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Original Article

Status and Potential of Implementing Circular Economy for Plastic Recycling Business in Craft Villages in Northern Vietnam - A Case Study in Hung Yen Province

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Abstract: Encouraging and promoting the implementation of a circular economy (CE) is crucial for reducing emissions, minimizing production costs, and promoting resource efficiency and circularity. Plastic production and recycling activities are prevalent in craft villages. However, alongside economic benefits, these activities also generate significant environmental concerns. It is essential to investigate CE implementation's status and potential in these businesses to promote enterprises in craft villages to transition to a circular economy. This study assesses the current state of CE adoption by plastic businesses in plastic recycling villages based on the ReSOLVE framework. The research findings indicate that the practices are still at the initial implementation stage and lacking specialized measures for environmental management and practical solutions. The study also identifies the strengths and weaknesses of enterprises in craft villages when transitioning to a circular economy and proposes solutions to promote CE adoption among plastic businesses in craft villages.

Keywords: Circular economy, Plastic waste, craft village, ReSOLVE framework, environment.

1. Introduction

More than 100 definitions of the circular economy have been proposed to date. The most widely accepted definition is the one presented by the Ellen MacArthur Foundation (EMF) at the World Economic Forum in 2012: "A circular economy is a restorative and regenerative system by intention and design. It replaces the end-of-life concept with restoration, shifts towards

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renewable energy, eliminates toxic chemicals that hinder the reuse of materials, and aims to eliminate waste by designing materials, products, technical systems, and business models" [1, 2].

According to Clause 1, Article 142 of the Environmental Protection Law 2020, a circular economy is an economic model in which the activities of design, production, consumption, and service aim to reduce the extraction of raw materials and materials, extend the life cycle of products, limit waste generation, and minimize adverse environmental impacts. The definition of the circular economy in the Environmental Protection Law 2020 provides a framework for promoting this model in Vietnam. It is a vital tool for achieving the country's sustainable development goals [3].

Thus, from an overall perspective, the circular economy is an economic system that continuously regenerates and restores, changing how goods and services are designed, produced, and consumed. Therefore, a circular economy is understood as a closed operating cycle. The output products of this process or waste can be returned, becoming production materials and input for another process. This will help reduce natural raw materials, save resources, reduce negative environmental impacts, and protect the ecosystem and human health.

Plastic recycling is a type of production within scrap recycling craft villages. It involves using plastic items, such as cans and bottles, from the waste stream to create raw materials for new recycled plastic products. Plastic recycling in craft villages in Northern Vietnam is a widespread practice. These craft villages are typically small-scale, often operating at a household level, and clustered together with a long tradition. Production technology remains manual, and input materials are mostly uncleaned scrap. Most production facilities lack measures to control pollution, treat waste, and ensure necessary labor protection [4, 5]. Therefore, although the quantity is small, plastic recycling craft villages have been causing severe environmental problems [5, 6]. Some studies have shown the socio-economic benefits and risks to the environmental quality of plastic recycling craft villages [5, 7].

To improve environmental quality, recycling efficiency, and energy consumption in craft villages, transitioning to a circular economy is essential for Vietnamese plastic manufacturing businesses in these areas. Evaluating the current implementation status of the circular economy is necessary to support this transformation, identify areas for improvement, and capitalize on potential opportunities.

The circular economy is a research area attracting significant interest from various stakeholders. Several studies have been conducted in this field, including overviews of international experiences on circular economy and suggestions for Vietnam [8, 9], research on circular economy models for Vietnam's plastic industry [10], and explorations of developing a circular economy in Vietnamese businesses [11]. These studies provide a solid scientific and theoretical foundation for implementing a circular economy in Vietnam, particularly within the plastic industry. However, prior research has yet to assess the current status and potential of implementing a circular economy for plastic businesses, especially those in craft villages.

The ReSOLVE framework was used to evaluate the implementation of CE practices in the facility/sector [1]. The ReSOLVE framework is a set of six business actions built on preserving natural resources, optimizing resources, and eliminating negative external effects. The framework's actions are Regenerate, Share, Optimize, Loop, Virtualize, and Exchange. The framework is commonly used to evaluate the implementation of CE practices in various sectors, such as the built environment [12], municipal waste management [13], manufacturing industry [14], climate change [15], planted tree sector in Brazil [16], and the water and wastewater sector [17, 18]. However, this tool has not yet been used to determine potential circularity in the plastic industry. In the past, our research used the ReSOLVE framework to identify current and potential

practicing CE in the plastic sector. There are a lot of differences between the plastic industry and plastic in craft villages.

This study fills this gap by assessing the current state and potential of implementing a circular economy for plastic businesses in plastic recycling craft villages of Vietnam.

2. Methods

2.1. Methods of Collecting Secondary Information

This study gathers information on the Vietnamese plastics industry from various sources, including national reports or research on plastic waste, relevant legal regulations, and practical solutions for implementing a circular economy. In addition, articles and books have been researched and used to evaluate the current status of plastic waste research in Vietnam and worldwide.

2.2. Sociological Investigation Methods

Phan Boi and Minh Khai in Hung Yen province are two villages known for plastic recycling. These villages primarily focus on purchasing, producing, and trading recycled plastic products.

Their source materials include used plastic bags, components, and packaging, collected domestically and even imported. Notably, plastic in these two craft villages is limited. This lack of advanced technology creates significant pressure on the environmental quality of both villages [19].

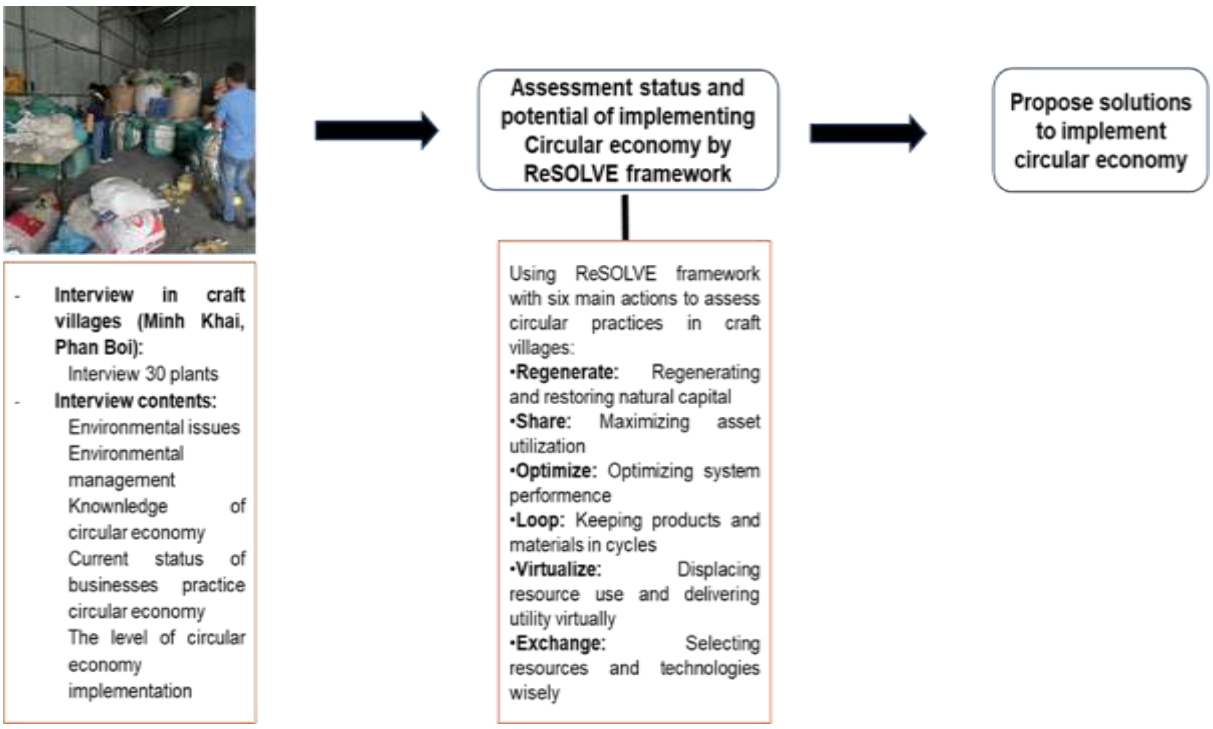


Figure 1. Method diagram.

Plastic collection and recycling activities in plastic craft villages form a production chain supplying recycled plastic to the local and surrounding areas. The survey identified four primary types of production in Minh Khai and Phan Boi plastic craft villages: i) Primary collection: Establishments purchase plastic waste from households and waste collectors and resell it to other businesses; ii) Secondary collection: Individuals and businesses purchase

scrap plastic from primary collectors within and outside the villages. The collected plastic is then sorted and resold; iii) Primary recycling: Producers buy scrap plastic from secondary collectors and other sources and then process it into plastic granules; and iv) Secondary recycling: Producers create plastic products, such as bags, chairs, tables, cups, and mugs.

This study focuses on two primary production types, primary and secondary recycling, to investigate and assess their knowledge and circular economy practices. The number of primary and secondary recycling enterprises in these two craft villages is limited, and access to these enterprises is also challenging. Therefore, this study only surveyed 30 businesses in Minh Khai and Phan Boi craft villages using interview questionnaires to determine the current application of the circular economy model in plastic production and trading businesses. The research steps are outlined in Figure 1.

2.3. Evaluation Method of Implementing Circular Economy According to the Resolve Analysis Framework

There are six business actions to implement the principles of the circular economy representing significant circular business opportunities depicted by the ReSOLVE framework [1]. This study uses the ReSOLVE framework [1, 20] to assess activities toward a circular economy in plastic businesses in craft villages. Specifically, the evaluation criteria are as follows:

Table 1. Circular practices were used to evaluate facility performance [16]

ReSOLVE	Description of practices
Regenerate	Has waste management for regeneration of what can be used.
	Practices reverse logistics of the inputs used.
	Generates non-toxic residues in the process.
	Uses raw material from renewable sources.
	Uses energy from renewable sources (clean).
Share	Performs sharing (cars, rooms, materials for professional use, appliances, etc.).
	Practice sharing with other companies (equipment, training, resources, raw materials, etc.).
	Uses second-hand (used) products.
	Provides rental, sharing, leasing and concession services.
	Performs life cycle analysis of products.
Optimize	Invests in technology to increase product performance/efficiency and its useful life.
	Invests in technology to optimize the use of resources and reduce waste generation.
	Invests in continuous improvement.
	Avoids/reduces the generation of waste in the process.
	Campaigns on conscientious consumption.
	Encourages customers and suppliers to reduce consumption.
	Uses production methods based on cleaner production, avoiding the generation of waste through the maximum use of inputs.
	Replaces the use of toxic substances.
	Refuses to buy and sell products with dangerous components.
	Refuses products or services from companies that do not respect environmental legislation.
	Has a closed cycle for using water in the process.
	Has a high technological level of research and development.
Loop	Practices product reuse.
	Uses reusable and/or recycled inputs (e.g., packaging).
	Encourages the consumption of reused products.

	Encourages the reduction of consumption of products and resources.
	Encourages recycling and reconditioning as an alternative to disposal.
	Encourages the use of waste for energy production.
	Products are designed with the possibility of reuse and recycling in mind.
	Practices recycling of materials.
	Performs the extraction of substances from waste.
Virtualize	Practices dematerialization in sales (use of digital technologies).
	Practices dematerialization in purchases (use of digital technologies).
	Uses technological resources that reduce the use of offices and travel.
	Uses advertising and digital marketing campaigns.
	Provides solutions in the form of services, product-service system.
Exchange	Replaces the use of non-renewable materials with more advanced ones.
	Updates products/services.
	Updates older technologies with more efficient ones.

To quantify the level of practice application, a scaled scoring system from 0 to 10 is used, with 0 points assigned to “Nonexistent” (KTT), 4 points to “Newly Implemented” (MTH), 7 points to “Established” (DTL), and 10 points to "Optimized” (TUH). We then recorded the average scores and standard deviations for adopting each practice and action group within the ReSOLVE framework.

2.4. SWOT Analysis

SWOT analysis evaluates an organization's internal strengths and weaknesses and external opportunities and threats within its environment. Internal analysis identifies the organization's resources, capabilities, core competencies, and competitive advantages. The external analysis identifies market opportunities and threats by examining competitor resources, the industry environment, and the broader external environment [21].

This study employs a SWOT analysis to identify the strengths, weaknesses, opportunities, and challenges plastic manufacturing enterprises face in Minh Khai and Phan Boi craft villages implementing circular economy initiatives. Based on these findings, appropriate circular economy implementation solutions for these enterprises will be proposed.

3. Results and Discussion

3.1. Current Status of Production, Business, and Awareness of the Circular Economy of Some Plastic Businesses in Craft Villages

Figure 2. Production scale according to investment capital.

A survey of plastic manufacturing enterprises in craft villages revealed that most respondents (40% to 43.33%) were small and medium-sized businesses with investment capital below 1 billion VND. These businesses primarily engage in initial plastic recycling. They purchase plastic waste collected by households, then sort, clean, and grind or shred it into plastic granules and flakes. Some

businesses produce plastic products such as bags, chairs, tables, cups, and mugs.

During the survey, when the concept of circular economy was not explained, a significant portion of businesses (86.7%) reported not implementing any circular economy practices (Fig. 3a). However, after the concept was presented, this number dropped to 73.3% (Fig. 3b). This suggests that many businesses, particularly small ones, were unfamiliar with the idea of the circular economy. Their resource-saving practices likely stemmed primarily from cost-reduction goals rather than a conscious effort toward circularity (Fig. 3).

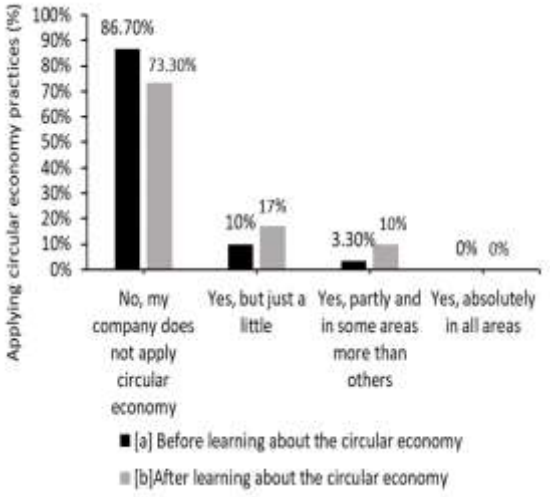


Figure 3. Percentage of establishments applying circular economy practices.

A survey of businesses in craft villages revealed a concerning lack of environmental management practices. Most (73.3% - 90%) do not implement any solution, with information sharing being the least adopted (90%). This suggests a reluctance among businesses to share production and management knowledge. Partial implementation of environmental solutions is also limited, ranging from 3% to 23.3%. While partially applied renewable energy (23.3%) and cleaner production solutions (20%) are the most common practices, they focus primarily on cost-saving within the production process rather than a commitment to environmental sustainability. Overall, the complete application of environmental management solutions remains very low (0-10%) (Fig. 4).

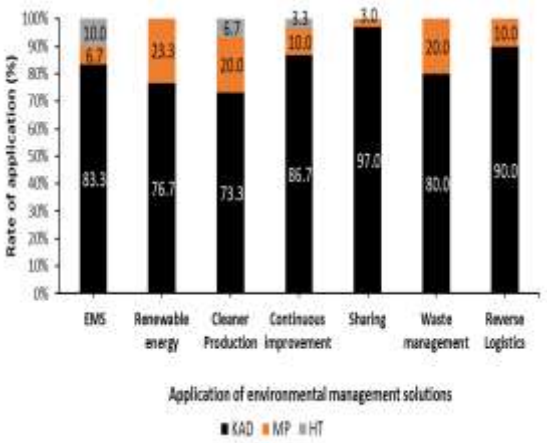


Figure 4. Rate of application of environmental management solutions by businesses in the study area.
Note: KAD: Not applicable; MP: Partially applicable; HT: Fully applicable.

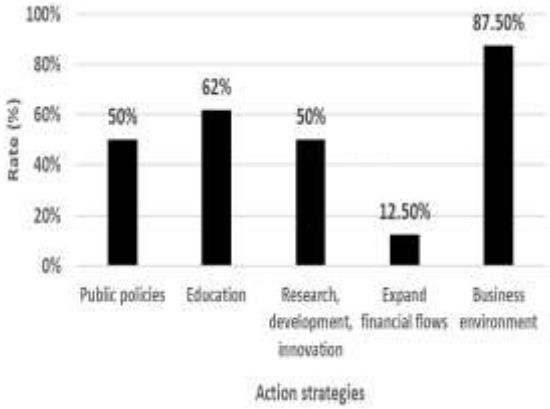


Figure 5. Essential action strategies in encouraging the adoption of a circular economy.

Interviews identified businesses' most critical strategies for promoting circular economy adoption: a supportive business environment (particularly market cooperation) and educational initiatives (Fig. 5). This aligns well with the current awareness regarding the circular economy. Since the concept is not yet widely understood, a market environment that

promotes circular practices is crucial. Additionally, educational policies are essential to raise awareness and shift mindsets among businesses and workers. This shift prioritizes environmental protection alongside economic benefits, ultimately contributing to a sustainable economy.

3.2. Assess the Current Status of Implementing the Circular Economy Model in Plastic Businesses According to the ReSOLVE Framework

The results of the investigation and interviews with 30 plastic plants on implementing practices belonging to 06 action groups according to the ReSOLVE framework are presented in Table 2 and Figure 6 as weighted score evaluations.

Table 2. Implemented Circular Economy in the plastic recycling businesses, according to the ReSOLVE framework

Re-SOLVE	Description of practices	Code	Point					Average point	Standard deviation σ
			KTT	MTH	ĐTL	TUH	Total		
Regenerate (Re)	Has waste management for regeneration of what can be used.	Re1	0	0.8	0.5	0	1.3	0.6	0.2
	Practices reverse logistics of the inputs used.	Re2	0	0.3	0.5	0	0.8		
	Generates non-toxic residues in the process.	Re3	0	0.1	0	0	0.1		
	Uses raw material from renewable sources.	Re4	0	0.8	0	0	0.8		
	Uses energy from renewable sources (clean).	Re5	0	0	0	0	0		
Share (S)	Performs sharing (cars, rooms, materials for professional use, appliances, etc.).	S1	0	0.1	0	0	0.1	0.3	0.1
	Practice sharing with other companies (equipment, training, resources, raw materials, etc.).	S2	0	0.1	0	0	0.1		
	Uses second-hand (used) products.	S3	0	0.5	0.5	0	1		
	Extends the life of products with designs aimed at durability.	S4	0	0.3	0	0	0.3		
	Provides rental, sharing, leasing and concession services	S5	0	0	0	0	0		
	Performs life cycle analysis of products.	S6	0	0	0	0	0		
Optimize (O)	Invests in technology to increase product performance/efficiency and its useful life.	O1	0	0.3	0.2	0	0.5	0.7	0.2
	Invests in technology to optimize the use of resources and reduce waste generation.	O2	0	0.4	0.5	0	0.9		
	Invests in continuous improvement.	O3	0	0	0.5	0	0.5		
	Avoids/reduces the generation of waste in the process.	O4	0	0.9	0	0	0.9		
	Campaigns on conscientious consumption.	O5	0	1.1	0	0	1.1		
	Encourages customers and suppliers to reduce consumption.	O6	0	0	0	0	0		
	Uses production methods based on cleaner production, avoiding the generation of waste through the maximum use of inputs.	O7	0	0.3	0.2	0	0.5		
	Replaces the use of toxic substances	O8	0	0.4	0	0	0.4		

	Refuses to buy and sell products with dangerous components.	O9	0	0	0.5	0	0.5		
	Refuses products or services from companies that do not respect environmental legislation.	O10	0	0.5	0.5	0	1		
	Has a closed cycle for using water in the process.	O11	0	0.8	0	0.7	1.5		
	Has a high technological level of research and development.	O12	0	0	0	0	0		
Loop (L)	Practices product reuse.	L1	0	0.7	0.5	0	1.2	0.5	0.2
	Uses reusable and/or recycled inputs (e.g., packaging).	L2	0	0.5	0.5	0	1		
	Encourages the consumption of reused products.	L3	0	0.7	0	0	0.7		
	Encourages the reduction of consumption of products and resources.	L4	0	0	0.5	0	0.5		
	Encourages recycling and reconditioning as an alternative to disposal.	L5	0	0.1	0	0	0.1		
	Encourages the use of waste for energy production.	L6	0	0	0	0	0		
	Products are designed with the possibility of reuse and recycling in mind.	L7	0	0	0	0	0		
	Practices recycling of materials.	L8	0	0	0.5	0	0.5		
	Performs the extraction of substances from waste.	L9	0	0.4	0	0	0.4		
Vertualize (V)	Practices dematerialization in sales (use of digital technologies).	V1	0	0.3	0.2	0	0.5	0.3	0.1
	Practices dematerialization in purchases (use of digital technologies).	V2	0	0.3	0.2	0	0.5		
	Uses technological resources that reduce the use of offices and travel.	V3	0	0	0	0	0		
	Uses advertising and digital marketing campaigns.	V4	0	0.3	0	0	0.3		
	Provides solutions in the form of services, product-service system.	V5	0	0	0	0	0		
Exchange (E)	Replaces the use of non-renewable materials with more advanced ones.	E1	0	0	0	0	0	0.4	0.2
	Updates products/services.	E2	0	0.7	0	0	0.7		
	Updates older technologies with more efficient ones.	E3	0	0.4	0	0	0.4		

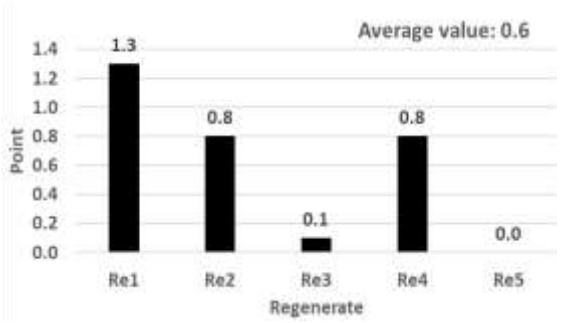
Note: KTT: Nonexistent; MTH: Newly Implemented; DTL: Established; and TUH: Optimized.

An evaluation using a weighted scoring system was conducted based on a survey and interviews with 30 plastic businesses. The evaluation assessed their implementation of practices within six action groups defined by the ReSOLVE framework. The results revealed generally low scores across all six action groups, indicating that most practices are not widely implemented in these small-scale enterprises.

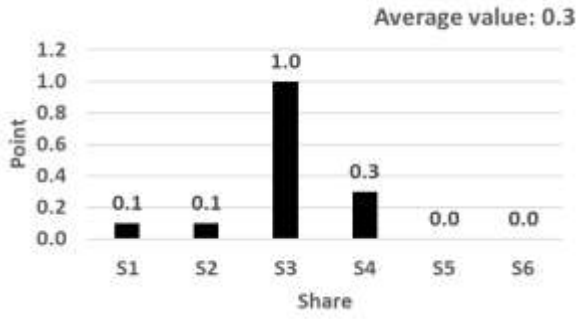
Among the action groups, "Optimize" achieved the highest average score (0.7 points). Notably, the practice of "Having a closed-loop water system in the process" received the highest individual score within this group (1.5 points) (Fig. 6c).

It can be seen that the practices of the Optimize-O group are focused on businesses, especially large-scale businesses. These practices all contribute to increasing economic benefits for enterprises, such as reducing investment costs in input materials and reducing output waste treatment costs. Besides, saving resources and costs is mainly brought about by the water reuse process (the closed cycle of water use). However, this group's practice of "Encouraging customers and suppliers to reduce

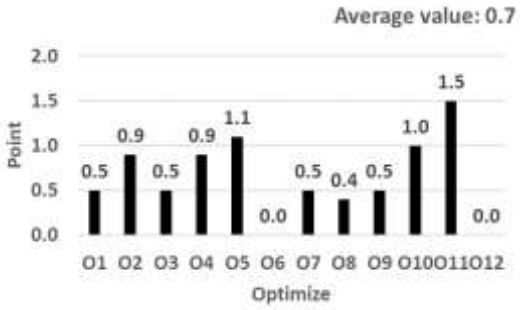
consumption" is not implemented at all by businesses because businesses do not want to reduce their customer base and lose potential customers.



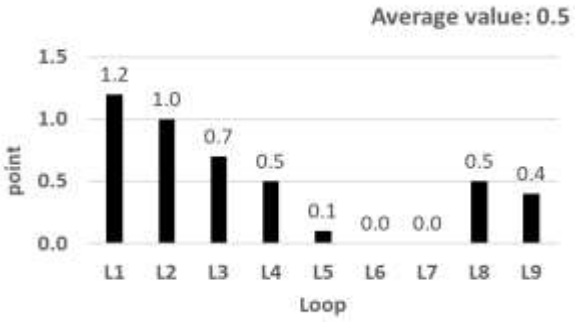
a. Regenerate



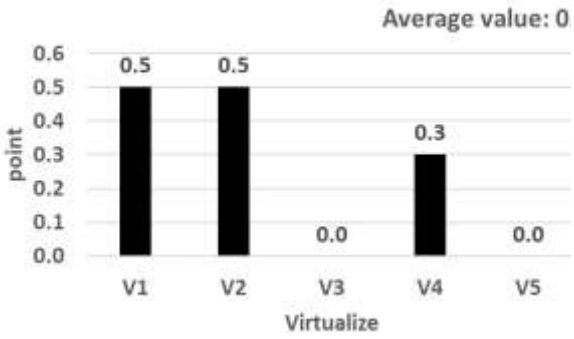
b. Share



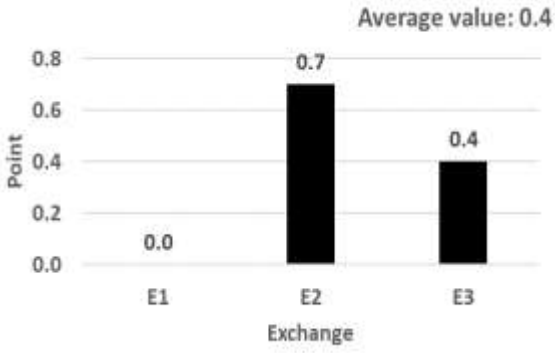
c. Optimize



d. Loop



e. Virtualize



f. Exchange

Figure 6. Results of six action groups in the ReSOLVE framework.

Following "Optimize", practices within the "Regenerate-Re" group achieved an average score of 0.6 points (Fig. 6a). This group emphasizes waste management to regenerate materials and closed-loop water systems, practices that align with businesses' desire to save resources during plastic production and recycling. However, "Using energy from renewable (clean) sources" stands out as the only practice absent (0% adoption) within this group. Interviews revealed that businesses perceive transitioning to renewable energy as expensive and difficult to manage. As previous studies have demonstrated, the information exchange system within logistics is limited in supporting the transition to a circular economy. Goods flows, including those involved in reverse logistics and supply chain management, are managed through logistics services. The current network design is a barrier to achieving circular economy goals and requires adaptation to facilitate seamless shifts between transportation modes [22].

The "Loop" action group (Fig. 6d) ranked third in performance with an average score of 0.5 points. This group extends reuse beyond waste materials (Regenerate-Re) to include inorganic or "technical" materials. These materials can be recycled or, even better, remanufactured. "Reusing products" is the most common practice within this group, scoring a relatively high 1.2 points, second only to "closed-loop water use" and "waste management". This highlights the cost-effectiveness and importance of reuse in saving raw materials and boosting economic efficiency. However, two practices within "Loop" remain unimplemented: "Encouraging the use of waste to produce energy" and "Designing products for reuse and recycling". Survey results show these practices score 0 points due to perceived difficulty, cost, and the challenge of measuring their effectiveness.

The Exchange (E) action group (Fig. 6f) stands out for its minimal implementation. Notably, 100% of plastic manufacturing facilities do not engage in "Replacing the use of non-renewable materials with more advanced materials." This suggests that a primary focus on economic benefits may overshadow resource conservation and environmental protection efforts. Similarly, a study by Rizos et al. identified a lack of skills within small- and medium-sized enterprises (SMEs) as a significant barrier to implementing the circular economy. These businesses often fail to recognize the potential benefits of adopting more advanced technologies, which can reduce environmental impacts and generate cost savings [23].

The Share (S) and Virtualize (V) action groups (Fig. 6b and Fig. 6e, respectively) see almost no implementation among plastic manufacturers. This reluctance likely stems from a culture of confidentiality, as most businesses hesitate to share internal production information to avoid potential losses. Additionally, 100% of companies do not conduct a "Life Cycle Assessment" (LCA). While LCA is crucial for identifying opportunities to implement a circular economy, it remains a new concept for many businesses, leading to a lack of adoption.

The barriers to implementing a circular economy within plastic enterprises identified in this study align with findings from other research. For example, a study by author Jaeger and colleagues highlighted several challenges faced by plastic enterprises, including the quality of recycled materials, the complexity of the supply chain, coordination issues among companies, product design and production limitations, difficulties in product dismantling, and high initial investment costs [24].

Based on the business surveys and circular economy practice evaluations, here are some general observations on plastic production and recycling practices in the study area (Table 3).

Table 3. Analysis SWOT in plastic businesses

Strengths (S)	Weaknesses (W)
- Recycling and production of plastic products takes place concentrated in craft villages.	- Haven't had access to regulations/policies/practice guidelines for the plastic industry. - Recycling technology is not modern,

- Abundant labor source, low labor costs. - Have its own collection and recycling system. - Large recycling market. - Possesses a skilled workforce and the potential to create value from waste.	especially for small businesses; having difficulty investing in technological change. - Raw materials are mainly imported from abroad. - Business awareness of plastic waste and recycling is not complete.
Opportunities (O) -The Government and state pay attention to and promote the implementation of circular economy through regulations codified in legal documents. - Encourage and have mechanisms to encourage businesses to implement circular economy. - The plastic industry is one of the industries with natural potential suitable for implementing a circular economy.	Threats (T) - Documents guiding the practice of circular economy for the plastic industry are not yet available - Businesses are not willing to convert/change the use of renewable energy. - The scale of businesses is often medium and small, so they have limited access to information and willingness to invest/improve production technology.

3.3. Promoting Circular Economy in Plastic Businesses

According to the results of assessing the level of implementation of circular economy (CE) solutions according to the ReSOLVE framework, it is evident that most plastic manufacturing enterprises in craft villages have not yet adopted circular economy practices. Although there are existing policies and legal regulations to promote the transition to a circular economy, there is a need for more detailed sub-law regulations to provide specific guidance for different industries and enterprises. This includes clearly defined incentive mechanisms, implementation procedures, and evaluation criteria. Inconsistent recycling standards and infrastructure create barriers to efficient circular economy systems. Therefore, based on the current status of CE practice in plastic recycling craft villages and CE implementation in Vietnam, this study proposes several solutions to promote the CE implementation process for the plastic industry, especially for plastic businesses in craft villages.

- Solutions to maintain O – Re – L implementation for large-scale enterprises:

A clear legal framework, from Party guidelines to national laws and policies, is essential to support the development of a circular economy, particularly within the plastics industry. This framework should be complemented by an official website that provides easily accessible models for circular economy practices. This website can empower plastic manufacturers to make environmentally responsible choices by providing information on energy and fuel conservation, using renewable energy sources, and emissions reduction. This two-pronged approach – establishing a legal foundation and offering practical guidance – will drive the transition towards a circular plastics economy. Large enterprises generally have better access to information and technology than small enterprises. To address the gaps identified in Re – O – L practices, the following solutions are recommended for this group: i) Regenerate-Re: Innovate recycling technology, utilize renewable energy to reduce environmental emissions, and enhance the quality of recycled products to improve their competitiveness; ii) Loop-L: Extend the lifecycle of plastic products through redesign, enabling easier recovery, reuse, and recycling of used products; iii) Optimize: Employ less toxic production processes and promote reduced consumption

- O – Re – L approach solutions for small-scale businesses:

Small businesses typically need more time to transition to a circular economy. To start, we should launch an educational campaign to increase awareness and understanding of the circular economy and its benefits among this group. Then, it's essential to guide how to transition, helping these businesses identify their

position in the plastics and recycling supply chain and implement suitable strategies. Government support facilitates access to capital, appropriate production facilities, and advanced production and recycling technologies. A comprehensive, multi-faceted roadmap is necessary to effectively promote the circular economy transition for plastic businesses, particularly small-scale enterprises.

- Solutions to improve the ability to access and implement E – S – V in all scale businesses:

The analysis of the E – S – V above activities indicates that most businesses have not implemented these solutions. Therefore, this study proposes several strategies to promote E – S – V adoption.

For the Exchange element, a successful transition to a circular plastics economy necessitates a comprehensive approach encompassing policy, public awareness, and technological innovation. Firstly, businesses should modernize production technology by replacing non-renewable materials with advanced alternatives and fostering research and development of production technologies that support biodegradable, reusable, and environmentally friendly products.

Increased sharing within the plastics supply chain is crucial to implementing the Share action of the ReSOLVE framework. This involves sharing assets (e.g., cars, rooms, professional equipment, appliances) or resources (e.g., equipment, training, raw materials) among businesses.

Regarding the Virtualize element, integrating information technology into production and business operations is essential. This includes utilizing technology to reduce office space and travel, employing digital marketing campaigns, and offering service-based solutions.

Implementing these E – S – V strategies requires a clear legal framework with detailed guidelines. This framework should encompass general circular economy regulations, specific implementation responsibilities, incentive mechanisms to encourage adoption, and economic instruments to protect the environment. Fostering public-private partnerships is crucial to raising awareness among plastic businesses about the importance of circular economy principles.

4. Conclusions

A comprehensive study was conducted to evaluate the applicability of the ReSOLVE framework within the context of plastic businesses operating in craft villages. To assess the current state and potential for improvement of circular economy practices, a weighted scoring methodology on a 10-point scale was employed. The findings indicate a low adoption rate of circular economy principles among most businesses. Notably, the 'Optimize' category exhibited the highest performance with a score of 0.7, while the 'Share' and 'Virtualize' categories demonstrated the lowest levels of implementation.

A SWOT analysis was performed to gain a deeper understanding of the factors influencing circular economy adoption, identifying the businesses' strengths, weaknesses, opportunities, and threats. The plastic craft village boasts a skilled workforce and the potential to generate value from waste. However, limited knowledge of circular economy principles, inadequate infrastructure, and negative public perception pose challenges. Opportunities arise from government and state attention to and promoting circular economy through formalized regulations. Threats include restricted access to information and a reluctance to invest in or improve production technology. Based on these insights, the research proposes actionable recommendations to stimulate the integration of circular practices within the studied region. Future efforts necessitate the involvement of the government, regulatory bodies, non-governmental organizations, and businesses in fostering the implementation of the circular economy in plastic craft village enterprises. Simultaneously, policy frameworks that incentivize and support enterprises, coupled with

detailed circular economy implementation guidelines, are essential.

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