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Implementing EPR as a Tool for Addressing Environmental Issues in Vietnam

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Abstract

The Extended Producer Responsibility (EPR) scheme has emerged as a critical environmental policy instrument around the world, holding great promise for addressing significant environmental challenges in Vietnam, a country undergoing fast economic expansion and industrialization. This literature review proceeds to describe Vietnam's EPR program, focusing on its regulations and implementation procedures. By highlighting several obstacles and directions in Vietnam, this review emphasizes the importance of aligning EPR strategies with the country's socio-economic context to achieve sustainable management of waste and a circular economy.

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Keywords

Extended producer responsibility (EPR), Vietnamese regulations, waste management, sustainable development

1. Introduction

The extended producer responsibility (EPR) is defined by the Organization for Economic Cooperation and Development as "An environmental policy in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle" (OECD, 2001). EPR represents a paradigm shift in environmental governance, with the core principle of placing the onus of responsible product management squarely upon producers. By doing so, EPR aims to curtail the externalities of production and consumption, mitigate the environmental impacts of waste generation, and foster resource efficiency. Its adoption marks a significant shift in global environment strategies (Pouikli, 2020b), offering promising avenues to address environmental issues and transition toward a circular economy (Jana Brinkmann, 2022).

Vietnam is in the stages of development (World Bank, 2023) and undergoing rapid industrialization and urbanization (Nguyen et al., 2019; Shibuya, 2018). It is one of the ASEAN region's fastest-developing economies (Hoang et al., 2019). However, this growth has resulted in the degradation of the environment (Chu, 2018). The rapid growth of the population is outpacing the provision of essential resources such as clean water, adequate housing, and green spaces (Nguyen Van Dao, 2020). Vietnam used to emit very low greenhouse gas emissions, but in the last two decades, it has had some of the world's fastest emissions growth rates (World Bank Group, 2022). Moreover, water pollution is particularly acute in urban and surrounding industrial areas, and river basins exhibit concentrated water quality degradation in their midstream and downstream regions (ADB, 2022; Hoi, 2020; MONRE, 2021). Furthermore,

Vietnam is shifting from an energy exporter to an energy importer because the finite supplies of fossil fuels continue to be depleted (X. P. Nguyen et al., 2021). This country is also under enormous strain from solid waste since infrastructure and management are unable to keep up with the increasing volumes of waste, which have doubled in less than 15 years (Office of the Government, 2016). More especially, the Vietnamese government subsidizes almost 80% of solid waste management costs (World Bank in Vietnam, 2018). Therefore, with the burgeoning challenges of environmental degradation, resource depletion, and waste management in Vietnam, the introduction of EPR offers a timely opportunity to redress these issues and promote circular economies.

This review, by synthesizing and critically evaluating the existing body of scholarly work, seeks to delineate the theoretical foundations of EPR and present its regulations, implementation process, and potential challenges in the Vietnamese context. Additionally, its purpose is to identify gaps in the current research and present avenues for future actions, contributing to the effort to develop sustainable environmental management practices and policy development in Vietnam.

2. Overview about EPR

2.1 EPR concept

Establishing a clear and accurate notion of EPR within the scope of environmental management is essential. Introduced by Thomas Lindqvist in 1990 in a report to the Swedish Ministry of Environment (Abhishek Gaur, 2022; Thomas, 2000), EPR is defined by the OECD as an environmental policy that broadens a producer's responsibility for an item to the post-consumer phase during the product's life cycle. This shift means that producers are now accountable, either partially or fully, for products environmentally, moving responsibilities from local government to producers and incentivizing eco-conscious product design (N. Kunz, 2018; OECD, 2016a). According to the EPR concept, its scope covers extends beyond financial responsibility for producers; it also encompasses accountability for information dissemination, transportation, waste management, and environmentally conscious product design (Nathan Kunz, 2014). In addition, as an environmental strategy, EPR can be implemented using different policy instruments (Forslind, 2005). At its foundation, EPR is a commitment by manufacturers and producers to assume responsibility for their products throughout their entire lifecycle. It encompasses not only the producing and distributing phases but also the crucial post-consumer stage, which includes product collection, recycling, and proper disposal. (Gupt & Sahay, 2015; OECD, 2014b).

By doing so, EPR not only reduces the detrimental environmental effects of products but also encourages a more circular economic system in which resources are preserved and used efficiently. EPR recognizes the complex relationship between production, consumption, and environmental repercussions, highlighting that efficient environmental management requires the active participation of those who introduce new items to the marketplace (Cai & Choi, 2021). Therefore, it is a strategic tool for addressing the rising environmental challenges faced by contemporary society.

2.2 Theoretical framework for EPR

The theoretical basis for the EPR initiative is rooted in several key concepts and principles, as follows:

Firstly, EPR is grounded in the principle of producer responsibility, requiring the producer or importer to be accountable for their product’s impact on the environment. This notion is based on the premise that individuals who deliver goods to the market should bear responsibility for every phase of their lifecycle, including disposal and environmental repercussions (N. Kunz, 2018). Furthermore, it aligns with the Polluter Pays Principle, which states that those who cause environmental harm or pollution should share the expense of mitigating or controlling that damage. In the framework of EPR, producers contribute financially to the collection, recycling, or secure disposal of their goods in order to reduce environmental effects (Barbara Siuta-Tokarska, 2022; Pouikli, 2020a). Additionally, EPR is closely related to the theories of a circular economy, striving to reduce waste while increasing resource efficiency. It promotes the development of items that are easy to either refurbish or reuse, thereby lowering the requirement for virgin resources and decreasing the harmful effects on the environment (Bening Mayanti, 2023; Căpriță, 2019; N. Kunz, 2018; Pouikli, 2020a). Lastly, EPR emphasizes the importance of stakeholder engagement

and collaboration among different parties, such as producers, government organizations, consumers, and waste management organizations, which is essential for successful EPR implementation. The framework highlights the significance of working together to achieve environmental goals. (WWF, 2020b; WWF Philippines, 2022).

Overall, the theoretical framework for EPR is built on the principles of producer responsibility, circular economy, economic incentives, and stakeholder collaboration. It provides a structured approach to addressing environmental challenges associated with product lifecycles while promoting sustainable production and consumption practices.

2.3 The benefits and challenges of EPR implementation

The deployment of EPR programs brings a range of advantages and, concomitantly, confers certain disadvantages. The manifestation of these advantages and disadvantages is contingent upon the precise program configuration, industrial sector, and regulatory framework. Herein, a synopsis of the advantages and drawbacks associated with the operationalization of EPR initiatives is provided.

2.3.1 Benefits of EPR implementation

The EPR program is an innovative procedure for product management that provides several benefits. In this overview, the main advantages of EPR, such as waste reduction, resource conservation, pollution avoidance, economic growth, environmentally friendly design, transparency, and a greater public understanding… are described. These advantages highlight the critical role that EPR plays in establishing a more sustainable and environmentally conscious future.

EPR programs have made significant contributions to ***waste collection and recycling efforts***. Under this scheme, collection and recycling rates of products can be increased due to the financial support for proper waste management (Julian Ahlers, 2021). EPR provides a financial incentive for companies to build more efficient recycling systems by putting the responsibility for end-of-life product management on them (Campbell-Johnston et al., 2021). For example, between 1997 and 2000, container and packaging trash recycling in Japan rose by 27% (1.25 to 1.59 million tonnes) (OECD, 2014b). Moreover, the percentage of waste that is recycled in the EU climbed from 47% (EU15) to 65% (EU27) between 1998 and 2012 (EUROPEN).

EPR programs emerge as influential drivers of ***economic benefits for both producers and governments***. According to Atasu and Subramanian (2012), carrying out technical innovation within EPR schemes helps producers minimize product costs and boost economic benefits in terms of ecological design, regenerative raw materials, and recycling. For example, the EPR program in Japan led tea companies to stop using colored PET bottles and to start producing thinner ones, helping them reduce waste collection costs (Hosoda, 2004). From the perspective of local authorities, EPR can play a pivotal role in mitigating the financial burden of waste management (OECD, 2016b; Walls, 2006; WWF, 2020b). Through the strategic transfer of responsibility for end-of-life product management from government officials to producers, EPR effectively curtails the volume of waste managed by local authorities, thereby alleviating the associated financial costs (Campbell-Johnston et al., 2021).

In addition, one of the most significant benefits of the EPR program is its unwavering encouragement of ***sustainable product design***. Tojo (2004) argues that mandatory EPR programs have positive effects on the environmental design strategies of enterprises. EPR is an opportunity for manufacturers to imbue items with the values of durability, recyclability, and resource efficiency (Davies, 2023). Yuqi Peng (2020) and Chang et al. (2019) also show that implementing EPR programs motivates producers to develop eco-innovation. This emphasis on eco-friendly design fits in perfectly with global efforts to reduce negative environmental repercussions.

EPR programs aim to ***reduce waste generation*** by encouraging responsible product disposal, recycling, and reuse (Wang, 2012). Opoku (2004) proposed that EPR promotes waste prevention and reduction during the manufacturing phase by connecting all phases of the product's life cycle and supporting actions for product improvement. It significantly reduces the quantity of waste that ends up on dumping grounds and burning facilities (Stephanie Newman, 2015). EPR incentivizes manufacturers to create goods with incredible lifespans and lower ecological impact, aligning with sustainability aims.

EPR helps conserve to ***reduce resource consumption*** by promoting the recovery and recycling of materials (WWF, 2020a). It minimizes the demand for virgin resources while also conserving natural resources (I. A. Ajania, 2019). The methodical recovery and reuse of materials adhere to the fundamentals of a circular economy, in which resources are efficiently conserved and reused, decreasing the strain on ecosystems and supporting sustainable resource management.

These advantages are supported by empirical research and scientific evidence, elucidating the favorable repercussions of EPR programs on environmental, economic, and societal domains.

2.3.2 Challenges of EPR implementation

EPR initiatives have been introduced across the globe to address the environmental consequences of product end-of-life. However, in addition to their benefits, EPR programs have several limitations and obstacles.

The implementation of EPR programs requires significant ***financial investments*** on the part of both governments and manufacturers (OECD, 2021). Governments must budget for program development, database collection, regulatory compliance, and administrative tasks. Meanwhile, manufacturers are dealing with increased compliance costs, which include trash collection, recycling facilities, and reporting obligations. These interconnected financial repercussions can put pressure on the government and small and medium-sized enterprises. As a result, determining the exact expenses of program implementation and balancing the involvement of both government and business becomes critical to optimizing the efficiency of EPR projects.

EPR programs can ***overburden SMEs***, which usually lack the necessary administrative and financial resources to handle the complexities of compliance (Yasuhiko Hotta, 2009). This circumstance can lead to decreased competitiveness and, in the worst-case scenario, business closures. SMEs may need assistance in completing reporting requirements, complying with recycling guidelines, or reacting to changes in packaging and product design. Addressing the compliance costs for SMEs is critical to maintaining a fair playing field and encouraging broad participation in EPR initiatives.

EPR regulations ***vary in complexity and scope*** across jurisdictions, posing significant obstacles to enterprises operating in numerous regions (Kolk et al., 2001). Regulatory differences in types of products, recycling goals, and reporting techniques create confusion and increase compliance costs. To address this challenge, manufacturers need to spend time understanding and responding to the demands of each jurisdiction in which they operate. Striking for EPR regulation harmonization at the regional, national, or global levels is a promising answer for reducing complexity and streamlining compliance for geographically diversified organizations.

Despite the intention of EPR programs to hold manufacturers responsible for end-of-life goods management, the potential of ***cost-shifting to consumers*** arises (Gottberg et al., 2006). Manufacturers may respond to increased compliance costs by raising product pricing, essentially shifting the financial responsibility back to end consumers. Striking a careful balance between responsibility for producers and customer affordability becomes a critical factor in EPR program design. Effective regulatory monitoring and methods to avoid cost pass-through to customers are critical to achieving EPR goals without placing an undue financial burden on the public.

One other possible challenge of EPR programs is the creation of ***free riders*** who benefit from the process without fully contributing or accurately disclosing their duties. These free riders can jeopardize the program's finances by avoiding their fair share of the expenditures connected with managing end-of-life products (Kalimo et al., 2015). Appropriate auditing and enforcement systems are essential for preventing free rider behavior and ensuring that the burden of duty is divided evenly among all participating enterprises.

Unintended consequences of EPR programs may happen (Gokce Esenduran, 2002; Işıl Alev, 2019), including the relocation of waste disposal to places where EPR standards do not apply, the creation of illegal and informal recycling activities, or the transformation of the product design... Both businesses and consumers can look for solutions to avoid the financial consequences of EPR that may cause damage to the environment if not adequately controlled. Furthermore, whereas collection and recycling goals appear to be equivalent EPR adoption levers to raise total material recycled, they have opposite effects on influencing producer decisions regarding design. To illustrate, a

calibrated numerical study of the photovoltaic panel industry demonstrates that more strict EPR standards can result in a PVP technology choice that has less recyclability and more excellent durability, resulting in higher greenhouse gas emissions (Huang et al., 2019). Through extensive program design and continuing evaluation, regulators and policymakers must anticipate and avoid these unforeseen impacts.

Some ***industries and manufacturers may be resistant*** to EPR programs because they see them as a financial burden, time-consuming for the organizations, and an obstacle to their existing business methods (Campbell-Johnston et al., 2021). It is essential to engage all stakeholders, including producers, the government, and environmental groups, in developing and implementing EPR initiatives to overcome this resistance. Demonstrating the tangible benefits of EPR, such as reduced environmental impact and improved resource efficiency, is vital to convincing these entities of its value. Collaborating closely with industry leaders to create rules that balance ecological effectiveness and financial viability is also crucial. This collaborative approach ensures that EPR is tailored to fit different industries' unique needs and circumstances, making it more acceptable and sustainable in the long run.

Environmental managers in the government and other public authorities grapple with many challenges because they take charge of regulations, governance, and enforcement of the EPR program, manage waste management operators, connect producers, consumers, waste management operators, etc... (OECD, 2014a; WWF). It is more challenging for some who still need to familiarize themselves with the EPR concept in some countries. They spearhead the implementation of EPR programs, so high attention and support for them are necessary.

These restrictions highlight the significance of carefully developing and monitoring EPR programs to maximize benefits while minimizing unanticipated negative impacts. When well-designed and efficiently implemented, the benefits of EPR frequently outweigh the negatives. Addressing these possible downsides through deliberate program design, the involvement of stakeholders, and robust enforcement mechanisms can assist EPR programs in gaining tremendous success and sustainability.

3. Overview about the EPR scheme in Vietnam

3.1 Environmental policies and regulations related to EPR scheme in Vietnam

In Vietnam, the Law on Environmental Protection in 2005 stipulates take-back responsibility for producers for some types of discarded products (Article 67, Account 1), which has been considered the first Vietnamese legislation that defined the implementation of the EPR scheme. This is clarified in Decision No. 50/2013/QD-TTg dated September 8, 2013 of the Prime Minister (then replaced by Decision No. 16/2015/QD-TTg dated May 22, 2015)(The National Assembly, 2005; The Prime Minister, 2013). After that, based on Decision No. 16/2015/QD-TTg, the Vietnamese Ministry of Natural Resources and Environment issued Circular No. 34/2017/TT-BTNMT dated October 4, 2017, on the recall and treatment of discarded products in detail. However, this circular only stipulates in detail Clause 13, Article 5, and Clause 1, Article 9 of Decision No. 16/2015/QD-TTg; other relevant instructions, especially the recovery rate, recycling, or disposal by the manufacturing enterprise, are not specifically regulated (MONRE, 2017).

In 2020, Law on Environmental Protection No. 72/2020/QH14 was approved by the National Assembly on November 17, 2020 (effective from January 1, 2022), stipulating in more detail to promote EPR in Vietnam in Articles 54 and 55. According to Article 54, products of producers and importers with recycling value must be collected for post-use recycling at the mandatory recycling rates. Moreover, Article 55 provides that "Organizations and individuals manufacturing and/or importing packages including hazardous materials, which are not recyclable or impede the collection and treatment, must contribute finance to assist with daily-life waste treatment operations" (The National Assembly, 2020). These provisions are guided in detail in Chapter VI of Decree No. 08/2022/ND-CP. Specifically, Articles 77 to 82 of this decree regulate the waste recycling responsibilities of manufacturers and importers of products and packaging, including objects, implementation roadmap, recycle rate, mandatory recycling regulations, implementation methods, registration of plans and reporting of recycling results, financial contributions to the Vietnam Environmental Protection Fund. Articles 83 to 85 of this Decree provide detailed regulations on waste collection and treatment responsibilities of producers and importers, including objects and levels of financial contributions, implementation procedures, and waste treatment activities support (The Government of Vietnam,

2022a). Registering plans recycling results reports and financial contributions declaration to the Vietnam Environmental Protection Fund are specified in Article 78 and Article 79 of Circular No. 02/2022/TT-BTNMT (MONRE, 2017). Compliance with the EPR scheme is stipulated in Decree No. 45/2022/ND-CP of the Government, detailing penalties for administrative violations administration in the field of environmental protection (The Government of Vietnam, 2022b).

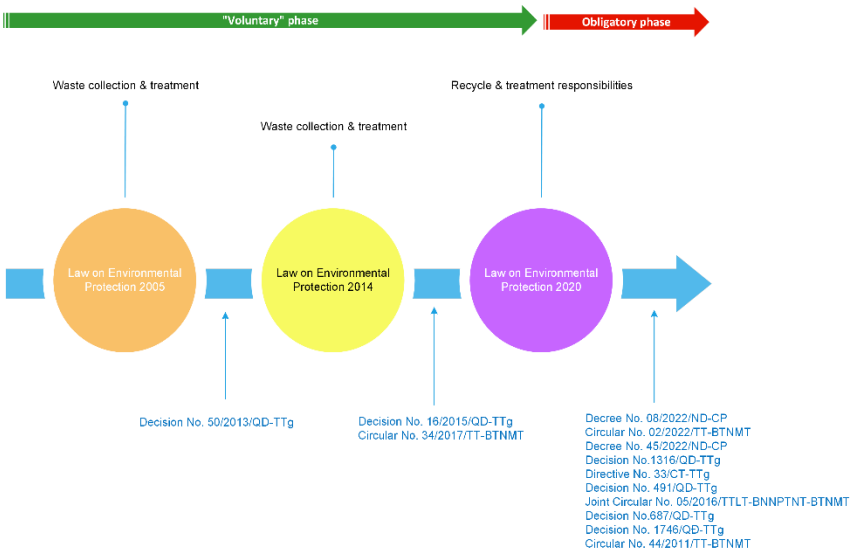

Figure 1 Process of EPR regulations in Vietnam

Note. This figure is adapted from *EPR implementation in Viet Nam*, by Nguyen (2022a). Adapted with permission

In addition, there are some other documents related to the EPR program in Vietnam including Decision No.1316/QD-TTg dated July 22, 2021 of the Prime Minister on strengthening management of plastic wastes in Vietnam; Directive No. 33/CT-TTg dated August 20, 2020 on strengthening of management, reuse, recycling, disposal and reduction of plastic waste; Decision No. 491/QD-TTg issued May 07, 2018 related to approve adjustments to national strategy for general management of solid waste to 2025 with vision towards 2050; Joint Circular No. 05/2016/TTLT-BNNPTNT-BTNMT on guiding the collection, transportation, and treatment of after-use pesticide packages; Decision No.687/QD-TTg on June 7, 2022 of the Prime Minister approving the circular economy development scheme and setting a number of ambitious targets for the period ahead; Decision No. 1746/QĐ-TTg dated December 4th, 2019 of the Prime Minister on promulgating the National Action Plan on Marine Plastic Debris Management by 2030; Circular No. 44/2011/TT-BTNMT dated December 26, 2011 of Minister of Natural Resources and Environment on defining the national technical regulations on environment. (Duc Quang Nguyen, 2016; Huynh Trung Hai, 2017; Kim Thi Thuy Ngoc, 2023; *Legislation*)

3.2 EPR scheme in Vietnam

3.2.1 Previous EPR program

As described above regarding the process of EPR regulations, the EPR system used in Vietnam from 2005 to 2020 can be stated to be based on a voluntary method. Without enforcement, this EPR model could not promote the desired effect and could not create a sustainable financial mechanism for the recovery and disposal of products and packaging after use; it has no impact on the process of using raw materials and product design. According to the laws at that time, a business could be considered to have discharged its responsibility for recovering discarded products when it set up locations for product recovery and disclosed requirements for recovery. Several surveys stated that the number of recovery places for discarded products set up by producers was small, while the rules notified for the retrieval appear to be highly rigorous. For example, Panasonic Vietnam has designed two sites for recovering its products in Hanoi and Ho Chi Minh City. This company receives only authentic items or undamaged goods without broken or

missing parts. It requires consumers to personally transport their products to the recovery points and does not offer any promotional benefits for exchanging products. Moreover, the country's recovery process is relatively challenging, exemplified by Toyota Vietnam, which employs a 10-stage recovery process. As a result, despite over 15 years of implementing legislation on the duty for recovering discarded, producers and importers in Vietnam have yet to recover any product. (Nguyen, 2022b)

3.2.2 Ongoing EPR program

To transition from a voluntary to a mandatory EPR framework, the Law on Environmental Protection in 2020 in Vietnam established some principles and methods for implementation. Firstly, the obligatory recycling rate and criteria were established. Secondly, methods for producers to fulfill their recycling duties based on the principles of the market were regulated. Thirdly, implementing the EPR scheme through consensus among many stakeholders, including the government, businesses, and environmental and social parties, is controlled. Fourth, the estimation of payment rates for gathering and disposing of household wastes based on volume to increase at-source sorting of household wastes (the primary source of used items and package generation) was issued. Fifth, regulations for promoting the construction of infrastructure needed for solid waste collection and disposal, improving the recycling industry, providing support and incentives for environmental protection actions, and encouraging circular economy development were implemented and developed (Nguyen, 2022b). Since the enactment of the Environmental Protection Law of 2020, starting in 2021, the Ministry of Natural Resources and Environment in Vietnam has been actively conducting various workshops and training sessions. These educational events are designed to familiarize producers and importers with the new regulations, ensuring they understand and are prepared to implement them.

The Environmental Protection Law in Vietnam in 2020 requires EPR in two circumstances, including (1) products and packages that can and must be collected for recycling and (2) non-recyclable, dangerous products and packaging that must be collected for treatment (The National Assembly, 2020). Mandatory frameworks in the Vietnamese EPR program are shown in detail below.

a) Waste recycling obligations

Concerning the recycling obligations imposed on manufacturers and importers, Article 77 of Decree No. 08/2022/NĐ-CP outlines the specific categories subject to regulation, encompassing packaging, batteries, accumulators, lubricants, tires, electrical and electronic products, and vehicles. Effective January 1, 2024, recycling responsibilities apply to packaging (depending on the scale), batteries, lubricants, and tires. The implementation for electrical and electronic products is slated for 2025, while vehicles fall under this regime from 2027 onwards.

The scope of packaging extends to six distinct groups: food, cosmetics, pharmaceuticals, fertilizers, animal feeds and veterinary drugs, detergents, preparations for household, agricultural, and medical use, and cement. Furthermore, specific exemptions are stipulated in some instances, relieving manufacturers and importers from recycling duties.

Each type of packaging or product designated for recycling will be subject to mandatory recycling rates, contingent upon considerations such as product or packaging life cycle, disposal rate, collection rate, national recycling objectives, adherence to environmentally friendly standards, and socioeconomic factors. A triennial assessment will be conducted to evaluate and adjust recycling requirements as needed to ensure the efficacy of these recycling efforts.

Producers of items or packaging covered by Product Recycling Responsibilities and Packaging Recycling Obligations (called "Recycling Obligations") will be able to choose among the following options:

1. Recycling their products or packaging on their own.

2. Using a recycling service to do the recycling.

3. Appointing a qualified third-party organization to handle recycling.

4. Combining the three techniques listed above or contributing to the Vietnam Environmental Protection Fund with the norm of a fee (Fs) issued by the Prime Minister.

Manufacturers and importers who do not perform or perform incorrectly or incompletely their recycling obligations according to the provisions of the law will be handled for each specific violation.

All producers and importers who are under recycling obligations will have an annual requirement to register and report their recycling activities or declare their contribution to the Vietnam Environmental Protection Fund. In cases where producers or importers entrust a third party to manage recycling on their behalf, it is the responsibility of the third party to carry out the registration and report on the recycling activities.

The financial contribution, which serves as an alternative to direct recycling, will be determined based on several factors. These factors include the specific recycling rate applicable to the product or packaging, the volume of products and packaging produced or imported, and the per-unit recycling cost. This per-unit cost encompasses various expenses, including sorting, collection, transportation, and recycling processes, as well as management and administrative costs (Nguyen, 2022b; Phuong, 2021).

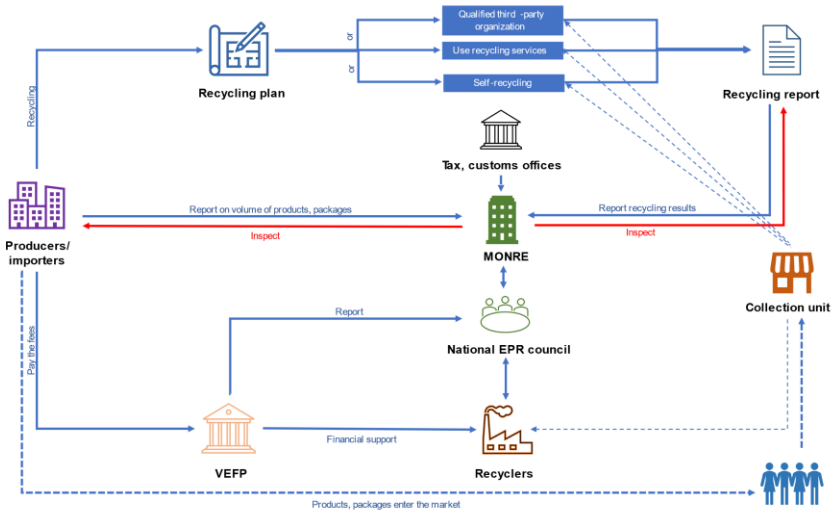

Figure 2 EPR operational scheme for recycling responsibility in Vietnam

b) Waste treatment obligations

Regarding waste treatment responsibility, manufacturers and importers are required to adhere to the regulations outlined in Article 83 and Appendix XXIII of Decree 08/2022/ND-CP (The Government of Vietnam, 2022a). These regulations pertain to specific products, including pesticides (with packaging), single-use batteries, chewing gum, cigarettes, and items containing synthetic plastic components, such as balloons, children's toys, disposable plastic goods, utensils, furniture, construction materials, and small plastic bags... Effective January 1, 2022, these manufacturers and importers must make financial contributions to the Vietnam Environmental Protection Fund, aimed at supporting waste collection and treatment efforts.

To fulfill this responsibility, producers and importers must engage in a self-declaration process and submit the relevant financial contribution declaration forms as per the guidelines issued by the Vietnam Ministry of Natural Resources and Environment. This submission should be made to the Vietnam Environmental Protection Fund within the stipulated timeframe. The calculation of the financial contributions is based on the production volume in the market and the number of products and packaging imported in the previous year. Notably, the party responsible, whether it is the manufacturer, importer, or an authorized representative, bears the duty of ensuring the accuracy and completeness of the information provided in the declaration (Nguyen, 2022b).

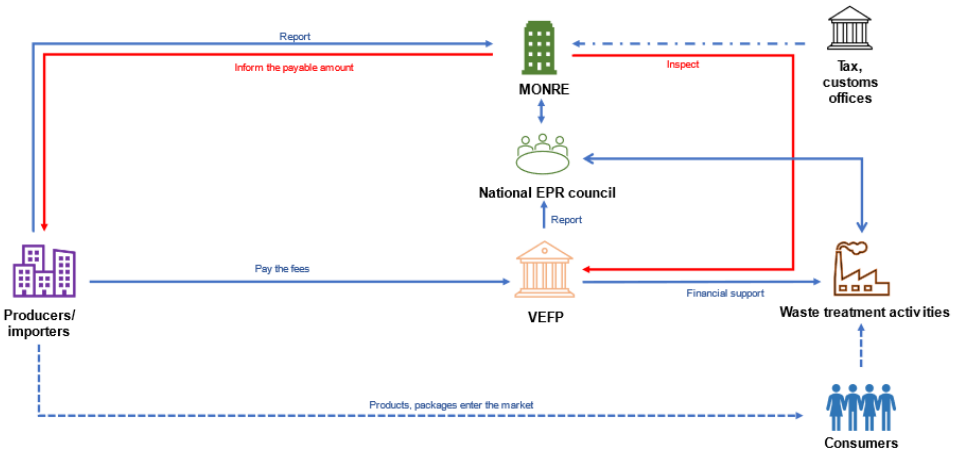

Figure 3 EPR operational scheme for treatment responsibility in Vietnam

3.3 Key challenges in EPR implantation and research gaps in this sector in Vietnam

The significance of the EPR scheme is crucial in the context of environmentally friendly waste management and environmental protection. For a rapidly developing country like Vietnam, the endeavor to actualize the efficacious implementation of EPR is concerned with a distinctive array of challenges and opportunities. The ensuing sections are dedicated to an in-depth examination of the principal challenges encountered during EPR implementation in Vietnam, thereby highlighting the existing research gaps in this domain. Through the systematic resolution of these challenges and the bridging of research gaps, a pathway towards the establishment of more streamlined and sustainable EPR practices that harmonize with Vietnam's environmental objectives and socio-economic circumstances can be forged.

3.3.1 Recycling Infrastructure Development

Vietnam's waste management and recycling system reflects the linear economy's dominance and systemic failure, with only 10-15% of municipal solid waste being reused or recycled. Recycling often occurs in low-tech "craft villages", leading to pollution (Lai Van Manh, 2021). Nguyen Khanh Bui (2020) notes that most recycling facilities are small in scale, outdated, and need more management and control from environmental protection authorities. (S T Pham Phu, 2018) states that while Hoi An City has a high potential for improving recycling, the recycling system is simple with rudimentary facilities and low effectiveness. Overall, Vietnam's recycling infrastructure needs improvement in terms of technology, management, and policy support. Therefore, the establishment of robust waste management and recycling infrastructure stands as a formidable challenge in the implementation of the EPR frameworks within the Vietnamese context.

The existence of adequate infrastructure that includes waste collection, segregation, and recycling assumes is vital for the seamless functioning of EPR programs (Gui, 2020). In the absence of a well-developed waste management system, the effective execution of EPR becomes a problematic endeavor. Realizing this underscores the need for substantial investments directed toward the construction of recycling facilities, the development of transportation networks, and the establishment of waste processing facilities. Furthermore, the adaptation of these systems to accommodate the frequently diverse and rapidly evolving product landscape poses a multifaceted challenge.

Vietnam's recycling infrastructure is still in its early stages of development. Current research on the country's recycling capabilities is limited and tends to concentrate on specific areas such as electronic waste, plastics, and construction debris. Lockrey et al. (2016) discuss the inefficiencies in handling construction and demolition waste in Vietnam, emphasizing the lack of proper classification, delegation, and regulation of waste streams by private companies. Similarly, Hoang et al. (2021) state that the absence of a formal recycling industry exacerbates the inadequacy of construction and demolition waste management in Hanoi. Studies regarding plastic recycling and E-waste in Vietnam reveal that these activities are predominantly conducted in informal settings, particularly in small-scale craft communities. Due to a lack of modern recycling technology and organization, the typical processes pose

health risks to individuals as well as an increased risk of environmental pollution (Salhofer et al., 2021; Tran Chung Duc & Petrus, 2016). Consequently, comprehensive studies and assessments are very necessary to find out the most suitable locations for recycling facilities and create recycling processes that are adapted to Vietnam's specific features.

3.3.2 Informal sector integration

In developing countries, the informal sector often shoulders a substantial portion of waste management tasks, a trend to which Vietnam is no exception (Johannes et al., 2021). According to Tong et al. (2021), Vietnam's waste management system heavily relies on the informal sector, which handles the bulk of recycling efforts. Their study emphasizes that this sector not only contributes to income diversification for the impoverished but also actively participates in waste recycling, advocating for its integration into the overall waste management process. T. H. Nguyen et al. (2021) provide data on the activities of informal waste workers and aggregators in several Vietnamese cities, demonstrating their presence and spatial allocation. Rémi De Bercegol (2017) discusses the co-existence, opposition, and potential integration of the informal recycling sector with municipal waste services in fast-growing Asian cities, including Hanoi in Vietnam. Moreover, junk buyers in Hanoi play a significant role in recycling, accounting for 8.8% of recycling by weight or 26.0% by volume and specifically recycling 25.5% of containers and packaging waste (Kawai et al., 2012). These findings underscore the significance of the informal sector in waste recycling in Vietnam and the need for recognition and integration into waste management policies.

Introducing EPR programs may engender disruptions to these informal systems, potentially resulting in job displacement and the emergence of social tensions (OECD, 2016a). As Vietnam has only recently begun mandating EPR policies, there is an urgent need for studies that explore the seamless integration of the informal waste management sector into the formalized EPR framework in Vietnam. To date, no research has been found on this specific issue. Such investigations could include identifying opportunities for integration and assessing the socioeconomic impacts of such integration. This endeavor promotes environmentally friendly waste management practices in Vietnam, which constitutes a holistic and multifaceted approach to the difficult problems with EPR implementation.

3.3.3 Stakeholder engagement

The absence of essential stakeholders is one of the common challenges in the implementation of the EPR scheme in developing countries (Johannes et al., 2021; Park et al., 2018). Therefore, in the context of Vietnam, this difficulty is likely to surface.

To effectively engage stakeholders, evidence-based approaches are essential, and these approaches can be facilitated through the provision of empirical data obtained from scientific research. Such data serves as the cornerstone for informed dialogue among stakeholders. This evidence-based dialogue, in turn, fosters a conducive environment for collaboration, ultimately leading to the development of more effective and widely accepted EPR schemes.

There are few studies related to the roles of stakeholders in waste management, particularly in the EPR scheme in Vietnam. Le et al. (2018) highlight the importance of stakeholder involvement in sustainable waste management and identify local authorities as the primary stakeholders responsible for managing municipal solid waste in agriculture in Hanoi. Nguyen Duc Quang (2016) and Nguyen Duc Quang et al. (2017) found that the function of intermediate stakeholders, the facilities for E-waste treatment, and monetary distribution flows under the lack of legislation are the primary elements that contributed to the failure of the EPR system's implementation in Vietnam. Nguyen (2023) synthesizes the experience of some countries in organizing and managing registration agencies for packaging manufacturers and importers, clarifies the roles of relevant parties, and offers potential recommendations for Vietnam in applying the EPR scheme. Therefore, a research direction of notable relevance involves analyzing the influence of stakeholder engagement tactics within certain industries to mitigate resistance to EPR adoption in Vietnam. This study intends to investigate the complex relationship between stakeholder engagement strategies and successful resistance mitigation throughout the implementation of EPR efforts in Vietnam. The goal of the study is to shed light on practical strategies that can raise the acceptance and efficiency of EPR programs within the Vietnamese context.

3.3.4 Free-riding and orphan products

The Asian developing countries' EPR scheme is facing challenges, one of the primary ones being the identification of producers. This difficulty is pronounced because many producers in these regions, especially in developing nations, operate as small, unregistered businesses. These entities, often referred to as EPR "free riders" (Kojima et al., 2009), evade the formal regulatory frameworks established to manage and reduce environmental impact. Their status as "free riders" allows them to avoid contributing to the environmental costs associated with the life cycles of their products, a responsibility central to the EPR principle. This avoidance not only undermines the environmental objectives of these schemes but also creates an imbalance in the market, putting compliant businesses at a disadvantage. Forcing unregistered small-scale traders or small industries to participate in the EPR system presents a formidable challenge, especially when they represent a substantial portion of the market. Notably, the challenges of free-riding and managing orphan products often emerge prominently in the initial stages of implementing EPR schemes (OECD, 2014b). Therefore, devising pertinent strategies to address these intricacies within the context of Vietnam is not merely important but, in fact, imperative.

The endeavor to combat free-riding and manage orphan products within EPR systems represents a challenge necessitating a comprehensive approach. Numerous studies have explored and proposed different strategies to mitigate the issues of orphan products and free riding within EPR systems on a global scale. According to Frithjof Laubinger (2021); and Mark Hilton (2001, 2019), fee modulation schemes must be carefully designed to eliminate free-riding issues. Mark Hilton (2019) states that a lack of awareness, and the insufficient and complex enforcement of the EPR rules can lead to free riding and orphan products, so awareness campaigns are needed. Peer pressure and the disclosure of free riders can serve to discourage free riding and the final owner pays after the point of consumption, providing a finance option for orphan items (Mark Hilton, 2001). Monitoring is a critical way of guaranteeing compliance with an EPR program and ensuring that free-riding is minimized (OECD, 2001).In addition, because multi-seller platforms contribute significantly to free riding, Jones (2020) suggests that online platforms should be held responsible if they cannot demonstrate that an organization that sells an item on their site makes an “eco-contribution”.

Given that Vietnam is in the transition stage towards a mandatory EPR program, it is crucial to start research to identify strategies for reducing free-riding and dealing with orphan products, which will improve the effectiveness of the EPR system. The main goal of this research is to develop and seek strategies to reduce free-riding and deal with orphan products within the EPR system, thereby improving the program's environmental and economic outcomes. Vietnam could benefit a lot from the experiences of both developed and developing countries to choose an appropriate strategy that will help the EPR framework be successfully established.

3.4 Suggestions for promoting the EPR scheme in Vietnam

Advancing the EPR scheme in Vietnam requires a strategic and well-planned approach. Below are some primary recommendations with well-defined objectives, effective and practical solutions, clear organizational responsibilities, and robust measurement methods for promoting EPR in Vietnam effectively.

3.4.1 Recycling infrastructure

There are four primary solutions for improving recycling infrastructure.

1. Investments in improving recycling facilities are needed, encompassing the modernization of existing infrastructure and the maintenance of equipment to ensure optimal operation. Responsible organizations, including the government and waste management agencies, play a crucial role in implementing and overseeing these initiatives. Methods for measuring implementation include monitoring metrics such as recycling rates, waste diversion, and cost savings and comparing these data to the past. Additionally, conducting a waste audit provides insights into waste generation and processing efficiency. Furthermore, evaluating the financial impact of recycling infrastructure investments involves assessing the return on investment, cost savings, and revenue generation. It is equally important to measure the impact on job creation, the local environment, and economic growth resulting from these investments.

2. Encourage public-private partnerships need to be encouraged in recycling activities in order to share costs and mitigate risks associated with recycling infrastructure projects. The government, private companies, and non-profit organizations all play critical roles in this effort. Metrics such as increased recycling rates, waste diversion, cost savings, revenue generation, and the number of participants can be used to assess implementation success. Furthermore, reviewing partnership agreements will ensure that all parties involved are fulfilling their roles, responsibilities, and goals. Following that, conducting financial audits tracks the allocation of resources, funding, and expenditures within the partnership. Moreover, gathering feedback from the community and relevant stakeholders serves to assess their satisfaction with the partnership.

3. Incentives for private sector participation, which can be achieved through tax benefits, subsidies, performance-based contracts, and regulatory support, should be provided. The government is the accountable organization in this case. Ways to evaluate the effectiveness of implementation include comparing metrics such as the number of private sector participants, the amount of investment attracted, job creation, and increased recycling rates to past data. Additionally, gathering feedback from participating private sector organizations, government agencies, and other stakeholders is crucial to assessing their satisfaction with the incentive programs and identifying areas for enhancement. Subsequently, it is essential to evaluate the quality and quantity of the incentives.

4. New technologies in recycling systems, such as IoT (Internet of Things) sensors, automated sorting systems, data analytics software, mobile apps, artificial intelligence (AI), and geographic information systems (GIS), should be integrated. The government, private companies, and waste management agencies are all accountable organizations. Methods for evaluating implementation success include comparing data related to technology integration objectives such as increased recycling rates, reduced operational costs, improved resource recovery, and reduced environmental impact. Concurrently, equipment performance must be monitored to ensure alignment with integration goals. Additionally, evaluating the environmental benefits of technology integration, such as reductions in carbon emissions, energy savings, and resource conservation, is crucial. Finally, assessing the financial impact of technology integration involves comparing technology implementation costs with the resulting savings or revenue generated.

3.4.2 Informal sector

Six proposed solutions aimed to address the challenges in the informal sector are presented.

1. It is necessary to raise awareness and education in the informal sector about the EPR program and its benefits and impart skills and knowledge in waste sorting, handling, and safety. Relevant organizations, such as local governments and non-profit organizations, play an essential role in carrying out these activities. Some methods for measuring implementation effectiveness include conducting surveys or quizzes to assess the knowledge and understanding of informal sector workers before and after educational campaigns. As a result, comparing the results allows for the measurement of awareness improvements. Simultaneously, tracking attendance and participation rates in workshops, seminars, training sessions, and informational events organized for the informal sector provides valuable insights. Additionally, measuring quantifiable improvements in the informal sector's behavior and practices, such as increased adoption of recycling and proper waste disposal, adherence to regulations, and changes in collection and sorting methods, ensures a comprehensive evaluation of the educational programs.

2. Explicit legal provisions and regulations that recognize and formalize the role of the informal sector within the EPR framework, potentially incorporating licensing and registration procedures, should be established. The government will implement these measures. Methods for assessing achievement include assessing the extent to which informal sector workers and organizations are formalized and integrated into the EPR system. The new regulations include determining the number of unregistered, licensed, or recognized informal workers. Simultaneously, tracking and comparing informal sector workers' participation rates in EPR activities before and after the regulations' implementation is critical. Additionally, gathering feedback from the informal sector and other stakeholders assesses their satisfaction with the regulations. As a result, conducting a financial analysis for both producers and informal sector workers aids in evaluating the economic impact of formalizing the informal sector within the EPR framework. Furthermore, evaluating recycling rates, waste diversion, and environmental effects of including the informal sector in the EPR scheme.

3. It is necessary to establish appropriate collection points where informal sector workers can quickly bring recyclables and receive compensation from producers. Waste management agencies, producers, and importers are responsible for implementing these solutions. Measurement methods for operation include conducting routine audits and inspections of the designated collection points to ensure they are set up and maintained in accordance with the plan and provide an effective and safe workspace for informal sector workers. Simultaneously, tracking the number of informal sector workers, the frequency of visits, and the volume of recyclable waste brought in provides valuable data. Monitoring the compensation process also ensures that workers in the informal sector are fairly compensated for their contributions. In addition, gathering feedback from informal sector workers about their experiences with the collection points, including their satisfaction, suggestions for improvements, and any issues they encounter, provides insights. Furthermore, monitoring the allocation of resources, including funds and infrastructure, to establish and maintain collection points ensures their efficient use.

4. Financial incentives and mechanisms to ensure that informal sector workers receive fair compensation for their collection and recycling efforts should be developed. The government and waste management agencies are responsible for implementing these suggestions into action. Methods for monitoring the achievement of goals include maintaining and keeping track of the amounts, frequency, and consistency of payments made to informal sector workers as part of the financial incentive program. Simultaneously, conducting regular audits and inspections ensures that producers and recycling companies comply with their obligations to provide fair compensation to informal sector workers. Additionally, implementing measures to ensure transparency in the compensation process involves making payment records publicly accessible and establishing mechanisms for workers to verify the accuracy of their compensation. To further enhance transparency, collecting data through surveys and interviews gauges the satisfaction of informal sector workers with the financial incentive system, assessing whether they consider the compensation to be fair. Furthermore, comparing the compensation offered to informal sector workers with industry or regional standards evaluates its competitiveness and fairness within the local context.

5. Collaboration among government agencies, producers, and informal sector businesses, as well as encouraging partnerships and dialogue, should be encouraged in order to create a cohesive approach to EPR implementation. The responsible organizations for implementing these solutions are the government and waste management agencies. Measuring the level of engagement and participation of informal sector businesses in EPR programs, which includes attendance at meetings, workshops, and collaborative events, is one way of determining implementation success. Concurrently, conducting surveys and interviews with stakeholders gauges their perceptions of the collaborative efforts. This multifaceted approach enables for a comprehensive assessment of the involvement of informal sector businesses in EPR programs.

6. Mechanisms to monitor compliance and enforce regulations are in place, ensuring that the informal sector's rights and contributions are protected. The government and waste management agencies are the organizations responsible for implementing these solutions into reality. The strategies for measuring how well implementation goals are met include conducting regular compliance audits to ensure that producers, recycling companies, and other stakeholders follow the laws designed to protect the rights and contributions of the informal sector. Furthermore, assessing the number of workers who have obtained legal status or permits under the regulations involves assessing the degree to which informal sector workers and organizations are formally recognized and integrated into the EPR system. In addition, obtaining opinions from workers in the informal sector and other interested parties helps determine their satisfaction with protecting their rights and applying the law.

3.4.3 Stakeholders

The following are six major approaches for boosting stakeholder engagement.

1. All relevant stakeholders, both internal and external, should be identified, and their interests, needs, and concerns about the EPR system should be understood. These ideas must be implemented by the government and local governments. Creating and updating a stakeholder map that identifies all relevant stakeholders is one way to assess implementation success. Concurrently, conducting surveys, interviews, or focus group discussions with stakeholders aids in understanding and assessing their concerns and needs regarding the EPR system.

2. A plan for effective and regular communication should be established and followed, providing stakeholders with regular updates on the status of EPR implementation, its benefits, and each stakeholder's contribution to its success. Local governments must implement the suggestions. Methods for observing implementation outcomes include gathering stakeholder opinions to determine the impact of communication activities and comprehending their information needs. Simultaneously, determining whether participants feel involved is critical. Furthermore, conducting surveys and analyzing perception data assists in determining how well stakeholders understand the EPR system, its progress, and the value it provides, as well as whether they are aware of their role in its success.

3. Stakeholders should be involved in the planning and decision-making processes by forming cross-functional teams comprised of representatives from various stakeholder groups to gather input and ensure that all perspectives are considered. The responsible organizations for implementing these solutions are the government and local authorities. Maintaining records of stakeholder participation in planning and decision-making processes, such as meetings, workshops, and advisory committees, is one method used to evaluate the effectiveness of implementation. Moreover, it is also critical to track the frequency and diversity of stakeholder engagement. Obtaining feedback from stakeholders also aids in assessing their experiences and satisfaction with their involvement in planning and decision-making, as well as determining whether their input is valued and acted upon. Furthermore, determining the extent to which stakeholder input influenced decision-making and planning is critical for a thorough evaluation.

4. Stakeholders should have access to training and educational resources to help them understand the features and benefits of the EPR system, which should be tailored to the specific needs of each group, such as clinicians, administrative staff, or patients. Local governments will implement the ideas. Maintaining records of stakeholder participation in training programs and educational initiatives is an option for determining the effectiveness of implementation. Simultaneously, tracking the number of participants, their roles, and the frequency of their engagement is critical. Furthermore, feedback from stakeholders who have received training should be collected to help determine the effectiveness and relevance of the educational resources, and whether they feel more informed and prepared to engage with the EPR system. Furthermore, conducting assessments or surveys assesses stakeholders' knowledge gained after participating in training programs, comparing their understanding before and after the training. Furthermore, evaluating the quality and understandability of educational materials ensures that the EPR system's features and benefits are effectively communicated. Lastly, evaluating whether or not stakeholder behavior and practices have changed because of the training, with a focus on actions aligning with EPR goals, such as improved recycling practices, completes the comprehensive measurement approach.

5. Mechanisms for stakeholders should be established to provide feedback, ask questions, and resolve conflicts among themselves. User-friendly channels such as online portals or suggestion boxes are recommended to facilitate this. The responsible organizations for implementing these solutions are the government and local authorities. Methods for measuring the implementation include maintaining records of feedback and questions submitted through established mechanisms and tracking the frequency, source, and nature of inquiries and feedback. Simultaneously, the response time to stakeholder feedback and questions should be measured, evaluating whether responses are timely and adequately address concerns or queries. Additionally, conducting surveys or collecting feedback can gauge stakeholder satisfaction with the mechanisms, assessing accessibility and effectiveness. Furthermore, analyzing the content of feedback and questions helps identify common themes, concerns, and issues raised by stakeholders, informing decision-making and process improvement. The evaluation extends to the efficiency of communication channels used for feedback and questions, such as online forms or hotlines, ensuring accessibility. Moreover, gauging the perceived transparency of the organization's response to feedback and questions is vital for stakeholders to feel valued. Lastly, the ability of feedback mechanisms to handle conflicts or disputes effectively is evaluated, measuring the success rate of conflict resolution.

6. Milestones and accomplishments should be recognized and celebrated throughout the EPR implementation process to keep stakeholders motivated and engaged. Local governments are the bodies in charge of putting these solutions into action. Measurement strategies for implementation include gathering feedback from numerous partnerships to assess their satisfaction with the recognition of milestones and achievements. The purpose of this evaluation is to determine whether the recognition has had a positive impact on stakeholder motivation and engagement.

Simultaneously, trends in stakeholder participation and engagement in EPR-related activities are examined, comparing the periods before and after the implementation of milestone recognition initiatives. Furthermore, an evaluation is carried out to determine whether the recognition of achievements has increased stakeholder commitment, enthusiasm, and contributions to the EPR system.

3.4.4 EPR compliance

For managing EPR compliance, there are seven necessary solutions**.**

1. A detailed plan for EPR compliance monitoring should be developed, defining the aspects to be monitored, the frequency, and assigning responsibilities. The government is responsible for these. Implementation assessment methods include developing a comprehensive plan, followed by a review and evaluation of the plan's completeness and clarity. This ensures that the plan includes all necessary components and complies with regulatory requirements.

2. Systems for collecting information on EPR compliance, such as product quantities, collection and recycling rates, and financial contributions from producers, should be developed. It is the responsibility of the government. A systematic approach is required for measuring implementation strategies. First, the effectiveness of the data collection system is determined. As a result, an assessment of precision and dependability ensures the accuracy and consistency of the gathered data. An examination of reporting methods follows to determine clarity and transparency, with data made available to stakeholders. Moreover, feedback is used to refine data processes, ensuring adaptability and efficiency in response to evolving demands.

3. Regular independent audits should be implemented to uphold data accuracy provided by producers, ensuring transparency, and preventing misreporting. The relevant organizations, particularly the government and municipal governments, play an important role in conducting this process. The frequency and scope of these audits must be assessed, to ensure adherence to legal standards and a comprehensive examination of the information submitted by producers to assess the implementation. Additionally, evaluating the quality and content of audit reports is pivotal, ensuring a thorough examination of data accuracy. The effectiveness of corrective actions taken by producers in response to audit findings should be assessed, ensuring identified discrepancies are rectified. Moreover, the measurement includes evaluating whether independent audits have contributed to an ongoing improvement in the accuracy of data provided by producers.

4. Penalties for non-compliance and simultaneously considering incentives for compliance should be defined. The accountable organization, in this case, is the government. For the purpose of evaluating implementation, it is crucial to verify that penalties are consistently and impartially enforced, ensuring that non-compliant parties face the consequences as specified in the regulations. Additionally, the assessment includes an evaluation of whether the defined penalties align with the applicable legal and regulatory framework and are proportionate to the severity of non-compliance. Subsequently, the measurement involves assessing whether the existence of defined penalties has acted as a deterrent for non-compliant behavior among producers and other stakeholders. Furthermore, the impact of defined penalties on compliance rates, recycling rates, waste reduction, and program success is assessed, determining whether non-compliant parties have improved their practices over time.

5. Consumers and the public should be encouraged to report non-compliant products or practices, and a system for receiving and investigating consumer complaints should be established. The responsible units are the government and consumers. In order to assess the operation, the number of complaints, their type, and how they were handled must be registered and tracked. Simultaneously, an evaluation is conducted on the accessibility, user-friendliness, and responsiveness of the reporting mechanisms, such as online platforms, hotlines, or complaint forms. The measurement also involves assessing the response time to consumer and public reports, ensuring timely responses, and adequately addressing reported issues. Furthermore, the assessment encompasses the public awareness of the reporting mechanisms and the ease with which consumers can find information on reporting non-compliance. Conclusively, data analysis collected from consumer and public reports is conducted to identify patterns, joint issues, and trends related to non-compliance.

6. Transparency and accessibility of information regarding EPR compliance, audits, and penalties to the public should be ensured, as transparency fosters trust and encourages compliance. The government and local authorities are the responsible organizations. Methods to check applications include evaluating the accessibility of information related to EPR compliance, audits, and penalties. Ensure that this information is readily available to the public through websites, publications, or other channels. Simultaneously, assess the perceived transparency of the information provided to the public. Determine whether the public believes EPR compliance, audits, and penalties are reported openly and comprehensibly. Additionally, examine the clarity and transparency of compliance reports, ensuring they are easy to understand and provide comprehensive information on producer compliance with EPR regulations. Furthermore, evaluate the transparency and comprehensibility of audit reports, ensuring that they communicate audit findings and compliance assessments clearly and informally. Conclusively, verify that data related to EPR compliance, audits, and penalties are provided in user-friendly formats and can be easily accessed and analyzed by interested stakeholders.

7. Training and resources to the enforcement authority and relevant stakeholders should be provided to improve their capacity for monitoring and enforcing EPR compliance. The government is in charge. A systematic approach is given to measure implementation. It involves maintaining records of training sessions conducted, including details such as the number of participants, topics covered, and training dates. Simultaneously, participant feedback collection is emphasized to assess the effectiveness of the training programs, gauging whether the participants found the training informative and relevant to their roles. Additionally, the evaluation extends to measuring the improvement in the capacity and skills of the enforcement authority and stakeholders involved in monitoring and enforcing EPR compliance. This includes assessing their ability to perform tasks related to compliance oversight. Furthermore, the measurement includes assessing the impact of the training on the enforcement authority's ability to impose penalties, sanctions, or corrective actions on non-compliant producers and stakeholders. Conclusively, the evaluation encompasses the improvement in data collection, reporting, and documentation capabilities of both the enforcement authority and stakeholders, ensuring a comprehensive assessment of the effectiveness of the training initiatives.

4. Discussion

The adoption of EPR in Vietnam has a high potential for promoting sustainable production and consumption, environmental conservation, and economic growth. In addition to introducing the EPR framework, this research recognizes the opportunities and obstacles involved with its implementation around the world in general and in Vietnam in particular. Furthermore, the review paper identifies and emphasizes the significance of certain research directions and practical solutions that should be pursued soon. It is possible to successfully apply EPR in Vietnam by bridging research gaps and implementing these recommendations.

This literature review on the implementation of EPR in Vietnam is critical for policymakers, industry stakeholders, and scholars. Policymakers can use the findings to develop and implement effective EPR policies. Industry stakeholders, armed with knowledge about Vietnamese EPR regulations and obstacles, can design strategic engagement plans. Furthermore, this literature review provides comprehensive suggestions for promoting the EPR initiative and ways for measuring these implementations. It enables authorities to identify each organization's responsibility, avoid overlapping between stakeholders, and understand strategies to assess these implementations appropriately. Researchers can use the review to define future paths by filling research gaps and investigating other areas of EPR deployment. Finally, it promotes international collaboration by providing a basis for exchanging experiences and working on research initiatives, thus increasing the overall effectiveness of environmental stewardship in Vietnam.

While the research carried out on implementing EPR in Vietnam is informative, it does have several shortcomings that lead to fields for future investigation. A lack of empirical data limits this study, so future research should involve more comprehensive data collection through interviews, surveys, or case studies to provide a more detailed and accurate understanding of waste management and EPR practices in Vietnam. In addition, this paper needs to go into detail about the long-term impact of EPR implementation on environmental, economic, and social effects in Vietnam to assess the success and sustainability of EPR policies. Furthermore, this study does not compare the EPR program with alternative policies or combinations of policies; therefore, tackling these limitations through future research

efforts would provide more nuanced knowledge of the problems and opportunities associated with implementing EPR in the Vietnamese context.

5. Conclusion

In conclusion, this comprehensive literature review has provided the overall picture of the EPR framework implementation for solving environmental challenges in Vietnam.

Through the exploration of Vietnam's unique regulations and plans, it has become evident that the efforts of the Vietnamese government on environmental protection can be recognized. The existence of free-riders and orphan products, the popularity of the informal sector workers, the specific challenges associated with waste management infrastructure, and stakeholders' participation demand suitable solutions. By understanding these challenges and advocating for further research to develop context-specific solutions, Vietnam can harness the full potential of EPR as a powerful instrument to mitigate environmental challenges, enhance resource efficiency, and advance its sustainability objectives.

As Vietnam continues its commitment to addressing pressing environmental impacts, EPR emerges not merely as a theoretical concept, but also as a practical solution. Thoughtfully adapting and integrating the above recommendations into the nation's policy framework, promoting environmental responsibility, and advancing a more sustainable future for Vietnam and its citizens will be achieved.

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