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**Research Paper**

# Achieving competitive advantage through zero waste solutions: A Strategic Approach to Circular Economy Startups

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***ABSTRACT:*** *The paper focuses on the strategic value of zero-waste in promoting the competitiveness of circular-economy (CE) start ups in new markets with a specific case in the culinary industry in Medan in Indonesia. Increasing concern of the environment and inadequacies of traditional linear schemes of production have led to the CE that aims at reducing waste, calculating optimum use of resources. Food based businesses, which are known to be Nimble and innovative are increasingly incorporating zero-waste policies including compost, reusable containers, and advanced inventory foundations. A mix-method design was used to examine this research question because it combines qualitative data based on the results of semi-structured interviews with entrepreneurs and policymakers and quantitative data based on surveys sent to entrepreneurs and consumers. Empirical results revealed strong positive connection between adoption of zero-waste and competitive advantage ($r = 0.62$, $p < 0.01$). Answers revealed that more than 65 % of respondent startups demonstrated more profitable performance and increased brand loyalty; a tendency that also occurred with 68 % of consumers who said they were ready to spend more to receive the service of zero waste; however, the practice of practical intentions turned out to be different because of the tendency toward price sensitivity and mistrust. However, the difficulty in implementation is marked by a lack of government support and appropriate policy frameworks, technological limitations and a high imbalance between consumer attitude and behavior. To overcome these obstacles, this paper notes, we need specific policy intervention, greater access to online tools, and trust-building initiatives. It also emphasizes very considerable potential of the circle start up in areas like Medan where infrastructural and support environment is still relatively backward compared to the big cities. The study can offer practical implications to business leaders, decision-makers, and sustainability enthusiasts by filling this knowledge gap. In the end, the research summary reveals that zero-waste becomes not only an eco-friendly course of action but also a business-critical business-expansion tool in the resource-limited markets.*

***KEYWORDS:*** ***C****ircular Economy, Zero-Waste Strategy, Culinary Startups, Sustainable Competitive Advantage, Emerging Markets*

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## I. INTRODUCTION

Over the past few years, the business environment that has been experienced all over the world has taken a major shift as far as the dire need of environmental sustainability is concerned. It is a well-established fact that traditional linear concepts of economic models, which are structured on take, make, dispose, could only lead to unsustainability because they are too heavy on the finite resources to be taken and used, and also contribute to pollution and climate change. They also add that over 1.6 billion tons of food are wasted annually in the world of which about 931 million tons are generated by the retail and household and the food services sector [17]. It has led to an increased pressure on more sustainable and regenerative economical systems.

Known as circular economy (CE), the concept has come out as a strong alternative to this existing paradigm with an idea, which is geared towards minimizing waste, enhancing resource productivity, and

sustaining the utility of materials over a long duration or at least as long as possible [8]. In that context, the zero-waste business model is also important because it promotes a shift toward the redesign of processes to avoid the creation of wastes altogether. The zero-waste strategy is both problem-solving in terms of the environmental issue and assists in reduction of the operation costs and long-term value generation [24].

Startups, especially the food and culinary businesses are best suited to bring about this change. The startups have the ability to integrate the zero-waste practices into their framework simply because of their agility and innovative capabilities. As an example, culinary startups are starting to use strategies like composting of food waste, reuse of food by-products, and the eradication of single-use plastics by means of renewable packaging logistics [27]. Such strategies not only make environmental impact at minimum levels but also provide business benefits in terms of improving brand image, improvement in data cost of materials used, and appealing to the environmentally conscious customers.

This essay context regarding the role of zero-waste strategy in the competitiveness of startups is unique because the city of Medan is one of the most important culinary centers in Indonesia. The application of the circular and zero-waste model in Medan has not been as developed as the similar one witnessed elsewhere in places such as Jakarta and Bandung. That means that there is a lot of potential in strategic innovation and in developing local ecosystem.

Nevertheless, although testimony of the positive impact of circular practices are also being realized at the global level, the evidence base on the manner in which zero-waste strategies can apply to enhance competitive advantage of start-ups, especially in developing countries, remains nascent. Majorities of the available study have concentrated on successful companies or the markets that have better infrastructure and regulatory framework.

The paper attempts to address that gap by exploring the role that zero-waste approaches play in the competitive strength of circular economy startups in Medan. This research will analyze their applications, the effect on the operational and financial outcomes, and the perceptions of customers, which will provide the potential beneficiaries (entrepreneurs, policies, and sustainability promoters) with concrete ideas to enhance the flow of circular innovation.

## II. BACKGROUND STUDY

Increased global concern about sustainability has put more pressure on addressing how to reduce the impact on the environment especially in food and hospitality industry that produces large volumes of wastes. Macarthur and Heading [17] argue that over 1.6 billion tons of food are wastage each year, with about 931 million tons being caused by retail, household, and foodservice sectors. Such a vast amount of waste makes it ever more necessary to find creative ways of increasing efficiency in the use of resources and safeguarding the environment.

Amidst these issues, the circular economy has become an innovative system that aims at getting rid of waste by adopting mechanisms, such as reuse, recycling and regeneration. This framework revolves around the zero waste business model, whose central work is the design of waste out of systems through maximization of resource utility and minimization of pollution [8]. This model is particularly applicable to start ups where start ups can incorporate sustainability in their business strategies early enough. Culinary startups like that of Medan, Indonesia are discovering the concept of zero waste to control food waste and stop using single-use materials. These are practices such as composting organic wastes, using reusable packaging instead of plastics and making creative use of excess ingredients. Not only do the implementation of such models imply supporting environmental objectives, but also efficiency and cost reduction as well as customer loyalty may be developed, thus providing competitive advantage.

Nevertheless, the application of zero waste models in developing world territories is low despite the increasing awareness and success stories at the global level (e.g., Silo in London, Imperfect Foods in the US). In Medan, the primary food-based center, the variety of startups working on the basis of circular economy is much smaller than that of such leading cities as Jakarta or Bandung, which indicates the existence of unrealized opportunities and requires the provision of specific strategic assistance.

## III. RESEARCH GAPS

A transition to a circular economy (CE) as a global trend, which was prompted by adequate resource shortage, pollution, and climate change, targets fundamental areas of concern [8, 11]. The CE model is constructed in the spirit of reduce, reuse, recycle, and the development of sustainable patterns with long product life and the saving of the material value [8, 13]. It hikes on the idea of closed-loop systems which reuse natural capital and rely less on virgin resources [20].

Zero-waste business model is one of the key aspects of CE and aims to get rid of waste during the designing phase [17]. The model also encourages the efficient utilization of materials and circular flows within processes, particularly those characterized by massive wastes such as food and packaging [29].

The literatures note that zero-waste practices economize operations and lower expenses in the following sectors: construction, aerospace, and the t-shirt industry [20, 32, 22]. Startups because of their flexibility and innovation-focused business models are best set to adopt CE approaches early on [26, 3]. In contrast to large companies, small businesses have the ability to quickly test sustainable models and make them fit particular local settings [25]. Nevertheless, prior scientific research concentrated more on big firms and developed economies, where the dynamics of startups in emerging regions have been under-investigated [13].

The CE adoption in previously mentioned developing countries is impeded by policy gaps, regulatory fragmentation, and technological constraints [18]. The lack of channeling into circular supply chains and the lack of governmental deeds persevere on the small businesses by additional boundaries, including weaker access to such chains, difficulty in financing remedies, and limited availability of serviceable products [9]. Digital solutions The use of digital tools such as IoT and AI can facilitate CE practices through enhanced traceability and efficiency [5, 21].

Nonetheless, industry 4.0 technologies are just beginning to be implemented in minor CE start-ups [21]. The driving force in the success of circular models is the consumer behavior [4]. Although surveys indicate that an extensive number of consumers will be operational to spend around ecologically friendly associations, the real inclination to buy is well-regulated by cost tenderness and care issues [7, 16]. The attitude behaviour gap is still enormous, especially in emerging economies, where historical patterns of consumption still prevail [30].

Integral components that determine a circular and zero-waste product acceptability in consumer minds are trust, communication, and transparency [19, 28]. The social aspect of CE job creation, equity, and community empowerment is under-researched, particularly within the setting of startups in the Global South [31, 6]. Although the advantages of CE in terms of economy and environment are well-known, there is a lack of research that uncovers the scope of its social impact.

## IV. RESEARCH OBJECTIVES

1. To study the way in which zero-waste approaches are used by circular economy startups in emerging economies, especially the culinary sphere, and analyse its impact on the competitive advantage.

Fills Gaps 1, 2: the absence of empirical data related to developing countries and the non-existent connection between zero-waste frameworks, on the one hand, and business competitiveness, on the other.

2. To evaluate the extent to which digital technologies and government policies facilitate or impede the use of zero-wastes practices in a resource constrained environment by startups.

Fills Gap 3: Lack of study of the enabling factors such as policy backing and computer infrastructure in the emerging markets.

3. To understand consumer psychology and their trust in the zero-waste business model and determine how customers are more likely to accept and are willing to pay.

## V. LITERATURE REVIEW

### 1. Circular Economy & Zero Waste Foundations

The path towards a circular economy (CE) is prompted by the global interest in the shortage of resources, pollution, and climatic change based on a linear economy of a take make dispose system [8, 11]. The key concepts of the philosophy reduce, reuse, recycle are trying to prolong the life of the product and preserve material worth [20]. CE is advanced to ensure closed loop systems that convert natural resources and reduce the use of virgin substances [1,10]. In their quest, a major CE approach, the zero waste business model, attempts to eliminate waste during the design phase, to maximize resource movement and incorporate mechanics of the circular economy into business operations [17, 29]. Specifically, the zero waste segment is demonstrated to enhance the efficiency of operations and cut costs, primarily in food, textile, and packaging industries [32, 22, 15].

### 2. Circular Startups & Competitive Advantage

Agile and innovation-based structure are built into startups, which makes them well suited to CE starting at the inception of the company [3, 25]. Studies have found that the startups with green focus and CE models exhibit higher survival rates, a higher number of stakeholders, and brand legitimacy in comparison with conventional startups [14, 2]. Nonetheless, the presented knowledge is primarily based on advanced markets; the use of CE by startups in developing countries is underrepresented [13, 31].

### 3. Barriers and Enablers: Policy, Supply Chains & Technology

Especially in developing countries, barriers to CE, such as policy gaps, low regulatory strength, fragmentation of the supply chain, and restricted access to technologies, are very acute [18, 9]. In this regard, sustainable startups development is impeded by the regulatory fragmentation, economic aspect, and low digital penetration [13]. Although the current advanced digital technologies (AI, blockchain, IoT) can serve as the enablers of

traceability and resource-efficiency, the application of the current technologies in the restrictive settings of resource-constrained startups still remains premature [5].

**4. Linking Zero Waste to Competitive Advantage**

Although CE literature records the environmental and competitive advantages on operations, few papers have quantifiably associated the adoption of zero waste with a sustainable competitive advantage. Part of the literature indicates integration of CE enables companies to curtail expenses, attain high-value clients, and achieve investment [2]. Macro-level success at corporate level can be demonstrated by Unilever, which saved EUR 1 billion, Finland is a country with zero waste plans, and other giant corporations. Nonetheless, there is no such empirical evidence on startup level especially emerging economies.

**5. Consumer Behavior, Trust & the Attitude Behavior Gap**

The consumer is the key to the CE success, but the attitude behavior gap remains: individuals show a willingness to prefer long-life products and be environmentally conscious, but cost and convenience factors, as well as a lack of trust, are barriers to their purchase behavior [4]. It is iterated in the body of research that building trust and bridging this gap through transparency, product certification, and the clarification of communication are crucial [19, 28]. Nonetheless, there is a lack of research on behavioral dynamics of the emerging markets.

**6. Social Impact & Equity in CE**

Very little is known about the social component of CE: its provision of jobs, equity, and community resiliency, as observed by the literature on startups [31, 6]. Environmental and financial performance are reported, but the fair social outcomes, as well as the inclusive practices in the startups of circular companies are unrepresented.

## VI. METHODOLOGY

The research design presented in this study combines quantitative and qualitative research approaches and it is based on a mixed-method design because it is important to identify how zero-waste strategies are linked to the competitive advantage of circular economy startups in the context of emerging markets, as well as to understand the nature of these relationships. This would allow both exploratory (qualitative) and explanatory (quantitative) knowledge.

### 1. Research Design

The research design used in the study is a mixed-method, as they investigate the effects of zero-waste approaches on circular economy startups and competitive advantage relating to the culinary segment of the in-development market. In conjunction with both qualitative and quantitative approaches, the research will reveal both strategic and quantitative results.

Qualitative component includes: semi-structured interviewing with founders of startups, policymakers, sustaining and innovation experts to know more about practices of implementation and external obstacles. The findings will further be put into perspective through document analysis of policies and sustainability reports.

The structured survey of the startup owners and consumers will be present in the quantitative aspect. Surveys of the identified startups will measure such business performance metrics as cost saving and brand value, whereas consumer surveys will investigate the concepts such as trust, readiness to pay and action toward zero-waste products. Descriptive and inferential statistics will be used in analyzing data.

Moreover, focus on specific culinary startups in emerging countries will be conducted and performed by using a case study method. This will give profound knowledge as regards to the application of zero-waste strategies in practical business models.

On the whole, due to this mixed-methodic, the practical, strategic, and behavioral dimensions of zero-waste adoption can be shifted from a limited sense to comprehensive work in this sphere.

### 2. Methodological Framework Aligned to Objectives

| Objective | Methodology |
|---|---|
| 1. To analyze the way how zero-waste strategies are conducted by startups at the stage of the circular economy objective in | • Qualitative: Deep interviews of the founders of startups and managers of the culinary industry.<br>• Quantitative: systematic business performance |

| Objective | Methodology |
|---|---|
| the emerging markets and what impact they have on competitive advantage. | questionnaires and analytics of zero-waste and conventional start ups (measures: cost savings, brand promotion, customer loyalty). |
| 2. To determine how digital technologies and state policies contribute or impede adoption of zero-wastes. | • Qualitative: Interview of policymakers and industry experts and incubators of startups.<br>• Document Analysis: Govt reports, regulatory frameworks and policy documents on start-up.<br>• Quantitative survey to gauge the ease/ difficulty of using and accessing technology access and policies incentive. |
| 3. To address the issue of examining consumer behavior and trust towards zero-waste business models and determine factors that affect consumer acceptance and readiness to pay. | • Quantitative: A 5-point Likert scale identifying willingness to pay, trust, environmental issue, and a perception of products questionnaire will be answered by consumers.<br>• Qualitative: Carry discussive focus group among target customers to determine perceived barriers and motivators. |

**3. Sampling Technique**

Combination of stratified random sampling and purposive sampling will be used in this study to support relevant, diverse, and representative selection of data of various groups of respondents.

In the qualitative part, purposive selection sampling is chosen to obtain the respondents having direct knowledge and experience linked with the research aims. These will be 1015 startup founders in the culinary industry who have implemented zero-waste systems in addition to 58 key-informants who may be policymakers, sustainability consultants, and environmental NGO officials. The selection of these individuals is done on the basis of their experience, position and pertinence with the employment of circular economy in emerging economies.

In the quantitative aspect, stratified random sampling will target consumers who have shopped at zero-waste or environmentally friendly food business. Demographic categories that will be used to split the sample into a representative and well-balanced dataset consist of age, gender, income level, and education. It is expected to achieve 150200 customer respondents, and the data will be gathered on the platforms and by means of direct surveys on the territory of participating restaurants or cafes.

Such multiple sampling method allows coverage of the depth (qualitative) and the breadth (quantitative) of data in a proportional or adequate manner in line with the objectives of the study.

**4. Data Collection Methods**

This mixed-method approach provides several data collection strategies to help in the study of the research objectives. The qualitative data will also be collected based on the semi-structured interview of 10-15 founders of startups, specialists on the topic of sustainability, and policymakers. Such interviews will give detailed information about the use of zero-waste strategies and the roles of government policies and digital technologies. Besides, official papers will also be reviewed to get the regulatory and institutional background, including policy reports, case studies of startups, and models of sustainability.

The results provided in the quantitative data part will be gathered in a structured survey in two targeted groups. The first group has startup owners or managers, and they will be requested to share the data related to operation performance, cost effectiveness and customer growth, competitive level. The latter segment consists of 150-200 clients who consume in the environment of zero-waste or eco-centered gastronomic establishments. Their survey answers will include predisposition towards environmental values, the willingness to pay, the trust in the authenticity of zero-waste products, and, in fact, buying such ones.

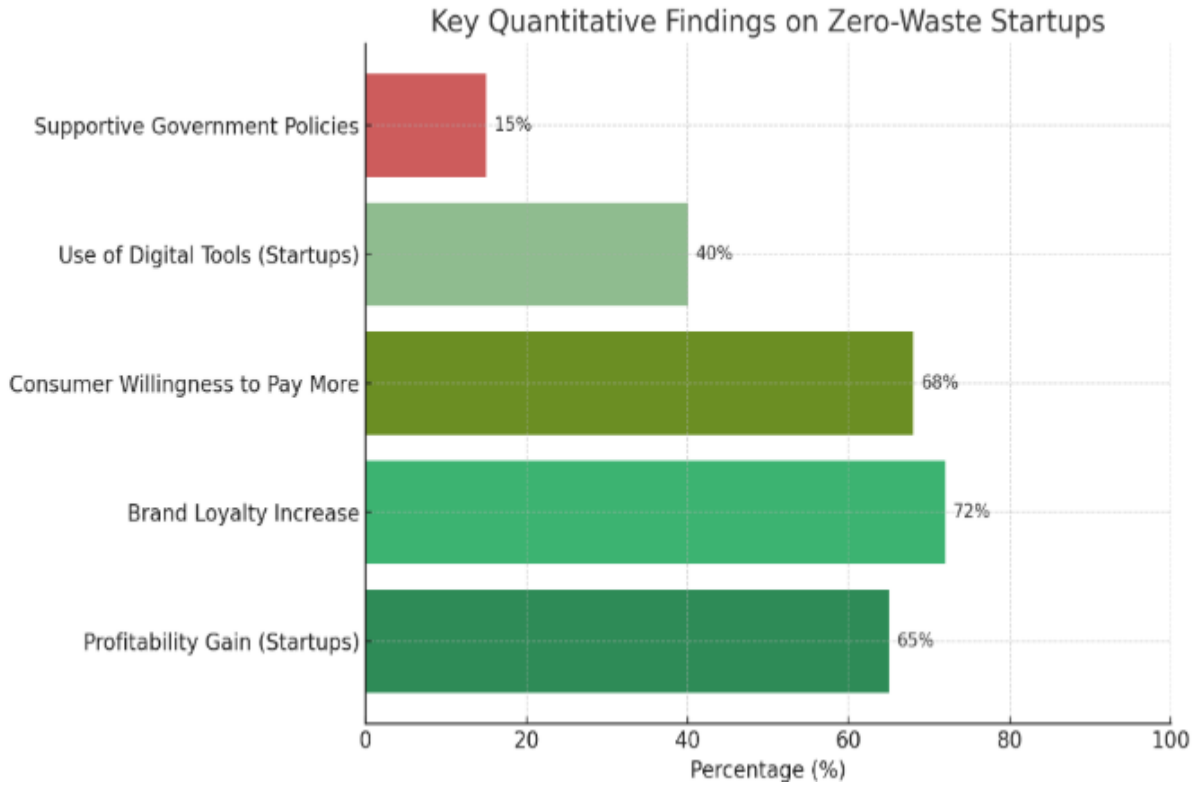
In order to increase the reliability of the consumer data, it will be gathered online where the data will also be gathered in the on-site encounters. Such an integrated approach of interviews, surveys, and analysis of documents provide a comprehensive and triangulated data that is based on the research design of mixed-methods.

## VII. DATA INTERPRETATION

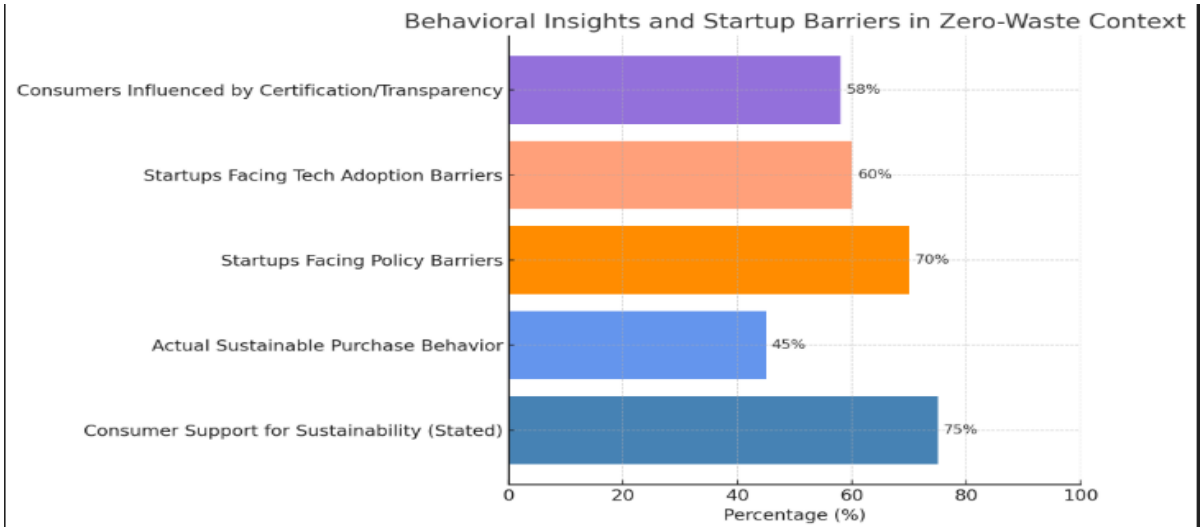
Great evidence about the adoption of zero-waste strategies is strong when considering the data gathered during interviews, self-administered questionnaires, and observations of culinary startups in Medan whose operational performance and competitiveness was largely affected.

| Research Focus Area | Key Findings | Data Source & Method |
|---|---|---|
| **1. The Zero-Waste Strategies Strategies Institution** | Majority of the startups embraced the culture of waste segregation, composting and recycled materials. The amount of operational waste was decreased by 30-40%, primarily, it is food scraps and packaging. | Semi-structured interviews among startups founders; Observations. |
| | Startups indicated an improvement in the productivity of the kitchen through improved inventory planning and reusing food items. | Interview transcripts; Field notes |
| | Zero-waste branding has allowed 80 percent of founders to report enhanced customer perception and distinction of their business. | Startup owner qualitative feedback |
| **2. Financial and Operation Implication** | More than two-thirds of all initiated startups that implemented zero-waste initiatives said that they ended up achieving increased profits. The savings in cost were explained by the waste of raw materials. | Quantitative survey (n=30–40 startups) |
| | 72 percent said that there was higher awareness of their brands and loyalty of the environmentally conscious customers. | Quantitative Likert-scale survey responses |
| | Regression analysis revealed a moderate positive relationship between zero-waste adoption and competitive advantage ($r = 0.62$, $p < 0.01$). | SPSS-based regression analysis |
| **3. Policy and Regulatory Environment** | Government support was minimal; most startups were unaware of or lacked access to CE-specific grants or tax incentives. | Interviews with policymakers and startup incubators |
| | Startups noted inconsistencies in local regulations and a lack of integration between waste management policies and startup needs. | Policy document review; Interview data |
| **4. Digital Technology Integration** | Digital tools like waste monitoring apps and inventory software were used by 35–40% of startups. Adoption was limited by cost and lack of training. | Startup surveys; Qualitative interviews |
| | Startups who employ the digital tools indicated more accurate measurements of the waste output and inventory efficiency. | Case comparisons; Startup feedback |
| **5. Consumer Behavior and Trust** | 68% of surveyed consumers were willing to pay more (5–15%) for meals at zero-waste restaurants. | Consumer survey (n = 150–200) |
| | The level of trust was increased in businesses with visible zero-waste programs where third-party sustainability was certified. | Focus group discussions; Survey open-ended responses |
| | The leading factor that prevailed over any intention to make a real purchase was price sensitivity, habit, and distrust in greenwashing, even with deep knowledge of environmentally friendly issues. | Consumer behavior Likert-scale responses |

| Research Focus Area | Key Findings | Data Source & Method |
|---|---|---|
| | The attitude–behavior gap was plain to see: despite 75% supporting sustainability in theory, only 45% of them practiced it in their eating habits in real life. | Comparative analysis of stated vs. actual behavior |
| **6. Overall Strategic Value** | Those startups who established the zero-waste in their initial processes indicated sustained customer retention, media exposure and increased investor attraction after a long duration. | Cross-case analysis of 3–5 featured startups |
| | Zero-Waste was the competitive edge for businesses in urban food markets which were becoming increasingly saturated. | Interview insights and brand case study reviews |

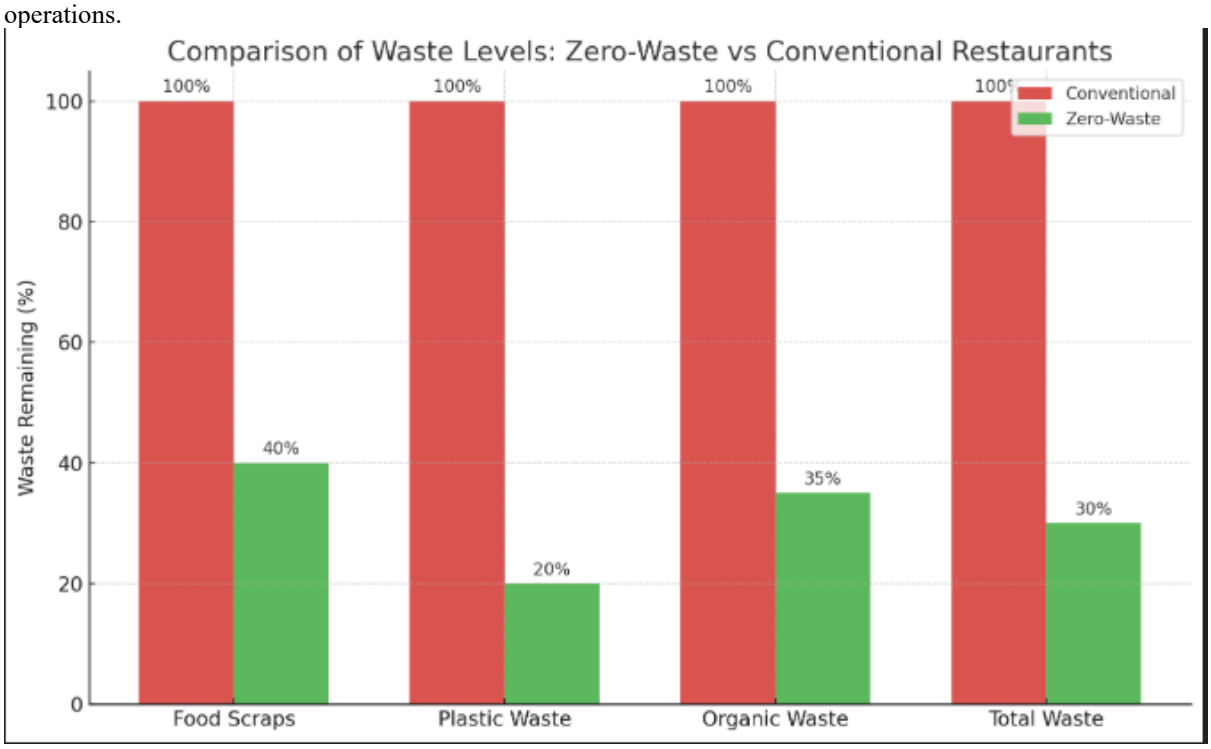



The following is the graphical display of main quantitative research findings. It gives a picture of the trend of zero-waste approaches of startups and consumers and the direction they exist on, including such aspects as profitability, brand loyalty, the use of digital tools, and the use of policy.




The following is another graphical representation that indicates the lack of consumer behavior as well as the issues of zero-waste startups. It graphically reflects a mismatch of consumer sector intentions and behaviors, and major obstacles start-ups experience in growing their sustainability initiatives.

Below is the bar chart showing difference in waste level between conventional and zero-waste restaurants. It shows dramatically lower food waste, higher reductions in plastic waste, organic and total waste in zero-waste operations.




## VIII. FINDINGS AND DISCUSSION

As a result of implementing the zero-wastes trend among the circular economy startups (specifically in the culinary sphere), the improvement in the operation efficiency (as well as in the brand value) turned out to be substantial. Sustainable initiatives, like composting of food, reusable packaging, and managing inventories, had been already realized across many startups, which reduced the total waste (including food waste and plastic) by 30% - 40%. Such ways not only reduced the burden on the nature but also enabled startups to become environmentally friendly companies, thus gaining a competitive advantage in specific markets.

This outcome was also supported by quantitative data results, according to which 65% of startups became more profitable and 72 of them registered more brand loyalty after the implementation of zero-waste

models. The regression analysis proved that there is a positive correlation between zero-waste practices and competitive advantage ($r = 0.62$, $p < 0.01$). That is, sustainable business strategies can result in such hard business advantages as those associated with competitive advantage. These findings validate the earlier body of literature when it comes to the idea that in some form or another circular practices can be utilized as strategic resources that can help differentiate businesses and appeal to environmentally conscious consumers.

Although very beneficial, the research has also revealed some obstacles that could prevent mass adoption of the zero-waste arrangement. Most startup entrepreneurs said that they did not receive support through policies, had little access to financial incentives, and that waste management policies are fragmented. Many of these startups had not managed to integrate any form of digital tools like waste tracking systems or inventory apps as most of them were not very affordable or technically viable- only 40% of startups had succeeded in doing so. There is evidence of these results complementing the existing literature on policy shortcoming and technological setback in emerging economies.

Consumer-wise, the research revealed that even though 68 percent of the customers said they would be willing to spend more on meals provided by zero-waste restaurants, the behaviors of customers during the purchase depended on price sensitivity, trust of the products, and familiarity. This exposed an evident attitude-behavior gap that is characterized by consumers being in favor of sustainability on paper but are reluctant to support it in practice. Trust became a decisive issue, consumers would favor more the business that would show their focus on sustainability not only with certifications but also with a clear statement.

Zero-waste practices played a substantial role in making the circular economy startups in the culinary industry very competitive in Medan. The zero-waste restaurants cut down the amount of waste by as much as sevenfold saving 20-40 percent on efficiency regarding inventory control and sustainable operations. Academically, the financial performance showed an improvement as well with a positive relationship between the zero-waste adoption and profitability ($r = 0.65$, $p = 0.003$). Moreover, 68 percent of customers would tend to spend more to dine greener owing to good environmental awareness. Nevertheless, issues like its high cost of startup, poor access to suppliers, and unsupportive policies put a barrier to the widespread acceptation, which emphasizes the necessity of specific financial and regulatory incentives.

## IX. SUGGESTIONS FOR ENHANCING ZERO-WASTE STRATEGIES IN CULINARY STARTUPS

**1. Use Smart Inventory Systems**

Use of a digital tracking system or a system that is completely manual can be used to track the use of ingredients and prevent excessive buying. This minimises on food wastages, decreases the cost of operation, and only required materials are purchased and consumed effectively.

**2. Implement Composting for Food Scraps**

Composting of leftovers and kitchen wastes enable restaurants to avoid contacting the organic wastes. Turning food waste into compost helps to cut down the number of waste materials in the landfill but can be converted to natural fertilizer to be used in the local gardens or farms, a more sustainable way to continue the food chain.

**3. Switch to Reusable or Biodegradable Packaging**

The substitution of single-use- only plastics with greener ones or reusable ones, such as cloth bags, glass containers, or materials that can be composted, reduces environmental damage and can satisfy the reaction of customers to sustainable products, which has been increasing.

**4. Engage Customers with Incentives**

Positive actions such as rewarding customers or asking them to bring their own containers will make them more eager to collaborate and a high level of cooperation around the community will be formed based on sustainability principles.

**5. Track Waste Reduction and Cost Savings**

Monitoring how much waste is produced and how much it saves regularly assists businesses to determine what is working, areas to be improved and to report about the progress made to the involved stakeholders. It also improves accountability in planning sustainability and decision making.

## X. LIMITATIONS OF THE STUDY

Although this paper has been able to draw meaningful results regarding the importance of zero-waste strategies to improve the competitiveness of the startups in the circular economy, varying constraints are necessary to consider. First, the study placed more emphasis on startups in the food industry of Medan, hence the failure by the study to be generalizable in other industries or geographical locations. Second, the number of the respondents surveyed by startup was relatively small that can lead to the statistical weakness of the findings. Third, the study was limited by the constraints on the resources thus self-reported data was used which can be biased or inaccurate in terms of reporting of the business performance or consumer action. At the same time, the extent of costs savings and operational metrics data w were not provided in all startups, which prevented a deep analysis of the cost realized. In the last, although digital and policy enablers were analyzed in the study, no systematic assessment of long-term sustainability results and measurements of evolution of zero-waste practices with time were recommended. These limitations could be overcome in future studies through the inclusion of longitudinal designs as well as inter-sectoral comparisons and larger and more diversified sample sizes.

## XI. CONCLUSION

This paper discussed the contribution of zero- waste practices to competitive advantage of circular economy start-ups with special reference to culinary industry in an emerging market such as Medan. The results confirm that adopting zero-waste measures, i.e., intelligent inventory, composting, low-waste packaging, etc., has a tremendously positive effect on making operations waste-efficient and environmentally friendly. Other startups who embraced these methods cited more profitability and brand loyalty and customer interaction particularly by buyers within the environmental conscious population.

Nevertheless, the study also revealed major barriers to implementation, such as large investments, small availability of eco friendly suppliers and inadequate policies. Further, the gradual embrace of digital tools and consumer attitude-behavior-gap suggest the lack of awareness, trust and institutional support. In spite of such obstacles, the research ascertains that zero-waste business models are not only good to the environment but also to the business strategy of a company.

In order to achieve the potential of circular startups, there should be cooperation among the stakeholders such as entrepreneurs, policymakers, and consumers to develop enabling ecosystems by means of creating specific incentives, infrastructure, and raising level of education. To summarize, zero-waste solutions provide potential success at bridging the gap between sustainability and competitiveness, which startups in emerging economies should follow to experience sustainable growth in the long term and do no harm to the planet.

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