



Research Article

Green Retail Development for Plastic Waste Prevention – Regime Trajectories and Levers for Change in Thailand's Socio-technical System of Single-use Plastics

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Abstract

Thailand faces significant plastic waste management challenges. Around 2018–2019, a growing number of green retail shops started emerging in Thailand, offering products and services that eliminate or reduce the consumption of single-use plastics (SUPs). This paper intends to explore green retail as a niche in the Thai socio-technical system of SUPs. It aims to understand the socio-technical system's current state, identify niche dynamics and momentum, illustrate key regime trajectories, and highlight policy levers. The study uses secondary data from academic articles and policy documentation, along with primary data from interviews with 20 Thai green retail founders conducted between 2020 and 2022, for thematic and content analysis. Findings suggest that the green retail niche has started establishing network, institutional and technological anchoring within the regime despite the disruptive impact of the COVID-19 crisis. Green retailers are committed to the development of their business models, but require support. The research suggests enhancing network formation and skills development within the niche, increasing access to financial resources, and establishing green financing options. It also suggests drawing links to more established niches and setting up incubation and acceleration programs for sustainability-minded small and medium enterprises (SMEs), thereby supporting their growth. Beyond the Thai context, this paper may be relevant for other countries and for evaluating sustainability niches in other sectors.

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Introduction

1) Background

Cheap, strong, lightweight, and convenient plastics have fueled economic growth and globalization. Unfortunately, the linear model of plastic production, consumption and disposal significantly contributes to environmental damage, climate change, and resource depletion. Between 1950 and 2015, a cumulative 8,300 million tons (Mt) of plastics have been produced, with 381 Mt produced in 2015 alone [1]. Around 5,800 Mt (70%) was used only once, and subsequently thrown in a landfill (4,900 Mt), incinerated (800 Mt), or recycled and still in use (100 Mt) [1]. While recycling rates rose

from 2% to 19.5% between 1990 and 2015, the absolute tonnage of plastic waste that is dumped, landfilled or incinerated keeps growing – with considerable consequences in terms of air, soil, and water pollution. Annual plastics production is expected to quadruple by 2050, accounting for 20% of global oil consumption and 15% of annual greenhouse gas emissions [2]. By then, the cumulative total of primary and secondary plastic waste may rise to 33,000 Mt, with 12,000 Mt of those in landfills or the environment, and 450 Mt in the oceans [3]. Yearly amounts of mismanaged plastic waste may reach 155–265 Mt by 2060 [4].

Thailand features among the 10 largest contributors to global marine plastic waste [5–6], causing around 3.2% of the total [5]. The country has the highest per capita plastic consumption in Asia, ranging between 40–66 kg a⁻¹ [7–8] against a global average of 29 kg a⁻¹. By one estimate, Thailand generated 5.96 Mt of plastic waste in 2018 [9], around half of which is inappropriately disposed of. All in all, Thailand's plastic waste generates yearly GHG emissions of 1.05 Mt CO₂ equivalent, about 15% of which occur at the end-of-life stage [10].

Better recycling capabilities alone are unlikely to handle the growing load, as their efficiency is limited by waste segregation and collection systems, a high share of downcycling, and an inability to process mixed plastic polymers. Germany, the world's top recycler, only manages a reported recycling rate of around 49–56% [11–12] after decades of efforts, with some estimates placing the real number closer to 38% [12]. In the context of growing SUP consumption, this highlights the importance of prevention. Waste management scenarios that include a focus on prevention and reduction have been shown to significantly reduce environmental harm [13].

Between 2017 and early 2020, increasing attention was drawn to the environmental impacts of plastic waste in Thailand, creating calls for transitions to more sustainable consumption. Media attention and online search interest for topics such as “plastic waste”, “single-use plastics”, and “zero waste” surged [14]. Those years also saw the emergence of green retail initiatives – alternative retail models with a strong focus on single-use plastic (SUP) waste prevention and reduction. Unfortunately, a lot of this momentum was lost due to the COVID-19 pandemic and the resulting shift in government, media and consumer priorities. Correspondingly, driving the prevention and reduction of an economically important and pervasive material is both politically challenging and met with a lot of resistance. This paper aims to explore the current state and potential of Thai green retail initiatives as an additional driver for SUP prevention.

2) Literature

Waste management aims to “optimize the use of the world's limited natural resources by avoiding the generation of waste, and where waste is nevertheless generated, treating waste as a resource” [15]. The waste hierarchy demands that prevention, reduction, recycling, recovery and disposal join hands to minimize the burden of human consumption. While prevention and reduction can bring the largest environmental gains [16], policy and academics have mainly focused on recycling and recovery.

Academic interest in plastic waste recycling has by far outstripped prevention. The literature is centered

around three key topical areas: (i) the effectiveness of recycling applications; (ii) approaches to promote recycling in specific sectors; and (iii) the motivations that drive recycling attitudes and behavior among consumers [17]. Extended producer responsibility (EPR) plays a key role in the literature, as it has contributed to sharp increases in recycling rates in many countries [18]. In theory, EPR schemes should incentivize producers to use less packaging and develop more recyclable packaging, through the imposition of fees that cover collection and recycling costs. However, the role of EPR in prevention remains unclear, as schemes lack global harmonization, transparency, and vary in terms of implementation and performance [19].

Instead of plastic waste, most prevention research has concentrated on flows such as food waste and waste electrical and electronic equipment (WEEE). A few early studies have explored the effectiveness of refillable containers for detergent and food to reduce SUP waste [20–22]. Other studies have investigated the effectiveness of refill stations in reducing plastic waste and CO₂ emissions [23–25]. The remainder of SUP prevention research has mainly revolved around: (i) material flow analyses (MFA) and lifecycle assessments (LCA); (ii) consumer-side drivers of plastic prevention awareness, attitudes and behaviors; and (iii) the role of EPR schemes and promotion of collaborative approaches [26–28].

From a policy and institutional perspective, the lack of focus on SUP prevention is also obvious. Over half of certain countries' alleged prevention efforts rely on end-of-pipe solutions like reuse and recycling [17]. Only a fraction of measures are targeted at actual prevention and they are often voluntary, non-legal and non-binding in nature [17].

In Thailand, academic research around plastic waste has mostly focused on forming an understanding of plastic flows through MFA and LCA. A seminal study from 2018 [29] provided a detailed analysis of plastic flows in Thailand, from production to disposal. Two recent papers also rely on MFA and LCA to model the effects of different waste management scenarios on waste generation and global warming potential [30–31].

Other papers have focused their attention on the role and drivers of segregation and recycling. One highlights the interactions between policy, economy and societal networks in support of plastic waste recycling, and emphasizes the role of societal networks in contributing knowledge, technology and funds to the system [32]. Another underscores how community-based management models for municipal solid waste (MSW) can help divert recyclables from landfills, increase reutilization rates, and decrease costs and emissions [33].

Only in the last few years have papers emerged with a focus on reduction and prevention. Most notably, a paper from 2023 points to the development of convenient alternatives, suitable incentives, adequate financial support and an equal regulatory scope to encourage stakeholder participation in plastic reduction campaigns [34]. Another article from 2022 highlights leverage points to reduce food delivery-related plastic waste in Thailand, including eco-labelling, deposit-return systems, green packaging procurement and subsidies [35].

This short review shines the light on two large gaps. First and foremost, existing research does not necessarily reflect the vast complexity underlying plastic waste, which involves a wide-ranging and diverse network of stakeholders and institutions. Micro- and macro-level analyses that focus on compartmentalized aspects of a system – e.g. consumers – usually fail to capture interrelations between different actors and institutions, as well as path dependency within the system. Systems-based approaches are crucial to uncover measures that facilitate prevention and reorient the entire system towards sustainability.

Second, the literature lacks a focus on innovative and competitive – in terms of price, convenience and accessibility – solutions that can help reduce SUP consumption. The convenience and cost-effectiveness of plastic is driving resistance to prevention from producers, brands and consumers alike. Hence, prevention will rely on the development of alternatives such as green retail, which may be influenced by network formation, knowledge sharing, finance and capital, and government support [36–38].

3) Research objective

According to Multi Level Perspective theory, innovations often emerge in niches [39–40], which can promote reconfiguration within the system they are a part of when they scale up [41]. This paper considers Thailand's green retail sector as a niche in the socio-technical system of SUPs, as it experiments with new forms of retail looking to prevent and reduce SUP waste.

This paper's main assumption is that the green retail niche can potentially help reshape the broader retail environment in Thailand, and thereby contribute to SUP waste prevention. Several pilots have shown that new reuse (refill) business models can help prevent virgin plastics consumption by up to 70–90% [42]. To fulfill this potential, the Thai green retail niche must develop, scale up and link up with trajectories and developments at regime-level. Accordingly, the paper aims to answer two research questions:

Research Question 1: What landscape pressures, actors, and institutions make up Thailand's socio-technical system of single-use plastics?

Research Question 2: What are the motivations, visions, expectations and relations that characterize Thai green retailers and their interactions with the socio-technical regime?

Taken together, this research sheds light on the general direction of regime trajectories, as well as the niche-internal dynamics that catalyze or hamper green retail development. In turn, it seeks to pinpoint levers that help maximize the niche's growth potential, influence on the broader retail sector, and contribution to plastic waste prevention. While the paper focuses on Thailand, its methodology and recommendations may prove especially pertinent for other developing countries facing similar plastic waste challenges.

4) Conceptual framework

Socio-technical systems consist of a cluster of aligned and co-evolving elements, including actors, markets and customers, formal institutions such as regulation and policies, scientific knowledge and technology, and more [43–45]. Under a systems approach, sustainability transitions amount to radical, long-term, multi-dimensional transformations [46,47] that enhance a system's overall sustainability through technological, social, political, or institutional interventions. The scaling up of innovations helps eliminate connected system failures and plays a central role in achieving strong sustainability [45–49].

Two complementary schools of thought have been applied to studying sustainability transitions in socio-technical systems such as mobility, biogas, organic food and sustainable housing [50–54]: multi level perspective (MLP) and strategic niche management (SNM) theories.

The MLP views socio-technical systems as made up of three distinct levels, and studies the dynamics and interactions between the three levels to form a picture of a system's trajectories and transition path [55–56]. The first level, the socio-technical landscape, consists of macro-level exogenous elements that affect the system and over which actors do not have a direct and short-term influence – such as ideologies, macroeconomic patterns, environmental and sustainability impacts, etc. [41]. The socio-technical regime, the second level, is made up of a broad range of actors as well as the rules and structures, both tangible and intangible, that shape actor behavior [49]. It can be viewed as the guiding element of the system, characterized by specific trajectories in terms of user preferences, industry, science, technology, policy, and culture. These regime trajectories represent the embodiment of the spoken and unspoken rules in the system, at the same time

influencing and being influenced by actors' activities and choices. Finally, technological niches, the third and last level, are protected spaces where actors with new expectations and visions can engage in extensive experimentation, learning and network building [40–41].

The three levels of a system are in constant flux and influence each other. As illustrated in Figure 1, landscape developments pressure the socio-technical regime and destabilize its trajectories while also influencing the emergence of innovations that embody new visions and expectations in niches. The disruption of regime stability opens up windows of opportunity for niche innovations to gather momentum and break through, establishing new directions for the regime trajectories and in turn influencing the landscape. While the emergence and growth of niches is critical to sustainability transitions, niche innovations can only break through if they link with ongoing processes at both the regime and landscape level, and thereby promote mutual adaptation within and between the levels [49, 57].

The SNM neatly complements MLP theory by pointing its lens at niche-internal dynamics [58]. It argues that three fundamental processes underlie the extent to which niches align around a dominant design, gather momentum and diffuse, and make connections at regime-level that will facilitate their eventual breakthrough [58–60]. First, visions and expectations must become more robust, specific, and substantiated. Second, networks must become broader (i.e. connecting a diverse set of stakeholders) to facilitate the articulation of multiple views, while also becoming deeper and committing significant resources to the niche's development. Third, learning processes within the niche should enable first-

order learning, such as data accumulation, and second-order learning, such as changes in cognitive frames and assumptions.

Support structures dedicated to connecting niche actors with each other and regime actors have the potential to accelerate niche development, by promoting the diffusion of know-how and access to critical resources such as markets and financing. For instance, a farming incubator in France helped scale organic farming by accelerating the transmission of knowledge and know-how, and by connecting the niche to local government organizations [61]. It also highlights the important role of policy when it comes to disseminating and embedding the niche's new visions and expectations into the regime.

Considering that systems are generally characterized by lock-in mechanisms and path-dependency that protect the status quo and hamper innovation [45], sustainability transitions call for policy interventions to help overcome free-rider problems and prisoner's dilemmas that can stifle investment and innovation, shoulder gaps in the price or performance of new innovations, and ensure that niches have appropriate tools and support to grow [40, 58]. It has been argued that sustainability transitions require a two-pronged policy approach that stimulates network formation and learning in niches, followed by measures that support the accelerated structuration of the niche and drive the uptake of sustainable innovations at the regime level [45, 62].

Based on MLP and SNM theories, the below conceptual framework (Figure 2) was developed for this paper.

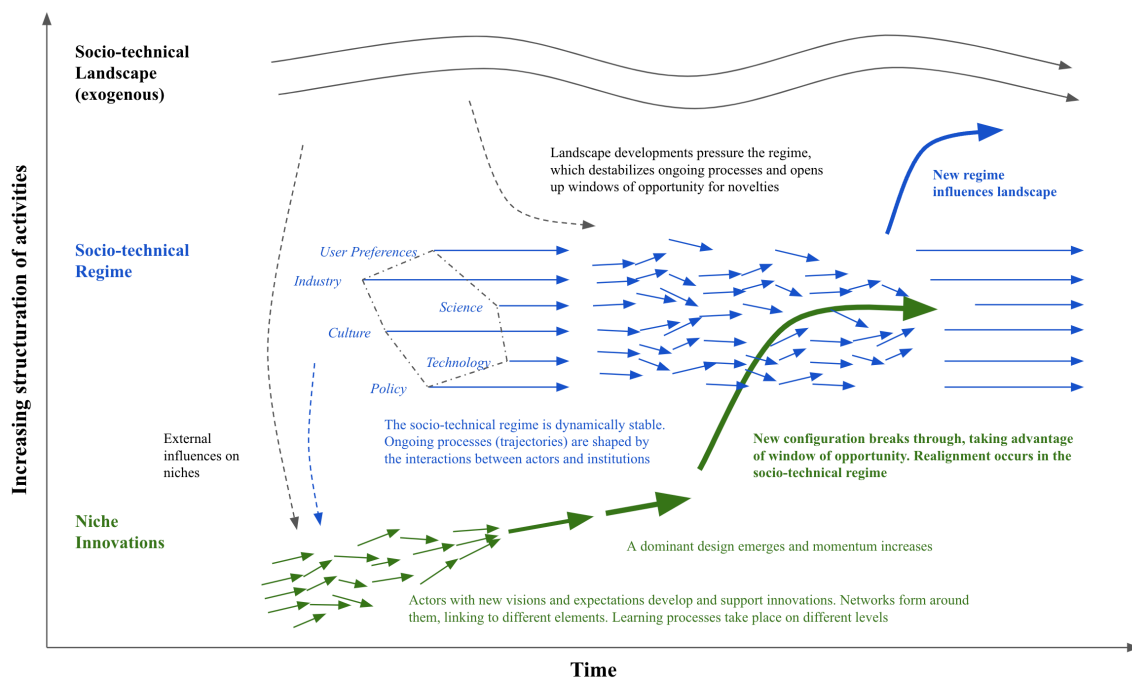


Figure 1 Transitions in the Multi-Level Perspective (based on Geels [49]).

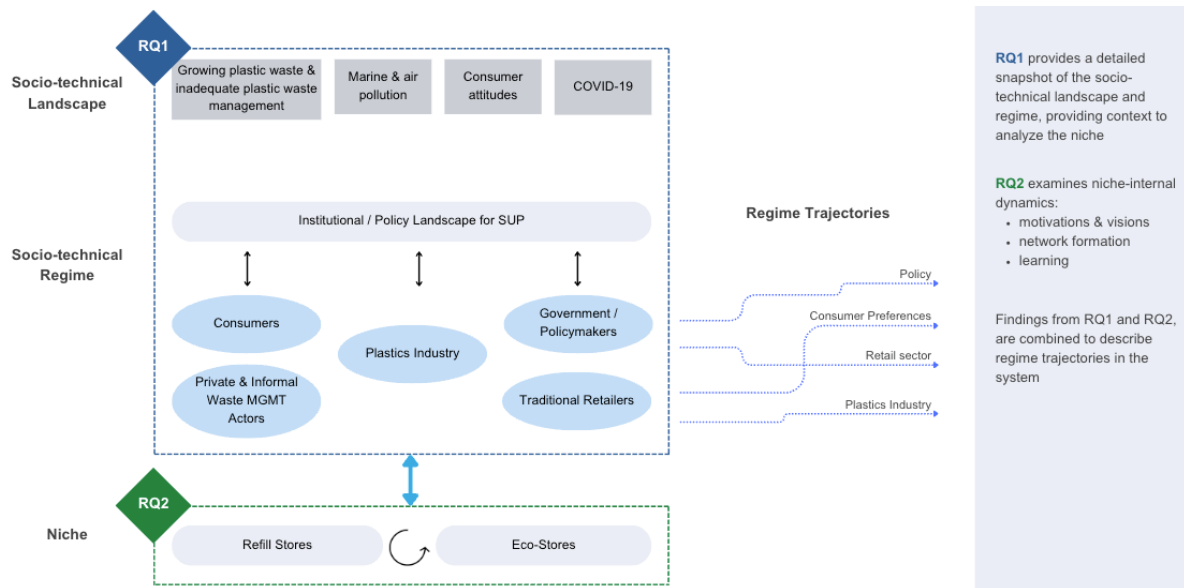


Figure 2 Conceptual framework.

Materials and methods

This study relies on exploratory qualitative analysis based on observation of the Thai green retail niche's real-world context. It is not concerned with identifying causal determination, but aims to describe the current state of the green retail niche and highlight levers to maximize its potential for SUP prevention. The study adopts a case study methodology centered around the proposition that the green retail niche requires additional support. To fulfill its objectives, it is structured around two studies, which align with the research questions.

Research Question 1: What landscape pressures, actors, and institutions make up Thailand's socio-technical system of single-use plastics?

Research Question 1 aims to provide a detailed snapshot of the structural conditions in which the green retail niche is operating, providing context to interpret the niche's current state. The study revolves around three pillars: (i) describing the most important landscape developments, and their influence on the regime and green retail niche; (ii) drawing out the network of key regime actors and their motivations and priorities; and (iii) highlighting the formal institutional structures that shape actor behavior related to SUPs. The qualitative analysis is based on secondary data such as academic papers, research from the UN and other international institutions, policy documents, government reports, and news articles from Thai and international media. Relevant sources and data were identified through a snowball approach, ensuring that the critical landscape developments, regime actors, and institutions are covered. The analysis is built around process theory to examine the current state of the socio-technical system and illustrate how it got there.

Research Question 2: What are the motivations, visions, expectations and relations that characterize Thai green retailers and their interactions with the socio-technical regime?

Research Question 2 takes a magnifying glass to the niche, and investigates the degree of convergence in green retail founders' visions and expectations, the extent of network formation in the niche (and beyond), the level of learning that is facilitated, and perceived dynamics with traditional retailers and/or the government. It is based on the analysis of primary data obtained through semi-structured interviews with green retail shop founders in Thailand.

Green retailers are defined as stores with a primary focus on SUP prevention, falling into one of two categories:

- (i) refill stores, selling unpackaged dry foods or staples (e.g. rice, pasta ...), other foods (cereals ...) and hygiene products (soaps, shampoo, and detergents) to customers using reusable containers; or
- (ii) eco-stores dedicated to the sale of sustainable everyday or lifestyle products that facilitate SUP prevention and eco-friendliness (e.g. reusable drinkware, shopping bags, straws, etc.).

The study is limited to green retailers that operate a physical store and/or online sales channels in Thailand. It does not include fashion-related and beauty-related brands and stores positioned as eco-friendly. Refill stations or green retail brands associated with traditional retailers (e.g. Siampiwat's Ecotopia) are considered as being part of traditional retailers and not the green retail niche.

Given the limited size of the Thai green retail niche, no sampling was applied, opting instead for a census study approach. In total, 62 relevant green retailers were

identified and approached, resulting in 20 interviews between 2020 and 2022. Nine of the interviewed shops were based in Bangkok, with the remainder spread across the country (Chiang Mai, Surat Thani, etc.). Nineteen shops wished not to participate in the study, because their business model changed (3) or they permanently closed (16). The remainder never got back to interview requests, some of which likely also permanently closed their doors. All interviews were based on voluntary participation, with informed consent from interviewees, and data was treated in confidentiality.

The questionnaire draws on concepts from MLP and SNM, and explores: (i) the motivations, visions and expectations of green retailers; (ii) the breadth and depth of network formation and the degree of learning in the niche; (iii) perceived relations with traditional retailers; and (iv) expectations with regards to government and regulation. Interviews were conducted online through a video-conferencing software (Zoom Meeting), for the added convenience of all participants and to easily accommodate interviews with green retail stores outside of Bangkok and vicinity.

The study involved transcribing and translating green retailer accounts, then coding them using a combination of thematic analysis and content analysis. Thematic analysis was used to compare responses, construct thematic areas and identify patterns, while content analysis counted the incidence of coded concepts. Thematic areas were grouped and visualized in a mindmap format. Drawing on process theory and grounded theory, the researcher formed a narrative based on the gathered data.

The structure of this study induces risks of survivorship and social desirability biases on the interviewee side, as well as confirmation bias on the researcher side. Conscious of this, the paper relies on triangulation – i.e. the use of combined methods or data [63–64] – to eliminate bias and satisfy the criteria of confirmability, consistency and transferability, which best suit qualitative methods [65–66]. Other studies have relied on similar methodologies, combining SNM and MLP concepts with qualitative research to explore sustainability transitions in the fields of e.g. green construction and organic food [52–54].

Results

1) Research question 1

This section provides a detailed description of landscape pressures, regime actors and regime institutions in the socio-technical system, as illustrated in Figure 3.

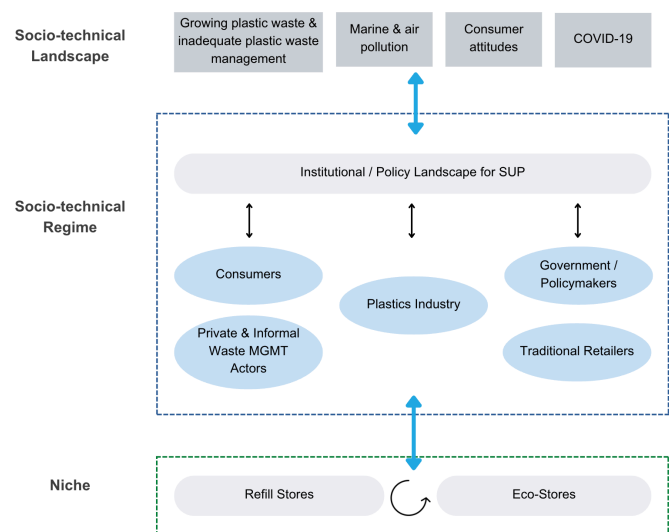


Figure 3 - Visualization of Thailand's socio-technical system of single-use plastics.

1.1) Landscape pressures

Available data consistently points to a challenge of growing plastic waste in Thailand – the first landscape pressure. The country consumed around 6.8 Mt of plastic resin in 2013 [29] or 4 Mt in 2015 [67], depending on the estimate. The bulk of it is produced domestically by the country's huge petrochemical sector, the largest in ASEAN and 16th largest in the world [68]. Plastic waste generation has also grown considerably, from 4.1 Mt in 2013 [29] to 5.85 Mt in 2016, 5.88 Mt in 2017, and 5.96 Mt in 2018 [9]. In 2021, Thailand collected 2.76 Mt of single-use plastic waste, around 11% of total MSW by weight [69]. When looking at waste disposal sites, plastic items accounted for 28.1% of the total volume treated. When looking at the source, it represents 16.8% of MSW from households and 23.7% of MSW from condominiums [70].

Thailand suffers from considerable waste management challenges, such as a low reported recycling rate of around 20% [29, 67, 71]. Since Thailand does not practice source waste segregation, up to 80% [67] of collected plastic waste is found unsuitable for recycling due to contamination. While official numbers from Thailand's Pollution Control Department (PCD) indicate that 28% of MSW was improperly disposed of in 2021 [72], academic papers have placed the total far higher: from 45% [73] to 60% [74]. This can be attributed to Thailand's flawed and under-resourced waste collection system, covering only 66% of Local Administrative Organizations. Even in localities that benefit from formal waste collection, up to 47% of collected waste is handled inappropriately [74]. Despite these challenges, Thailand is an importer of plastic scraps, but recently introduced an import ban starting from 2025, with a handful of exemptions during 2023–2024 for 14 Thai factories [75].

The second landscape pressure can be found in Thailand's visible exposure to marine and air pollution, and climate change impacts. Among other things, the deaths of a beached pilot whale [76] and baby dugong Mariam [77] as well as news of Thailand's leading role in marine plastic waste led to a sharp build-up of momentum to demand action against SUPs in 2018–2019. Around the same time, Thailand started dedicating significant attention to air pollution, PM 2.5 and its impacts. As a result, online searches for plastic waste and air pollution reached levels not seen for over a decade [14]. Though the COVID-19 pandemic led to the breakdown of that momentum, there are signs that more focus may shift back to plastic waste soon. The recently drafted Bangkok Declaration on Combating Marine Debris in ASEAN [78] is an encouraging sign.

The third landscape pressure relates to changing consumer attitudes in Thailand, which have accelerated in reaction to the above. A recent study in ASEAN countries found that 91% of consumers and 82% of businesses expressed significant concern with the plastic waste situation [79]. Another study of Thai consumers highlights that 31% and 63% perceive plastic waste as a top-1 and top-5 environmental concern respectively [80]. Despite shifting attitudes, both studies nevertheless underline that behavior change is lagging, an illustration of the well-known attitude-behavior gap.

The COVID-19 pandemic and its impacts represent the final major landscape pressure. In a double blow, growing concerns with virus transmission resulted in an explosion of single-use plastic consumption while lockdowns prompted exponential growth in food delivery and ecommerce. As a result, the volume and composition of solid waste has changed significantly, with household plastic waste growing over 60% in 2020 [81]. Food delivery-related plastic waste is estimated to have further grown by 15% in 2021 [35]. Given the convenience of food delivery and ecommerce, as well as the aggressive marketing strategies pursued by leading platforms and brands, it will be a challenge to reverse the trend.

1.2) Regime actors

The complex socio-technical system of SUPs is made up of many actors. For brevity's sake, this section is limited to five of the most important ones.

The first group, the plastics industry – made up of plastic polymer and packaging producers and retailers – accounts for roughly 7% of Thai GDP [82], employs around 200,000 workers, and functions as a regional and global production hub with strong supply chain integration [83]. The industry and its interests are represented by lobbying associations with close

connections to politics [82], linked to the Federation of Thai Industries (FTI) – notably the Plastics Industry Club, Petrochemical Industry Club and the Thai Plastic Industries Association.

Recently, the plastics industry has channeled its political influence into maintaining business as usual and resisting costs relating to bans, levies or EPR. As a result, government agencies have struggled to design and enact cohesive and meaningful reforms [84]. Beyond that, the Thai plastics industry's priorities revolve around four key areas. First, it has accelerated investments in initiatives that relate to better waste management and especially recycling [85]. Second, large producers are diversifying their product range into e.g. paper and cardboard packaging to mitigate future sales risks [86]. Third, investments in bio-degradable alternatives are picking up pace even though their introduction would require simultaneous developments in plastic waste management systems to effectively contribute to environmental protection [87]. Fourth and last, small players in the industry are likely to be pushed out of business [88], leading to further industry consolidation, with potentially costly consequences for consumers and the environment.

The second set of actors this paper considers are government organizations. Where the national government formulates and establishes policies, regulations and guidelines for waste management, provincial authorities translate those into a local context and transfer guidelines to local government offices [73]. Local governments oversee execution, designing and enforcing the municipal rules that relate to collection, separation, transportation, disposal and the setting of fees [67, 89]. Legislative gaps limit the ability of local governments to charge treatment fees and hence coordinate sufficient waste management funds [84]. They rely on collection fees only, which cover just a small share of waste management costs [73]. Ambitious national-level plans and roadmaps often lack dedicated budgets to support implementation at the local level, leading to low commitment from underfunded local administrations [84].

Unlike many countries, Thailand does not have a national-level waste management agency coordinating policies, reforms and budgets [82]. Five Thai ministries and their departments play a role in the management of SUPs [67, 73], often without much consultation and coordination. Arguably, the two most influential players are the PCD, in charge of issuing technical recommendations on municipal solid waste management policy [67], and the Department of Local Administration (DOLA), looking after the actual implementation of waste management policy through its network of provincial and sub-district administrative organizations

[73]. It has been argued that the PCD suffers from a marginal position in government which significantly hampers its attempts to push through reforms [82]. At the same time, other government offices such as DOLA lack strong incentives to drive waste prevention because the current system may indirectly encourage growing amounts of waste [84].

The third group of actors is formed by a patchwork of private-sector and informal waste management stakeholders who fill large gaps in public capabilities. A network of independent and often informal waste scavengers, pickers, sorters and merchandisers [67] complement formal waste management systems, with a strong focus on non-contaminated and high-value items that can be resold. Items such as plastic bags, bottles, etc. mostly do not get picked and end up leaking into waterways, or being landfilled or incinerated [82]. Garbage items that retain some intrinsic value are sold to waste recyclers and shops, who process them and sell them on. In many cases, garbage collection and disposal is outsourced to private companies through loosely regulated contracts [82]. Many of these companies have close ties to local officers and politicians, and are paid by kilo of waste collected or treated [84]. The resulting mix of formal and informal, public and private actors is ruled by market forces and bound by loose regulation, putting the system at odds with principles of sustainable waste management and waste prevention. Moreover, collection rates have been shown to suffer when market prices of high-value plastics fall [90].

The retail sector, the fourth group of actors in the system, is made up of 2 subsectors. The first, traditional retailers, includes department and convenience stores, grocers, supermarkets, food and beverage chains, and other brand-name outlets. They include names like 7-Eleven, Big-C, Lotus's, and Tops, and account for about 30% of all plastic bags handed out in Thailand [91]. The second group covers mom-and-pop stores, fresh markets, and street vendors, who account for the rest of plastic bags. Two significant changes have characterized the Thai retail sector in recent years, with potential implications for future plastic waste prevention efforts. The consolidation of the retail sector and adjacent supply chains, which has seen a few corporations gradually swoop up more market share, causes considerable concern for competition, innovation, and influence over policy [92]. Consumers and the environment bear the brunt of the costs associated with high market concentration. The COVID-19 pandemic has also greatly accelerated the trend of digitization [93], placing additional strain on waste management systems.

In January 2020, a consortium of 75 leading traditional retailers worked with the government to introduce a

voluntary ban on plastic bags [94]. The “Say No To Plastic Bag” campaign highlighted retailers’ awareness of their contribution to the plastic waste crisis and set a precedent for coordinated private sector action. However, support for the initiative waned and some retailers such as 7-Eleven walked back on their commitment. Most mom-and-pop stores and fresh markets did not participate in the ban, since they depend on cheap and easily available plastic packaging as a result of fragile cash flows and customer expectations.

Consumers form the last important group of actors in the system of SUPs. Through their purchasing decisions, their activism, and their interactions with mainstream media, consumers can potentially have a large influence on the system. Public perceptions on plastic pollution have changed over the past years, resulting in more knowledge around plastic waste impacts and accordingly, higher acceptance for the imposition of a plastic ban and fees levied on plastic bags [95]. Changing attitudes may pave the way for stronger public and private sector action towards sustainability-oriented measures, such as regulatory bans on single-use plastics [89].

1.3) Regime institutions

Actors in any system are bound by its institutional landscape, i.e. the umbrella of rules and procedures, incentives and disincentives, and negotiating vehicles that formally or informally rule actors’ behavior [96]. Table 1 summarizes the most significant laws and regulations, policies and action plans related to SUPs and plastic waste in Thailand, the majority of which were passed in or after 2018.

Arguably, the Roadmap on Plastic Waste Management (2018–2030) represents the single most important policy on plastic waste [89]. To reach its goals, the Roadmap is underpinned by an Action Plan on Plastic Waste Management, which has been structured in successive phases: Phase I (2020–2022) and Phase II (2023–2027). Phase I of the Action Plan on Plastic Waste Management introduced a nationwide “ban” on four types of plastic waste (thin shopping bags, styrofoam containers, straws and cups) and a goal of 100% recycling for select plastic waste types by 2027. Unfortunately, it was effectively diluted only four months after its introduction as talks of banning morphed into reducing instead [84]. Phase I did not result in the implementation of significant enough new regulations, laws or legally enforceable incentives such as bans, EPR laws, landfill and incineration taxes, deposit-refund or pay-as-you-throw schemes [16]. Instead, it relied mainly on public awareness, advocacy and voluntary measures to achieve its objectives [86]. At the same time, it was not backed by a solid

implementation plan and supporting budget. Target achievement at the end of 2021 was suitably low: a 42% reduction in thin plastic bags, styrofoam food boxes, plastic cups and straws was achieved versus a target of 75% reduction. Similarly, recycling of the 7 target types of plastic did not exceed 25% in 2021, versus a target of 40% [97].

The Roadmap has also led to the establishment of a Subcommittee for Plastic Waste Management, along with three working groups. The third working group has enabled an association of private sector corporations and interest groups, called Thailand PPP Plastic, to gain extensive influence over policy and initiatives that relate to the promotion of environmentally friendly alternatives to SUPs and the development of recycling and reuse of plastic waste. The association is chaired by the Plastics Industry Club and involves some of the country's largest plastic / petrochemical and retail companies. It has been argued that the sizable clout of the plastics industry may help explain the Thai government's reluctance to implement strong measures aimed at prevention, instead focusing on waste segregation and management, recycling and waste-to-energy [84].

Phase II of the Action Plan on Plastic Waste Management was launched in 2023. While it pushes on with several focus areas from Phase I, it seemingly incorporates

a stronger emphasis on actionable and binding plastic waste management tools, as well as a nascent focus on prevention. Indeed, the policy package includes a strong focus on the development of an EPR scheme, including legally binding measures. In another first, Phase II incorporates a dedicated emphasis on supporting the setup and growth of refill stations and eco-friendly stores, seen as forms of innovation to reduce plastic waste. Refill-related measures include the regulatory expansion of eligible product types, voluntary collaboration with the retail sector, and awareness campaigns.

In summary, Research Question 1 reveals that growing landscape pressures led to the development of fragmented plastic waste plans and policies. Initiatives lacked a common thread, adequate implementation plans and funding, and eschewed legally binding mechanisms in favor of voluntary measures. Most likely, the political influence of the plastics industry and its focus on maintaining business as usual hampered the development of stronger policies. The growth of a network of informal and private-sector waste management actors driven by market forces has further led to distorted incentives for plastic waste management. The COVID-19 pandemic forced government, businesses and consumers to shift their attention away from plastic, breaking down the momentum built up over previous years.

Table 1 Key policies and plans related to plastic waste in Thailand

Name	Developed by	Focus / Targets
National 3R Strategy (11th & 12th NESDP – 2012 to 2021)	Ministry of Natural Resources and Environment (MNRE)	Promote collaborative public-private approaches to reduce and segregate waste at the source, increase reuse and recycling, and further develop waste utilization and waste-to-energy methods [73].
National Waste Management Master Plan (2016–2021)	MNRE	Reach (i) at least 75% proper disposal of MSW by 2021; (ii) 100% proper disposal of accumulated waste by 2019; and (iii) over 50% of local governments having systems in place for waste segregation at the source [71].
Plastic Waste Management Plan (2018–2022)	MNRE	Recycle at least 60% of plastic waste by 2021, by promoting eco-packaging design and eco-friendly plastic alternatives, providing education in the field of plastics and alternatives [67, 71].
Municipal Solid Waste Management Action Plan (2018)	DOLA	Reach (i) 40% proper disposal of MSW and (ii) 30% recycling / reuse [71].
Roadmap on Plastic Waste Management (2018–2030), and the Action Plan on Plastic Waste Management: Phase I (2020–2022) & Phase II (2023–2027)	PCD & 1st Working Group of the Subcommittee for Plastic Waste Management	(i) Reduce single-use plastic consumption, and replace SUPs by environmentally friendly alternatives; and (ii) recycle plastic waste through a Circular Economy approach [69].
2nd National Action Plan on Waste Management (2022–2027)	MNRE	Achieve (i) 80% proper management of MSW, (ii) 74–100% recycling of specific materials like plastic waste, paper, glass and aluminum, (iii) and a 28% reduction in food waste [70].

2) Research question 2

This section presents the main findings of the interviews with 20 green retail founders from Thailand.

2.1) Niche motivations, visions and expectations

The interviews underscored high articulation and alignment of motivations among Thai green retailers, revolving around three sets of ambitions. Nearly all green retailers opened their shop to contribute to the reduction of plastic waste, solve environmental problems, address perceived government inaction, and/or replicate the experience of green retail abroad. Over 80% of interviewed shops opened between 2017 and 2019, when public discourse on plastic waste was highest. Moreover, founders generally expressed the desire to “strengthen awareness, education and knowledge” around plastic waste and prevention, which are viewed as the top drivers of success for the green retail niche. Conversely, lack of awareness is perceived as a critical obstacle. Finally, several founders underlined their commitment to “empowering and expanding the existing community of individuals” seeking to pivot from linear throwaway culture to more sustainable models.

A wider degree of divergence is observed when it comes to visions and expectations. Despite agreement that consumers will likely care more about the environment in 5 years, founders have contrasting expectations regarding the future of their green retail shop and the sector. They range from having a small-scale local impact, to scaling up and contributing to sustainable retail and plastic waste prevention on a broader scale. Some green retailers are experimenting with new approaches to address issues like high prices, limited product variety and lack of convenience for refill customers. For example, a few are developing innovations like online delivery for refill, return systems for reusable packaging, and bulk selling. Others are expanding to local initiatives such as zero-waste restaurants, consulting services, waste management solutions and small-scale recycling. A handful of green retailers are also exploring partnerships with established retailers, who are expected to play a crucial role in the growth of green retail. Most shops believe that traditional retailers view them as a source of inspiration and new ideas.

In summary, a substantial amount of experimentation is taking place in the niche, and no dominant model has emerged so far.

2.2) Network development

The green retail niche relies heavily on fostering a sense of community among “like-minded individuals” who share values and attitudes. Founders spend a lot of

time with their customers, “building relationships”, and developing awareness about their products, waste management, and green retail. As one shop put it, “it is important to create this sense of community and belonging” because without it, people see only the very limited impact of their own actions, “which can be very discouraging”. The sense of community enables meaningful change on broad scale. Moreover, it also promotes word-of-mouth, identified by several shops as one of the key drivers to acquire new customers.

Green retailers mostly view each other as allies that should support and learn from each other. Most founders mentioned consulting with other shops prior to opening their own, seeking advice and tips. In fact, Refill Station, a refill pioneer in Thailand, for a long time provided knowledge-sharing workshops to facilitate the emergence and growth of refill shops. Nevertheless, around half of founders have no regular contact with other green retailers, while the other half only occasionally connects with a handful of shops to discuss topics like suppliers, pooling of orders and new product ideas.

Surprisingly, the green retail niche has already established significant connections with traditional retailers. Some have been approached or are currently partnering with large supermarket chains, popular Bangkok malls, lifestyle brands, or even an automotive brand and a real estate developer. While it is unclear whether traditional retailers will intensify their green retail efforts in the future, some are clearly recognizing its potential.

Support structures play a crucial role in the scale-up of niches, by expanding networks and improving access to know-how, skills, and financial or other resources. However, green retailers highlighted the inadequate state of green retail support, with only four founders aware of formal support structures. Surprisingly, not a single shop mentioned SE Thailand, Thailand’s social enterprise association, which offers support, knowledge, partnership and consulting opportunities for its members.

Clearly, the rise in attention to plastic waste between 2017 and 2019 drove the rapid expansion of green retail networks. Regrettably, this momentum was brought to a halt by the COVID-19 pandemic, reversing past progress.

2.3) Learning dynamics

First-order learning taking place in the niche has grown but remains limited, since wide-scale dissemination of learnings is limited by the current state of networks. Stronger first-order learning will hinge on the growth of support networks and the emergence of more green retailers. Traditional retailers are also evaluating the attractiveness of green retail.

In terms of second-order learning, the interviews showed that initiatives are driving perceived changes in consumer preferences and attitudes, aligning with green retailers' goal of raising awareness and promoting learning. However, green retail is prohibitive for the average consumer due to high prices, inconvenience, and limited availability. For the most part, its appeal is limited mainly to individuals with higher income, high eco-consciousness and/or those in search of very specific products.

Existing collaborations between green and traditional retailers have mostly been limited to premium or life-style brands catering to a select customer base. The financial success of these collaborations will determine whether traditional retailers will double down on their experiments and whether more mass market retailers will join. Several green retailers expressed concerns about the risk of “greenwashing” or public relations (PR) exercises, doubting traditional retailers’ motivations and the truthfulness of their eco-friendliness claims.

Discussion

Combining the findings from the primary and secondary research, this section discusses the apparent trajectories of government policy, customer preferences, industry, traditional retail, and the green retail niche in the socio-technical system. In doing so, it assesses the extent of anchoring of the niche, and highlights implications and recommendations for policy interventions

aimed at supporting the green retail transition and SUP prevention.

1) System trajectories

Two distinct phases can be identified when it comes to the system’s trajectories. Before COVID-19, Thailand’s system of SUPs was significantly shaken up, which opened a window of opportunity allowing for green retail to emerge and for regime trajectories to take on new directions. Unfortunately, the start of the COVID-19 pandemic broadly shut the window due to urgent new public health and economic challenges.

From a policy perspective, growing pressure and momentum before COVID provided the Thai government with a window of opportunity to pass decisive and impactful plastic waste reforms with broad public support. Instead, the Roadmap on Plastic Waste Management relied on mostly voluntary measures without regulatory or legally binding mechanisms. None of the policies addressed glaring shortcomings in the country’s formal waste collection and treatment capacity. To some extent, the softness of measures is likely a consequence of a powerful plastics industry that enjoys a high degree of formal policymaking influence, and a reliance on contracts with private waste management firms which leaves the door open for conflicts of interest that hamper sound policymaking [84].

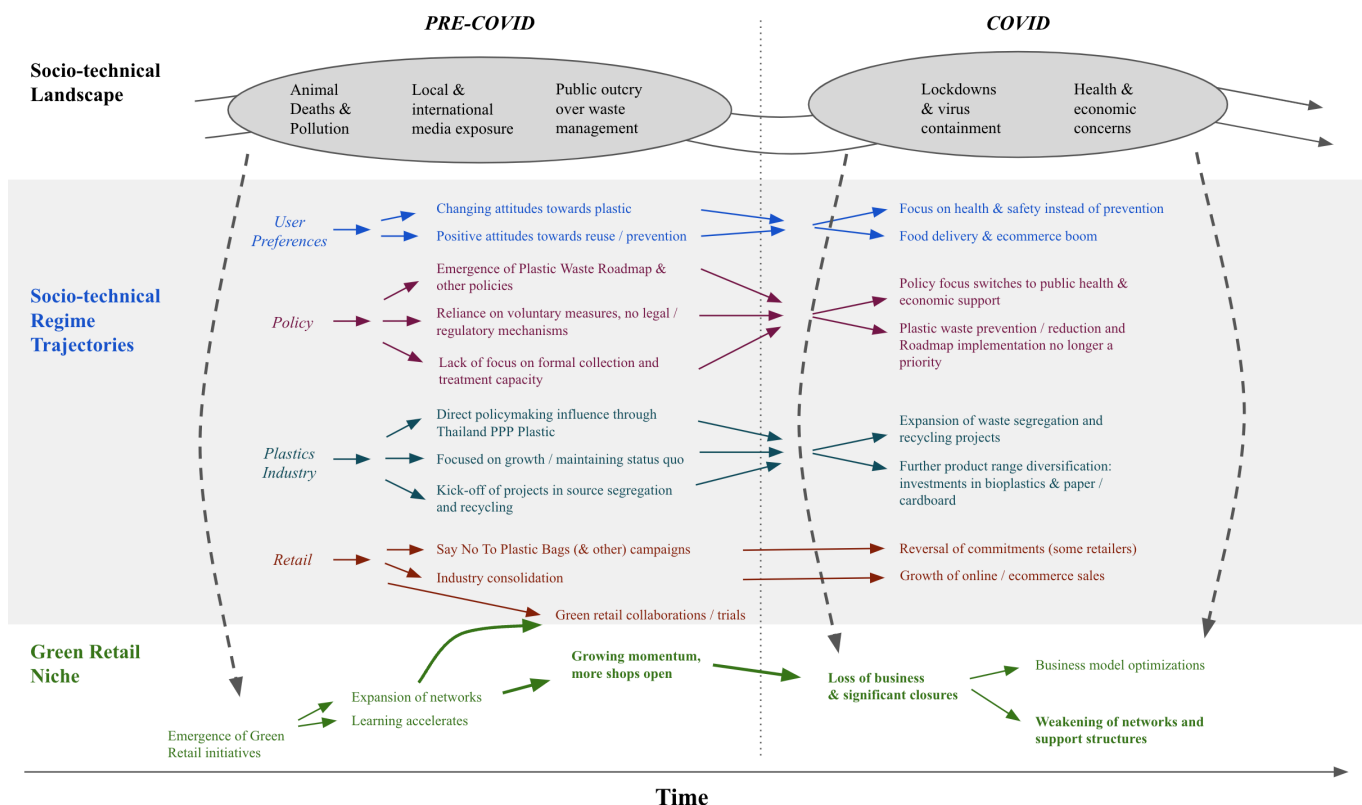


Figure 4 Regime trajectories in the socio-technical system of single-use plastics, before and during/after COVID-19.

The limited achievements of Phase I of the Action Plan on Plastic Waste Management support the idea that the policies were ultimately let down by their voluntary nature, lack of coordinated action, weak monitoring and enforcement mechanisms, and lack of political commitment. In a positive twist, Phase II introduces a focus on legally binding mechanisms such as EPR, and the notion of refill stations, though the approach remains largely dependent on voluntary measures – a risk for target achievement. In the context of Thailand's efforts to promote a BCG (bio, circular, green) economy, Phase II retains an overarching focus on segregation and recycling at the expense of prevention. Even so, the government has recently introduced two ministerial notifications that define and extend operational requirements and eligible product types for refill stations. Taken together, the above amounts to forms of institutional and technological anchoring, in which niche rules are adapted into the regime and the technical attributes of an innovation are defined [98].

The COVID-19 pandemic has significantly impacted progress on plastic waste management in Thailand, arguably reversing already limited progress. Current incentives to enact stronger plastic prevention policies can be best characterized as weak.

When it comes to customer preferences, several events led to broad-scale changes in attitudes to plastics and prevention. Unfortunately, growing anxiety over the COVID-19 virus combined with extensive lockdowns led to a boom in food delivery and ecommerce activity, further raising the SUP waste burden [35]. By now, these habits form part of most customers' everyday life, and will prove difficult to shake. The success of plastic waste prevention activities will largely depend on government policy and the retail sector's adjustments to products, prices, packaging, and greater convenience. The government's recent spotlight on separation and recycling is "convenient for customers", as it requires less behavioral change than prevention while easing environmental concerns or guilt. Indeed, the knowledge that separation leads to recycling may relieve moral pressure to reduce consumption.

The plastics industry's influence in waste management heightens the risk of policy capture due to its vested interests in maintaining the status quo and resisting prevention measures. The government's growing focus on separation and recycling is certainly beneficial for the plastics industry – as it poses no direct threat to its long-term growth. The industry is actively involved in several pioneering plastic recycling projects, as well as the development of bioplastics and investments in paper and cardboard packaging.

The traditional retail sector, with its quasi-monopolistic nature, can hamper innovation and competition, potentially affecting the breakthrough of green retail initiatives. Similar to findings from the UK organic produce niche [52], traditional retailers, brand owners and the private sector may play a significant role in adopting and reconfiguring aspects of the green retail and refill niche. Several leading retailers have backtracked on the "Say No to Plastic Bag" campaign, highlighting the fragile nature of voluntary measures that cannot be enforced. On the flipside, a few upscale traditional retailers have started partnering with green retailers, demonstrating the start of network and institutional anchoring of the niche. This joins a global trend, where 61% of signatories to the Ellen MacArthur Foundation's Global Commitment (mostly private sector organizations) have reuse / refill pilots in place [42]. However, certain green retailers have labeled the move as opportunistic and greenwashing.

Broadly speaking, the green retail niche emerged to help fill gaps left by government policy. The COVID-19 pandemic led to widespread closures of small shops, shrinking already limited support structures and slowing down learning and network formation in the niche. Green retailers, who mostly operate based on trial and error, would benefit from support to run and scale their businesses. A representative structure would help advocate for the niche's interests, coordinate efforts to expand networks and facilitate learning and skills development. The niche could also benefit from closer connections to the broader social enterprise and organic farming niches, which are bolstered by more established support mechanisms. Easier access to financial resources (through loans, raising capital or other financing options) would support store setup and growth. As green retailers further develop their business models, learning and network formation may pick up.

To summarize, a great amount of the momentum that was gathered towards coordinated action against plastic waste has faded due to the COVID-19 pandemic. Nevertheless, the plastic waste issue persists, growing in urgency. In coming years, additional pressures will inevitably mount on the government, renewing calls to address the issue.

2) Potential policy levers

Since waste prevention requires affordable, convenient and hygienic alternatives to SUPs, the green retail niche can be seen as an important partner for the government. Similar to startups that have shaken up other industries, green retail shops can serve as a "breeding ground for experimentation", bringing new innovations into the mass market. Scaling reuse and refill models

was identified by the Ellen MacArthur Foundation as a significant opportunity to reduce virgin plastic consumption, waste, and leakage into the ocean by up to 20% by 2040 [42]. As hinted in the closing paragraphs of the previous section, government and private sector play a central role in supporting green retail, by promoting (i) network formation and skills development, and (ii) facilitating access to financial resources.

Strong support mechanisms are crucial for establishing broad and deep networks that promote knowledge sharing, connect niches to the regime and thereby help accelerate breakthrough [54, 61]. To support Thai green retailers, the government could review, clarify, and expand the existing social enterprise (SE) Act and its benefits [99], so as to unequivocally cover sustainability-minded SMEs. This would enable broader access to related benefits, SE networks and formal support structures like the association SE Thailand. Moreover, green retailers should actively seek to draw connections to more established niches and tap into existing networks and support mechanisms.

From the perspective of greater access to financial resources, government co-financing has been shown to significantly accelerate niche momentum [52, 54]. In essence, co-financing schemes provide financial support to promising niche actors to help cover part of their R&D and experimentation costs, and thereby reduce risk. The government could earmark funds for sustainable / green SMEs through for instance R&D and investment grants, subsidies, or tax incentives. Special programs with banks and financial institutions can ease access to green loans and financing. Dedicated incubation and acceleration programs for sustainability innovations, funded by the public, private and civil society sectors, could provide access to grants or funding opportunities as well as training, learning, guidance and coaching opportunities. It has been shown that accelerator programs for circular economy-related startups promote their faster development [100–102]. For example, one could imagine a government-backed program similar to DEPA's digital innovation incubator [103].

Green retail promotion should align with the government's policy toolkit to promote better waste management, sustainability, BCG and Circular Economy. Establishing a national-level waste management authority would help coordinate policies and budgets across relevant ministries. Thailand should focus on reducing power imbalances and information asymmetries with the plastics industry and private waste management entities, which can be achieved through more selective policy consultations, stronger regulation, transparent and mandatory information sharing, a crackdown on

conflicts of interest and corruption, and a focus on public good above profits [84].

Beyond prevention, regulatory and economic policy approaches for plastic waste management can be grouped into three successive key action phases [16]. The first step would be to close leakage pathways, through investments that expand waste collection and sanitary treatment capabilities, as well as bans or levies / taxes on the most frequently littered and harmful SUPs. The EU and several of its member states recently enforced such bans [104–105]. Thailand may also consider formalizing (part of) its huge informal waste sector [106] and aligning the incentives of private-sector waste management firms. Certain provinces are already experimenting with such approaches [107]. In a second step, Thailand should create incentives for recycling, e.g. through the introduction of landfill and incineration taxes and the establishment of a binding EPR scheme that push recycling obligations onto producers [16]. These measures should be accompanied with a simultaneous drive to increase source segregation through financial incentives such as deposit-refund or pay-as-you-throw. The third phase should aim to restrain demand and optimize product design, through the removal of support schemes for fossil-based plastics, the introduction of single-use plastic taxes, reuse incentives, recycled content targets, and EPR fee modulation.

Across the board, the government's upcoming EPR scheme can act as a coordinating mechanism that cuts across all three priority areas. It should incorporate most of the initiatives and measures described above. To be truly effective, it should also enforce a broad definition of packaging and cover the widest possible range of producers. Furthermore, eco-modulated fees should be introduced to incentivize SUP prevention and the use of packaging with recycled content. The government should also closely heed the progress and recommendations made by the Global Plastics Treaty [108].

Conclusion

This paper presents a status report on the green retail niche's development and momentum, focusing on its visions, expectations, and relations with the regime. Despite a slowdown in network development and learning within the niche, which lacks strong support, findings point to the start of network, institutional and technological anchoring of the niche into the regime. The paper emphasizes the government's role in developing policy interventions that support green retail development through mature support structures, access to funding, networking, and important skills and knowledge.

Rather than identifying causal determination, this qualitative paper highlights potential policy levers worthy of further exploration. Data collection and treatment measures were put in place to reduce the risk of bias during the interpretation of observed attitudes, visions and expectations of Thai green retail founders.

To promote green retail and other sustainability niches, this research suggests future studies should explore the role of support mechanisms in more mature sustainability niches, such as social enterprises, organic produce or even bioplastics. Future studies may also choose to explore the visions, expectations and behaviors of actors not included in this research, e.g. policymakers, brand owners and traditional retailers, the plastics industry, the informal waste sector, and more. Green retailers' frequent mentions of loyal expatriate consumers suggests that comparative analyses between Thailand and countries with more advanced green retail sectors may pinpoint important institutional factors and drivers of consumer or private sector behaviors. Additionally, studying existing incubator programs in Thailand and other countries may further clarify their potential in promoting sustainability innovations.

Despite this paper's focus on the Thai socio-technical system of single-use plastics, it can be relevant for other countries and sustainability-related niches. The analysis, methodology and recommendations may prove especially useful for other developing countries facing similar challenges to Thailand in terms of plastic consumption and flawed waste management.

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