definition, as shown by Kirchherr et al., (2017). In this paper, circular.



practices are considered to be conscious efforts aimed at keeping material and/or product value and reducing reliance on using virgin resources. Resilient supply chains are sustainable when they can not only predict and prepare for disruption, recover and continually adapt within environmental and social boundaries, but also keep operating. Business performance is all about Profitability, Liquidity, Delivery Results and Customer Retention.

African manufacturing is not a homogenous landscape. National institutions, industrial clusters organization, firm size, production technologies affect the possible circular arrangements. Godfrey (2021) sees circularity as a development opportunity; including resource intensive manufacturing in South Africa. This contextually based view indicates that context should be a primary focus of research, as opposed to assuming a practice has the same effects in different countries and/or industries.

1.2 Problem Statement

Potential overshadowing of environmental efficiency and operation continuity promises of circular production. By decreasing virgin material purchases, a manufacturer can become reliant on one recycling center. A third may be able to return the goods to the supplier but end up with stock holding that takes up much needed working capital. As such, unfortunately, there is no direct correlation between increased circularity and increased resilience or better business performance.

This empirical problem is of equal value. Studies can simultaneously investigate circularity, capabilities and performance, and both relationships have been susceptible to common perceptions and to reverse causality. Yet very profitable companies could just have more resources for recovery systems. This is an open question about performance implications of circular practices, when it is active, and how it can be differentiated from direct cost savings, related to resilience.

1.3 Objectives of the Study

The study aims to create an evidence informed explanation of the relationship between circular economy practices, sustainable supply chain resilience and business performance of African manufacturing SMEs. The specific goals are to explain the three constructs, develop an initial assessment of relevant African evidence and to draw and develop mechanisms and constraints, and formulate propositions for empirical testing. An additional goal is to break down the framework into measurable metrics and implementation priorities.

1.4 Research Questions

The essay contains four answers to the following four questions. What are plausibly circular practices which boost supply chain resilience in African manufacturing SMEs? How might resilience be able to provide better business performance through operational processes? What are the conditions related to the organization and context that strengthen or weaken these relationships? Lastly, which research design would provide more convincing evidence that the proposed indirect relationship was in place and that the financial and managerial benefits from the practice of circular adoptions did not necessarily exist?

2. REVIEW OF LITERATURE

2.1 Circular Economy Practices in Manufacturing SMEs

It is helpful to differentiate slowing the use of resources from closing material cycles. Repair and refurbishment can prolong the life of useful products and recycling techniques can recover materials when products have reached the end of their useful life. Prevention decreases material needs in advance, avoiding waste. Such activities vary in aspects of technical requirements and economic implications. They are not unbeatable 'check list' properties; it will hide if a firm retains valuable components or just sell out low value scrap.

Eliminating eco innovation and green supply chain management's impact on South African manufacturing SMEs' circular economy capability and performance based on survey responses from 240 manufacturing SMEs, Bag et al. (2022) examine eco innovation, green supply chain management, circular economy capability and SME performance. They are directly related to the capacity of organisations and circular production. Presence of similar constructs within one study does not imply that circular practices over and above the disruption observed eases recovery though. But for resilience, one needs to measure and explicitly consider disruptive events.

In this paper, "adoption depth" is defined as the percentage of the relevant operations covered by the practice, the technical reliability of the practice, and cómo "it was integrated into routine decisions". This difference makes it possible to rate the

skill in informal repairs without having to classify everything in resource constraint improvisation as planned circular management.

2.2 Sustainable Supply Chain Resilience

Resilience encompasses preparation, absorption, recovery and adaptation post-disruption/on the basis of experience. This should not be equated with the day-to-day efficiency. Low inventory can help to reduce normal operating costs, however, it restricts the resilience to deal with the absence of deliveries. Local sourcing can do the same with the transport exposure but weaknesses are that they will be supplied by the same electricity failure or flooding.

The analytical question is, is this internal loop of sourcing considered resilient if recovered inputs are usable and the inaccessibility of those inputs will not affect the recovery of the others? Two tandem sources of vulnerability provides less protection than an independent source of vulnerability. It is also important to consider how continuity is achieved as this is also part of the sustainable resilience. The use of hazardous transfer to underprotected workers would maintain production through an avenue that is opposite of the construct utilized here.

2.3 Circular Practices and Business Performance

Circular practices can impact on the functional dimensions of performance directly, as a result of reduced purchases of materials or reduced disposal costs, or via recovered product revenues. They can also have indirect impacts on performance, such as reducing interruptions of the production process and safeguarding customer relationships. Do not pathway together at this point. One could recover from distributed disruption, with an enterprise being able to enhance material efficiency, without a backup arrangement which would cost more, and would only be given for exceptional material incidents.

A survey of 120 managers of 10 manufacturing companies conducted in Greater Accra was reported by Lartey and Amikiya (2025). Their findings show that they are correlated with sustainable performance in the supply chain and that there is a partial mediation in their correlation with the construct of supply chain capability and supply chain flexibility. This allows to explore intermediate operational mechanisms. However, managers are embedded in a small number of companies and the location of the study is not automatically a representative of manufacturing SMEs across Africa. An even more important factor affecting sustainable supply chain performance is that it is still a unique quality in and of itself and has not yet been audited for profitability or disruption recovery.

2.4 Theoretical Foundations and Contextual Conditions

Hart (1995) tied environmental issues to the organization's resources and competitiveness in his natural resource based view. In this context, the theory indicates the possibility of recovering valuable capabilities in the areas of material knowledge, process improvement and relationship. The implementation and learning of it will be the base upon which the supposed advantage will exist. Buying recycling equipment is not proof of the development of an organisational capacity or returns.

Dynamic capabilities theory focuses on the ability of enterprises to integrate and reconfigure resources in reference to the conditions (Teece et al., 1997). In such a context, one could identify flows of materials that are vulnerable, commit resources to material flows that are feasible and develop a process of changing production habits when the supply situations go bad. The two theories merge to account for the potential of environment-enhancing resources being useful during the disruption period, but leave the nature of the size and duration of the performance effects up to investigation.

These capabilities don't necessarily translate to returns in certain contexts. Quality issues, poor advice, lack of government assistance, and negative perceptions on the part of customers are cited as remanufacturing challenges in South Africa by Ohiomah and Sukdeo (2022). Issues are addressed relating to financing mechanisms which could support circular investments in African enterprises by Schroeder (2021). These sources together compel a discussion of technical credential as well as financing considerations, in addition to managerial willing.

2.5 Empirical Evidence and Research Gap

The evidence reviewed here offers relevant foundations but is incomplete with regard to the causation proposed in this paper. African studies focus on the circular capabilities, flexibility, sustainable performances, and remanufacturing barriers. There are differences between their units of analysis and their definition of outcomes. So it would be wrong to aggregate the findings to a 'supposed average' financial impact or to assume that resilience has been already established as mediator.

The analysis in the following section is based on three assumptions. P1: When recovered resources are available as dependable substitutes, more deeply implemented circular practices enhance sustainable supply chain resilience. P2 claims

that there is a mediating effect of resilience on the link between circular practices and business performance. This indirect relationship is exacerbated by P3's collaborative capability and infrastructure reliability, P3 says. They are theoretical expectations involving conditions, and are not statistically tested hypotheses, but these are the logical outcomes that exist based on the theoretical results.

3. RESEARCH METHODOLOGY

3.1 Research Design and Selection of Evidence

A focused narrative review and conceptual synthesis approach is used in this paper. The research used a unit of analysis that is a relationship as described in the published research and not an original sample of enterprises. Academic research was chosen because it was related to circular practices, organizational capabilities, resilience or business performance. Manufacturing evidence from Africa was discussed in particular, with concepts from the underpinning theory providing explanations. The contexts of development and financing were offered in institutional publications.

The strategy is suitable for the elucidation of constructs and the construction of a framework in situations in which there are no comparable data. It is not a systematic review, bibliometric or meta analysis. It is not implied that all claims in the database are comprehensive. Selections are based on relevance and traceability and the conclusions relate to plausible mechanisms and research priorities rather than population numbers and prevalence of circular adoptions.

3.2 Data Sources and Collection Procedures

The combined use of targeted web search was as follows: circular economy, supply chain resilience, manufacturing SMEs, Africa, Ghana and South Africa. Publisher pages, research records and institutional reports were consulted and source checking was done in September 2026. Claims were verified using bibliographic information and available abstracts or report text. If such complete articles were not available, the interpretation was limited to presentation of the available content; specific statistical information not forewent if not available.

The final reference set is comprised of key theoretical publications as well as African empirical studies and contextual reports. Evidence was grouped by practice definition, capability mechanisms, practice performance outcomes and boundary conditions. There was a distinction between statements of results of published work and the author's own analytical extensions of the work. There were no company accounts or respondents observations or records, nor synthetic results, which were presented as empirical evidence.

3.3 Measurement of Circularity Resilience and Performance

Operational records should be collected to measure circular practices, wherever possible, in the future. Examples of these indicators are: percentage of recovered material of total material input, number of reuse cycles per packaging unit, percentage of completed re-uses, and verified recovery arrangements. For each indicator, a denomination and a reporting period need to be stated. If rejection rates and/or processing losses are significant, don't expect a good rating due to high recovered material intensity.

The indicators for resilience should reflect real-life experience of disruption. Days needed to reach an agreed production level, percentage of orders met while there is disruption, and qualified substitute inputs are useful measures. Preparedness indicators are able to document evaluated contingency practices, without being linked to outcomes of recovery observation. There needs to be not only an absolute reduction in social and environmental costs but also a reduction in costs of resource use per saleable unit, and job protection and payment promises need to be implemented.

Business performance measure should include both operating margin and operating cash flow, delivery reliability, and customer retention. Depreciation, inventory and owner remuneration need to be treated the same for accounting ratios. Where applicable, effect of price changes should be removed from sales growth. Firm age, size, sector, country, export exposure, financing access and prior performance are suggested controls, as they can be argued to affect access and the results.

Measurement should also differentiate, practices, from outcomes, that have informed a capability. The intensity of recycling and the coverage of repairs do not necessarily have to go hand in hand – this would not be proof of the validity of a circularity index based on internal consistency. Researchers need to explain the weights of indicators, examine indicators with missing data, and determine if indicators are similarly interpreted across languages and sectors. This would eliminate apparent/reported differences between countries that were only due to incompatible definitions and/or questionnaire interpretations.

3.4 Analysis Reliability and Ethical Considerations

Associations are understood based on the reported design. The constructs and samples differ which would lead to an invalid comparison when aggregating numerically. For this one narrative synthesis, transparent attribution and clear conceptual distinctions are said to form the basis for reliability.

Going forward, a panel study may help estimate if circular practices leads to better resilience, and if resilience leads to better results going forward in the context of earlier results. Firm changes will be better discerned with repeated observations, as well as multiple respondents. Informed consent, confidentiality of business information and protection of informal recovery partners would be ethical. The enterprises mentioned are not easily identifiable and are based on public sources that are used in the present paper.

4. RESULTS AND DISCUSSION

4.1 Profile of the Evidence and Manufacturing Context

The results are ‘thematic findings’ from the review; it is NOT a newly recruited sample. The African empirical data set relates to manufacturing SMEs in South Africa, manufacturing firms in Greater Accra and remanufacturing barriers in South Africa. This gives some context, but offer unequal spatial evidence. These studies do not make any inference on adoption rate in Nigeria, Kenya, North Africa or the Continent.

The proposed idea is most relevant if products or materials can be cycled through economically sound recycling systems. Examples include packaging reuse, metal component refurbishing and appropriate production residue exchange. Feasibility will be subject to product specifications and capacity in the region. There are components that can cause contact with the food, contaminated materials, or parts that are critical to the safety of food contact packaging for these items that require special care in qualification. These are examples of decision conditions, and not reported case findings.

4.2 Circular Practices and Resilience Mechanisms

The first of the proposed mechanisms is called "input substitution. When recovered materials comply with technical requirements and can meet production timetables, they can be used instead of traditional procurement processes. The manager should be familiar with which products are acceptable for substitution and if the processing equipment needs to be changed. The end credit towards resilience is dependent then, on the validated compatibility of the materials as well as sourcing availability during the relevant disruption. Recovered input which is not in production is not usable contingency capacity but is counted as inventory.

Second is equipment’s life extension. Reducing reliance on long replacement cycles with repair skills and reusable components and refurbishment arrangements. They are useful in the aspects of diagnosis, spare part compatibility and quality assurance. Reliability is a problem with tools and machinery, and stretching it too far can lead to more downtime and energy use. Keeping this in mind, the reliability of the services and life cycle costs should form the basis for judging circular maintenance and whether or not replacement is necessary where further repair is cost-inefficient.

The third mechanism is one of coordination of firms. Volumes, quality, and timing of returns need to be coordinated between different stakeholders—manufacturers, collectors, processors and customers. Transparency in the terms can help to minimize the uncertainty related to certain materials and certain parties and minimize having to face into rejected materials. But more interconnectedness can also bring about the creation of more dependencies. At least one processor is a must, and disruption can be shared between business entities in a network based on this processor. Therefore, the framework recognizes the diversity of recovery nets and contractual transparency as aspects and not necessarily as results of the adoption in a circular scenario.

For instance, let's take compliance with an illustrative packaging company on reusable transport containers. The firm would be required to maintain return calendars, return policies and a backlog of late delivered returns. It should be broken down to establish a comparison between the number of containers lost and cleaning requirements, and the number of containers avoided and the missed deliveries. For customers who would also like to return containers during a transport disruption, a greater shortage of containers might be possible as part of reuse. The case illustrates the need for a contingency plan for circular setups given what can seem like favorable material-economics for the circular setup.

4.3 Evaluation of Business Performance

4.3.1 Profitability and Operational Performance

This review helps to assess the performance via mechanisms and not as a blanket circularity premium. Comparing the avoided expenditure on material and disposal with the collection, sorting, testing, cleaning, storage, and processing expenditure is important for a manufacturer. Warranty and product rejection expenses also can be a big factor. For purposes of calculating a unit cost, only merchandise that is saleable should be included. Otherwise, however, the apparent savings for the use of cheap raw material may vanish literally if other losses are identified.

There's another economic advantage to resilience: losses not made. In order to maintain delivery, contribution margins can be maintained, emergency freight can be reduced and customer defection can be limited. Such advantages are subject to a disruption exposure and requirements of reliable supply by the suppliers to the buyers. These may go unnoticed in a dormant season. As a result, it is more important for the manager to consider continuity investments according to different and alternative scenarios of disruption, and less important to require each backup resource to minimize its usual operating cost.

The same discipline is needed to achieve environmental performance. An increased amount of recycled material input does not necessarily mean that there has been a reduction in the overall impact if the extra transport and/or extra energy and/or extra water has offset the saving. When a feasible alternative exists in an enterprise, the options need to be compared: provide the same function for a product. Thus, the paper suggests to analyse the circular initiatives by using a baseline which considers material losses and processing needs, and to document the uncertainty if total environmental inventories are not available.

4.3.2 Operating Cash Flow Performance

Even if margins are expected to improve in the circular expansion, cash flow can deteriorate. Firms might pay collectors before the products are recovered, may store slow moving products, or may finance test equipment. The timing of these difference have significance for the SME having limited liquidity. This would show whether and to what extent circular operations cause a financing burden that jeopardizes further production, after monitoring the time lag between the investment in recovery and subsequent customer payments.

Though a practical test of a process should track the number of inventory days resulting in a recovery of rejected returns, operating cash flows and the number of overdue receivables should also be monitored. Managers may be able to pilot some of those flow of materials without investing more in infrastructure. This recommendation is as a result of the proposed cash and quality mechanisms, and not a demonstrated intervention effect. Financing structures should be in line with the anticipation period of recovery as well as the affordable if the quantities of recovered materials and/or customer demand fall below expectations.

4.4 Relationship between Circularity Resilience and Performance

The conceptual synthesis puts circular practices first, and resilience second, as does business performance. Separate direct pathway: Resource savings and extra revenues. Partial mediation is conceivable due to the fact that continuity benefits account only for a part of the economic rationales. It is inferred that the determinants of the first pathway are collaboration and reliability of infrastructure, and factors such as financing can limit the depth of adoption and sustainment of recovery operations.

While this ordering is an analytically useful one, it cannot be used to make a temporal causal claim. Being solid-performing will help to fund circular investments, while able managers can often enhance recovery and customer service at the same time. Future design should measure adoption, then measure for resilience during and after the the disruption, and measure financial outcomes afterwards. Firms with similar degrees of adoption and progress would be used to compare and determine if changes seen are attributed to the adoption or due to general sectoral changes.

The framework also takes into account situations in which this bond will be challenged. Circular sourcing can make there a degree of vulnerability when all recovery partners use the same transport corridor, when the number of product returns decreases during an economic downturn, or when the quality of the material varies and recurring stoppages are experienced. The following are suggested counterexamples that would make P1 falsifiable. They also help identify failed and discontinued initiatives, while these might not be successful circular initiatives are needed to improve the circularity measures without choosing only successful circular adopters.

The message for managers is to start at an identified specific supply vulnerability and explore a technically viable, circular solution and subsequently discuss the financial and sustainability implications together. Feasibility may be better through supplier development and shared testing facilities if there is lack of scale. These types of interventions need to be assessed on a basis of change in material acceptance, recovery time, and cash needs documented prior to any other expansion being

recommended.

5. CONCLUSIONS LIMITATIONS AND FUTURE SCOPE

5.1 Conclusions

Circular economy practices can be a viable (albeit not inevitable) way of enhancing supply chain resilience of African manufacturing SMEs. The proposed contribution is generated through retained resources, routine use of which creates reliable production options; equipment repair processes preserve equipment availability; and working collaboratively allows the timely recovery of equipment. Business benefits can be delivered both directly in terms of resources saved and indirectly in connection with them saving continuity benefits. Such outcomes do not occur automatically as a result of either a circular policy or a recycling rate increase.

This paper's contributions are a separation of adoption, resilience, and performance and a framework that describes conditions linking these. Managers should filter recovered into filtering capacity, recovered by each flaw, and watch out for cash and profitability. Where shared technical and financial constraints exist, and these are supported by local evidence, development support should include consideration of these constraints. The studies reviewed warrant their continuation and further investigation, but do not provide continent wide causal effects.

Implementation can start with a materials flow audit, and a short operational baseline. Managers are then able to choose one vulnerable input, set an acceptance criterion with the recovery partners, and set stop conditions for unsafe or uneconomic batches. Demand shifts should be discussed and pilot reviews should be a comparison between production periods of the same kind. Once a level of technical reliability, cash needs, and of worker protections exist where they are defensible under the various disruption scenarios applying to that specific enterprise, expansion becomes defensible.

5.2 Limitations of the Study

The type of this narrative review is purposive reference set and publication material that can be used. The geographic coverage is focus and characteristics of the sectors are such that they restrict transferability. Available sources were mostly abstracted, so that detailed appraisal of the validity of measurements and the specification of the measurements' model was not possible. The mechanisms proposed, therefore, go beyond those that are directly observed in the studies of empirical research reviewed.

Recovery transactions might not be fully documented and registered enterprise samples might not include viable repair businesses. On the other hand, if it is being seen, and it is being reused, it may be a indication of scarcity, and not putting in the proper safety measures for the workers. Future research ought to differentiate between resourcefulness, intentional organizing function and substantiated sustainable results. This distinction would illuminate and expose locally-practiced modes of production without presuming informal employment to be intrinsically circular or necessarily inefficient.

5.3 Future Scope of Research

Future studies are recommended to cover manufacturers in different countries in Africa and sectors based on defined national SME definitions. Material flow records, disruption logs and financial statements should link up with repeated observations. Multiple moments of interviews with respondents and recovery partner would help differentiate between formal policy/implementation. Nonadopters and abandoned initiatives could be included, decreasing the likelihood of only looking at companies that can continue to keep circular initiatives going.

These direct and indirect pathways should be separately tested in a longitudinal design and whether there are alterations in their strength depending on the reliability of the infrastructure. Causal inference can be enhanced by natural experiments or by well-argued comparisons near the time of external disturbances. Financial results should be focused on workers' conditions and absolute use of resources. The primary empirical question is whether the use of proved circular capabilities empowers companies to adhere to responsibly produced goods and to recover more quickly with similar disruptions exposure.

Also, the severity and length of each disruption should be recorded for further research. After a minor interruption, the recovery can not be compared to recovery after prolonged infrastructure failure, as a faster recovery is expected. More interpretation could be done using event matching, transparency of exposure measures and sensitivity analyses. The reporting of null results and implementation costs would be particularly useful for managers when deciding whether or not the expected gains from continuity are worth the limited investment opportunity among the various options for production improvement and recovery.

In such comparisons, firms should not only remove their PV but also companies that have ceased operations due to a large amount of disruption.

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