

HONG KONG'S CIRCULAR ECONOMY ON PLASTICS: ARE THE ECONOMICS FAILING?

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ABSTRACT

In the Special Administrative Region Hong Kong, municipal solid waste has grown substantially over the past two decades with plastic waste accounting for an increasingly large proportion. In response, the Hong Kong government trialled several schemes that centred on economic mechanisms and the circular economic principles of recycling and reduction to manage plastic bags and plastic beverage containers. As the results of these measures have been met with strong criticism, the present paper assesses the extent to which therein applied economic mechanisms realised a circular management of these streams. To explore this question, the paper relies on quantitative and qualitative field research combined with an analysis of a specifically designed public opinion survey. The findings indicate that price setting is a key element towards circularity for waste plastics in Hong Kong, yet it is not the sole determinant. Using an evolutionary institutional framework the paper shows that besides economics the incorporation of consumers' and recycling stakeholders' interests are key for effective regulations towards a circular economy on plastics in the city.

1. INTRODUCTION

The Hong Kong Special Administrative Region, a global financial and trading centre, is characterized by high population density, high living costs and high levels of consumption. Given the scarcity in land and natural resources, Hong Kong not only critically depends on imports for nearly all products of everyday use. The city moreover has little space to accommodate for goods discarded at their end-of-life. With residents' affluence at an all-time high, municipal solid waste (MSW) generation has soared to 1.51 kg/cap/day in 2022 (EPD, 2023). These amounts are largely disposed in landfills (69 wgt%), about a quarter is exported for recycling (26 wgt%) and merely a small fraction (5 wgt%) is recycled domestically (ibidem). Within MSW, a continuously growing and in treatment challenging stream are post-consumer waste plastics. Of it, the city produces about 2,369 tons/day, rendering plastics into the second largest fraction (21.3%) of overall MSW (ibidem).

Given that existing landfills have operated near saturation levels for a considerable amount of time and free space for new landfills is scarce, more sustainable approaches are urgently needed. Additionally, global environmental dynamics that feature strong local impacts such as climate change and growing resource shortages further warrant adequate system adaptations in Hong Kong. One such con-

cept that aligns with sustainable development and climate change mitigation through resource conservation and their efficient use is the circular economy (CE). While literature has identified over 221 definitions (Kirchherr et al., 2023), at its core the CE is an evolving blueprint for systemic transition. It stipulates the replacement of globally predominating linear models (extract-produce-consume-dispose) with those that loop resources within socioeconomic systems (i.e. extract-produce-consume-recycle). In this sense, the concept calls for conserving resources to the best possible extent and simultaneously increasing efficiencies in resource use. So despite its frequent association with recycling, the CE bears much wider strategies for application encapsulated in the 10-R hierarchy of CE principles. These encompass the practices of refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle and recover (Potting et al., 2017).

In Hong Kong, where high emission levels, climate change and the potential of rising sea-levels constitute very real threats to self-preservation, the government has produced no shortage in strategy papers aimed at enhancing the city's sustainable performance (EPD, 2005; HKGov, 2017). Yet, in the domain of WM, measures yielding substantial results have been falling behind intentions. While the reduction of MSW generation at the source to alleviate



landfills has been a key tenet, practical measures remain fragmented and ineffective (Wan et al., 2018). This shortcoming is most visible when comparing actual MSW generation with the government's waste reduction plans issued since 1998 (Figure 1). For post-consumer plastics as well as for all other recyclable fractions most evidence points to unsustainable management. For example, estimations from 2020 point out that 80% of plastic beverage containers end up in local landfills (DWW, 2020). Further aggravating the situation are the waste import restrictions (the National Sword policy) implemented in Mainland China in 2017, which limit the import of most recyclables (BEC, 2021) and therefore cut-off Hong Kong from its major recyclable waste export market. Simultaneously, affluent lifestyles manifesting in conspicuous consumption (Lau, 2019) as well as the impact of COVID-19 triggering a packaging frenzy in the city have further increased the need to devise local, effective solutions.

In this context, the Hong Kong government has issued measures to address the plastic challenge. These include raising the levy on single-use plastic shopping and retail bags in 2022, a partial ban of single-use plastic table ware and food and beverage containers in 2023, the planning of an extended producer responsibility (EPR) scheme for plastic beverage containers for 2025 and a household waste charging scheme for 2024. The temporal sequence of these measures indicates an acknowledgment of the problem's urgency among governmental stakeholders. From a researcher's perspective, this raises the question to which extent such institutional (rule-based) actions can be effective in yielding CE related results.

To investigate this issue within a reasonable scope, the present contribution focusses on two post-consumer plastic waste streams, i.e. single-use waste plastic beverage containers (WPBCs) and single-use plastic bags (SUPBs). To benchmark the inquiry against the market-oriented, laissez-faire approach generally adopted by the Hong Kong government in WM (Lee, 2020; LEGCOPEA, 2023), the study aims to assess the economic effectiveness of official CE measures. The respective research question therefore asks to which extent are economic mechanisms effective to realize CE practices for WPBCs and SUPBs in Hong Kong? Specifically, the paper explores if Hong Kong's CE

on plastics (1) is predominately about price-setting and (2) if the official approach manages to 'get prices right'. The implicit hypothesis pursued in this paper is that the government's economic incentives are insufficient to foster a CE management of SUPBs and WPBCs.

Over the following paragraphs, the manuscript will first introduce the materials and methods used for the analysis. The subsequent section will then present the economic mechanisms implemented by the government for a circular management of SUPBs and WPBCs. After that the responses of non-governmental stakeholders to the official economic incentives will be analysed so as to assess whether official economic stimuli correspond to the stakeholders' own preferences. The concluding part will merge discussion and conclusion to elaborate on the role of economic factors in Hong Kong's CE on post-consumer plastics.

2. MATERIALS AND METHODS

Regarding materials and data, the paper builds its analysis on three types of data sources. In first instance, it draws on field research by the author on recycling structures for WPBCs conducted during late 2021. Related activities of material collection comprised interviews with collecting and recycling stakeholders, in parts belonging to the informal recycling sector, as well as observational quantitative data recording. The aim was to quantitatively ascertain transacted WPBC quantities along the value chain as well as an assessment of the practices and patterns adopted by collectors and recyclers when managing WPBCs. A detailed outline of obtained data is provided in Steuer and Chen (2023b). Second, the manuscript also presents so far unpublished survey results on waste plastic management and attitudes among Hong Kong residents. For these two surveys, conducted in May 2023 and September 2023, a total of 820 and 1,004 respondents were interviewed via the Hong Kong Public Opinion Research Institute (HKPORI) and Qualtrics. The questionnaires were disseminated online and comprised two types of questions: (1) multiple choice questions to capture waste single-use plastic generation quantities; (2) five-point normed questions along a Likert-scale to quantify behavioural patterns, routines and preferences of consumers on their engagement with

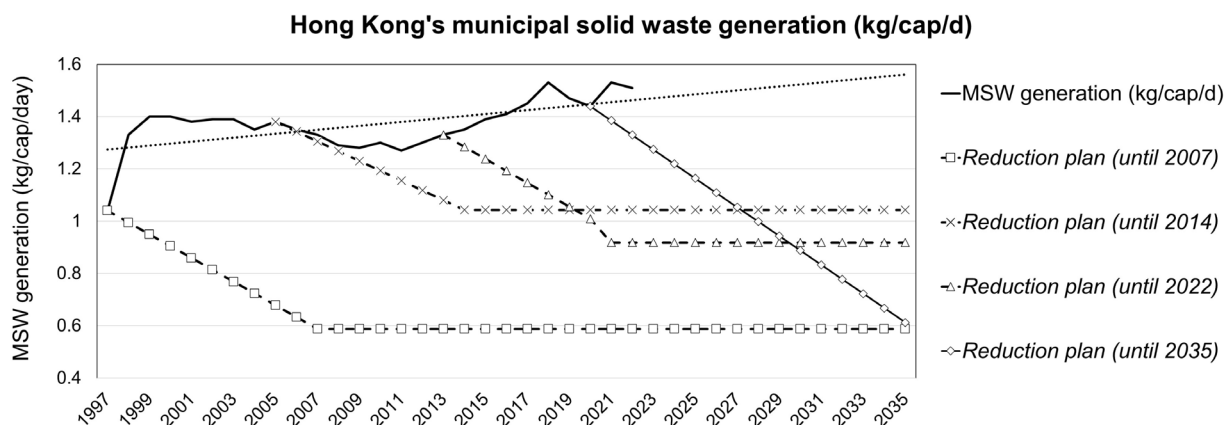


FIGURE 1: Official waste reduction plans vis-à-vis actual MSW generation in Hong Kong (the author based on EPD, 2001-2023).

single-use plastic waste products. In third instance, desk research was used to screen official documents and policy papers, corporate (sustainability) reports, public surveys and working papers from non-governmental organizations on Hong Kong's CE for waste plastics.

In terms of analytical methodology, the study uses an evolutionary institutional framework previously developed by the author for the assessment of CE performance in mainland China and Hong Kong (Steuer, 2021; Steuer, 2022). Its main purpose is to capture the process of institutional change and whether this dynamic results in effective outcomes. For the current study, the subject of analysis are the economic mechanisms, in particular the setting of prices for CE instruments, i.e. the levy system for SUPBs and the redemption value for an EPR on WPBCs in Hong Kong. As for whether the mechanisms are effective, two conditions must hold: First, the mechanism (a rule or institution) must achieve a quantitatively verifiable improvement, e.g. a reduction in SUPBs sold or consumed. Second, the mechanism must be 'interest-inclusive', i.e., it must account for the interests/ preferences of all involved stakeholders. For example, an officially implemented EPR on WPBCs must provide for deposit or redemption values that are in line with expectations of beverage retailers, waste generators, collectors, recyclers etc. In case of falling short in being interest-inclusive, the implication is that stakeholders do not participate in the system (generators do not return, collectors do not recover etc.) and likely develop their own solutions to handle WPBCs (such as discarding these in general waste bins, rejection to recover etc.).

The term of institutions in this context refers to man-made solutions to a problem, a challenge or a novel context. In related literature, institutions are often described as systems of rules, that structure and guide behaviour of and interaction between stakeholders (Groenewegen et al.,

2010). The evolutionary factor implies a system change over time, such as a gradual transition from a linear to a circular economic system. Here change can be envisaged as an unfolding interplay between novel challenges, problems or contexts and corresponding institutional solutions from different stakeholder groups (Mantzavinos, 2000). These solutions can be formal (regulations, laws, schemes etc.) or informal (routines, habits, norms) in nature. As new challenges affect diverse stakeholders at the same time, the analytical model illustrates an interplay between these agents. Each affected group does respond to the problem in their own specific manner: They craft institutions to solve the challenge at hand and once put into practice stakeholders may learn about how their as well as other stakeholders' institutions on the given challenge perform in reality. Learning is dependent on capturing information from feedback loops, such as through data collection, individual accounting efforts, observation of waste recovery patterns etc. The so acquired learning insights shape stakeholder experiences and value ideals and moreover decide if and how they adjust or refine their own institutions: Here shortcomings in achieving effective rules – by excluding other parties or because of quantitative target shortcomings – may lead to rule modifications or entire rule overhauls. A flow diagram illustrates a generalized evolutionary process of institutional change (Figure 2).

In the current study, the aim will be to identify whether CE related rules and practices on SUPBs and WPBCs have changed. And, if such changes can be traced back to feedback loops, information exchange or other interactions between governmental and non-governmental stakeholders. Hereby, a key, but not the exclusive focus will be changes in official pricing and other economic incentive structures that the government devises with the aim of attracting participation of ever more stakeholder groups.

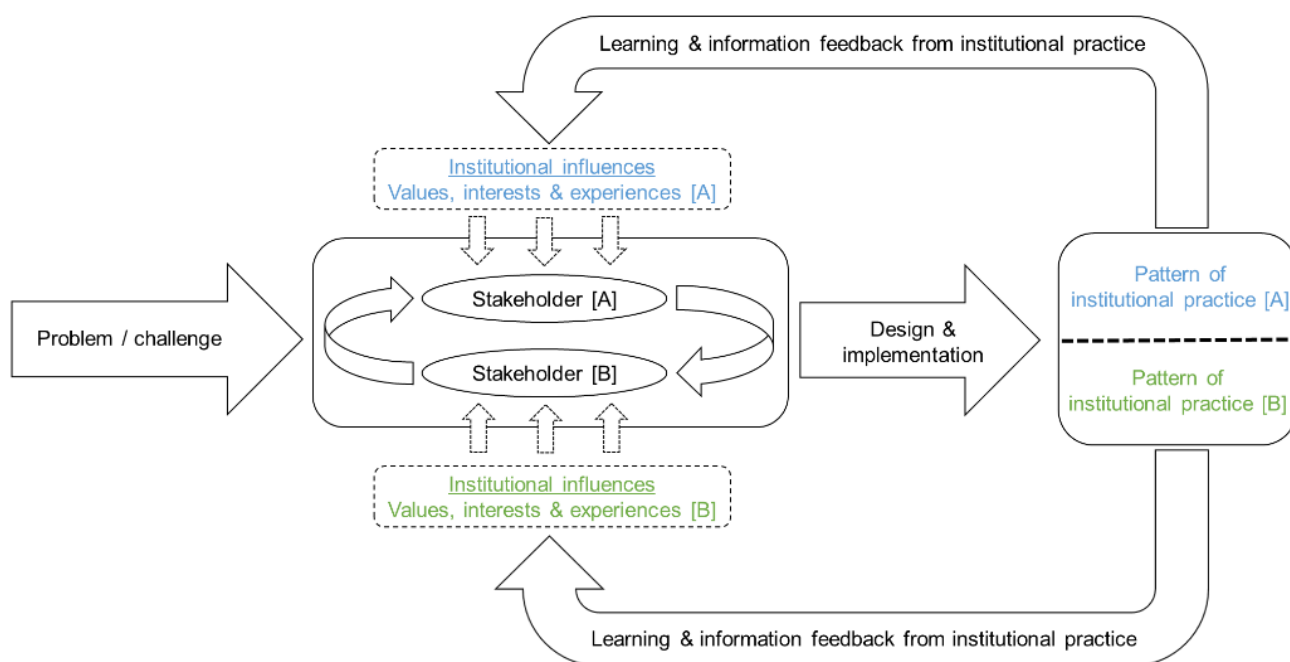


FIGURE 2: The evolutionary process of institutional change in a socio-economic system (based on Steuer, 2021).

3. RESULTS

3.1 The Economic Mechanisms in Hong Kong's Circular Economy on Single-Use Plastic Bags and Beverage Containers

3.1.1 Regulatory framework

The city's government regulates aspects of environmental protection and sustainability via single statutes (Tong, 2021). In contrast to other jurisdictions, Hong Kong has not formulated a CE law and CE relevant legislation is by and large fragmented and formulated as ordinances. The fundament for WM and CE measures is the 1980 Waste Disposal Ordinance, which has been extended by Product Eco-responsibility Ordinances for glass beverage containers, WEEE and plastic shopping bags. The piecemeal nature of this approach bears shortcomings in terms of measures being fragmented and with exception of the Product Eco-responsibility Ordinances often bearing overly voluntary and tacit characteristics. That is for example the case of source separation measures for MSW from households, which have failed to realise residents' participation (Wan et al., 2018). In regard to plastic waste, a direct comparison with the EU's institutional framework indicates that Hong Kong gave the issue too little attention. Issued regulations, such as the very recent waste charging scheme that was expected to take effect in 2024, address MSW recyclables in their entirety rather than setting up specific stipulations for individual waste streams. In terms of qualitative differences on promoted CE principles for managing post-consumer plastics, an earlier analysis by the author demonstrated that the EU's regulations predominately stressed 'refuse' and 'recycling' approaches. Hong Kong's regulatory stance on the other hand focusses on 'reduction', yet without notable achievements in curbing generation (Steuer and Chen, 2023a).

3.1.2 The levy for single-use plastic bags

The levy on SUPBs emerged as a result of the government's waste reduction strategy with the aim to promote a 'plastic-free' culture in the early 2000s when overall MSW amounts had increased notably (Deloitte, 2018). In 2009, the levy was introduced under the Product Eco-responsibility Ordinance and is next to glass beverage containers and WEEE one of Hong Kong's current mandatory (Extended) Producer Responsibility Schemes (PRS) (Tong, 2021). Launched in 2009 as a pilot, it initially covered a selected number of retailers, e.g. supermarkets, convenience stores, personal health stores etc. and levied 0.5 HKD (0.06 EUR) on every SUPB (EPD, n.d.). The scheme was extended to all retailers in the city in 2015, exemptions were abandoned, and the charging level was further raised to 1 HKD (0.12 EUR) in 2022 with the government promoting the reuse concept of 'bring your own bag' (ibidem).

Along with this development the price adjustment as a consequence of generated SUPBs deserves attention. The initial measure in 2009, indicated a 5% decrease in bags generated from the pilot-covered outlets over the following year (EPD, 2011). The coverage extension in 2015 achieved an even more notable decrease of 25%, i.e. a reduction of 5.24 billion to 3.93 billion SUPBs recorded at landfills (EPD,

2016). Yet, over the following years a rebound in growth rates of discarded SUPBs was assessed through landfill sampling, which indicate an annual median increase of 4.7% over 2016-2022 (EPD, 2017-2023). The resulting levy increase to 1 HKD by late 2022 is a direct response to this rebound (BEC, 2021). As of 2023, the scheme appears to have yielded some success according to Hong Kong's Environmental Protection Department (EPD): Over inspections across the entire city, it was found that retailers overall adhered to the levy scheme, had substantially reduced the variety of SUPB types for sale and helped distributing information on the practice of the levy (ACE, 2023). While most recent MSW statistics from 2023 have not yet been published, section 3.2.1 will explore to which extent its raise resonated with consumer preferences.

3.1.3 The Hong Kong EPR for waste plastic beverage containers

For WPBCs a PRS is currently under design and expected to be launched in 2025. Several pilots aiming to apply EPR specific mechanisms to WPBC recovery have been tested in the past. At their core the most controversial factor pertains to cost and price mechanisms. As of now, the common agreement among governmental and non-governmental stakeholders is that an economic incentive has to be applied to encourage the return of containers by consumers (Tong, 2021). In contrast to already existing PRS on glass bottles and WEEE, the scheme for plastic beverage containers will use a market-led approach aiming to outsource responsibility to commercial stakeholders (LEGCOPEA, 2023). The government will neither collect a levy from producers, importers and retailers nor coordinate downstream recovery services. Rather official stakeholders will set statutory recovery targets that beverage suppliers will have to meet. Moreover, coordinating duties including the implementation of a producer responsibility organization will have to be organised by beverage suppliers, while retailers with a retail floor area of 200 m² or above have to serve as designated return points and provide takeback and rebate services (EPD, 2021b). Takeback services cover plastic beverage containers and cartons containing between 100ml and 2 litres, and for these items scheme operators are obliged to provide rebates. As of 2023, a rebate amount of 0.1 HKD (0.011 EUR) is the current official benchmark (LEGCOPEA, 2023). As discussed in the sections below, this rebate level is far behind international EPR standards for WPBCs and emerged as result of lobbying from contesting interest groups.

3.2 Assessing the (Economic) Preferences of Non-Governmental Stakeholders

3.2.1 Scheme operators: Beverage manufacturers, retailers and recyclers

The variety of corporate stakeholders potentially affected by Hong Kong's PRS on WPBCs has recently merged into one dominant representative group to voice its interest. Drink Without Waste (DWW), which was established in 2017, comprises producers, retailers and recycling operators as well as NGOs. Quite in line with the government's

intent, it supports the PRS and aims to recover 70-90% of beverage containers upon the scheme's taking-effect. Beyond recycling, the initiative further intends to realise CE goals for WPBCs pertaining to reduction (via installing and operating beverage dispensers), and redesign (via sustainable packaging design standards) (DWW, 2020).

There is ample documentation of some individual measures by corporate entities within the group striving to fulfil these objectives. This includes weight reduction, reduction of virgin PET and full substitution via recycle by local beverage companies, single-use plastic bottle removal by hotel chains and the setting up of water dispensers by property management (Deloitte, 2018). At its centre, the initiative's efforts, are geared towards developing a recycling network for WPBCs. The key cornerstones are (1) to create a dense and easily-accessible network of return points; (2) adopt a value-on-return scheme (VRS) instead of a Deposit Return Scheme (DRS), which DWW considers to minimize costs and facilitates the money-for-bottle transaction process; (3) to keep the VRS at a low level, which was initially set at 0.05 HKD (0.005 EUR); this in turn (4) was considered sufficient to incentivise "not only consumers but also... domestic helpers, building and street cleaners, and other informal collectors" to engage as primary collecting stakeholders (DWW, 2020). Both latter aspects underscore the prominent economic interest of the group's solution, which will be further analysed in the discussion section.

In regard to recycling, the perspective of collecting and preprocessing stakeholders deserves to be outlined separately. In general, recyclers in Hong Kong face high rental as well as relatively high labour costs, the latter of which being in parts due to weak source-separation of MSW recyclables by Hong Kong households (Steuer and Chen, 2023a). Further complicating matters is that Hong Kong does hardly host any manufacturing companies, which could make use of recycle as production feedstock (BEC, 2021). This implies that recycled materials have to be sold on international markets, where Hong Kong's cost-competitiveness is substantially undercut by comparable recycle produce from China. Yet, to evaluate the feasibility for WPBC recycling systems, DWW has between 2020-2021 conducted a one-year pilot assessing the collection and

preprocessing capacities of existing private-informal WM structures in Hong Kong (Steuer et al., 2022). In terms of incentives the pilot provided 0.1 HKD (0.06 EUR) for the entire operating costs, including subsidies for collectors (0.05 HKD/bottle) and pre-processors (0.035 HKD/bottle). At that time, the author was tasked with assessing the pilot performance, which was essentially done via quantitative documentation in the field and interviews with collecting and pre-processing (sorting, cleaning, baling) stakeholders. Quantitatively, the results indicated a bottle recovery capacity of 3% (based on sale volumes) by the surveyed pre-processors during the pilot. Would the pilot have been extended to all active pre-processors in Hong Kong the recovery rate could have been raised to 23%. Yet, once subsidies were stopped, recovery rates dropped substantially (Steuer and Chen, 2023b). The qualitative results from the interviews shed light on the relatively low recovery rate: Collecting as well as recycling stakeholders indicated their dislike for recovering WPBCs, due to reasons of hygiene and low reimbursed per-unit-value. Furthermore, transport, sorting, cleaning and baling were considered as cumbersome compared to the predominately handled recyclable streams of paper, cardboard and metals. A longitudinal analysis of preferences for and against CE practices for WPBC management further underscored the unchanged willingness of collectors and recyclers to engage in WPBC recovery. Over the past few years, both stakeholder groups have expressed a clear rejection towards recycling this waste stream (Figure 3).

3.2.2 Consumers

A major driver behind the launch of the SUPB levy outlined in section 3.1.2e were environmental NGOs lobbying government towards using the argument of consumer opinion (Lau, 2019). Yet, in comparison to other measures such as municipal waste charging, recycling infrastructure or an encompassing PRS, public preferences for the relatively simple SUPB levy merely ranked 6th out of seven CE concepts (Wan et al., 2018). In regard to consumer behaviour, the initial levy of 2015 had a limited effect as SUPB generation rebounded again soon after dipping for a single year (BEC, 2021). One potential factor explaining



FIGURE 3: Binary Interest Node Schematic (BINS) mapping stakeholder interests for and against CE management of WPBCs (reproduced from Steuer and Chen, 2023b).

this trend can be discerned from consumer sentiment on what this stakeholder group perceives to be the minimum charging level needed to discourage consumption. In 2022, a governmental-led consumer survey found that 74.5% or 6,651 out of 8,804 surveyed Hong Kong residents would consider at least 1 HKD adequate to reduce consumption. The same study conducted a telephone-survey among 1,003 residents on what charging level would constitute the most effective deterrent. Presented with a range from a minimum of 1 HKD to over 5 HKD, interviewees' responses resulted in a weighted mean of 2.2 HKD (0.24 EUR) (CSD, 2022). Against this background the government's 0.5 HKD level from 2015 appears to be too low for curbing SUPB consumption.

Regarding WPBCs, relative early pilots on return schemes in 2005 and 2007 provided insights on the role of (monetary) incentives for Hong Kong residents' participation in the CE. Both schemes were funded and organised by the EPD in collaboration with Swire Coca-Cola, Vitasoy and Watsons Water as main partners and conducted within sites of selected residential quarters for a year each. There residents could redeem WPBCs (sized between 480-800 ml) for demonetized 'reward points'. Points were allocated by specifically set-up collection points on a per-container basis and had to be uploaded to a specific redemption card. Having collected a certain number of points, consumers could exchange these for souvenirs or beverages. Setting aside the scheme's peculiar logic of returning containers to be rewarded with more containers for consumption, the pilots showed little innovation and overall failed to encourage residents' participation. Based on the general attitude reflected in residents' feedback, it turned out that these rather cherished convenience (access and opening hours of the WPBC return points) over other factors (Chan, 2011).

Over a decade later that perspective still appears dominant. A public opinion survey by the renowned HKPORI among 976 respondents, revealed that economic rewards for engaging in the return of WPBCs only ranked a 4.4/10, while aspects of hygiene, return convenience and number of return locations achieved an 8.3/10, 6.7/10 and 6.9/10, respectively (HKPORI, 2022). For return convenience and locations, public preferences indicated an over 60% sup-

port for collection stations within residential areas, i.e. close to one's home, while bus stations and retail ranked second with 57% and 54%, respectively (HKPORI, 2021). The fact of economic mechanisms as relatively weak drivers is corroborated by the author's own survey, which indicates that around 55% of consumers would not feel (more) motivated by economic incentives to segregate WPBCs and other single-use plastics (Figure 4).

The HKPORI has in this context conducted a very insightful survey, which aimed to explore the threshold value of a PRS inducing consumers to return their WPBCs. The findings show that notwithstanding whether DRS or VRS, a value of 1 HKD (0.12 EUR) would induce 62% and 78% of 927 respondents to return their emptied containers (Figure 5) (HKPORI, 2021). What this high benchmark means for the overall institutional dynamics of Hong Kong's CE on plastics will be discussed in the subsequent concluding section.

4. DISCUSSION AND CONCLUSIONS

4.1 Single-use plastic bags

From the perspective of the analytical model, the official implementation of the levy for SUPBs is essentially the result of an institutional responsiveness dynamic between governmental and consumer stakeholders: the positive information and learning feedback from consumers in support of the levy in 2011 provided a strong motivator for Hong Kong's government to expand the scheme and raising the levy to 0.5 HKD per bag (EPD, n.d.). Apart from consumer support, the most recent adaption to 1 HKD in 2022 can be traced back to the information feedback from increased waste plastic bag generation. Consumer sentiment captured via a 2022 consumer survey yet further suggested that to render the scheme even more effective a levy of 2 HKD (0.23 EUR) would be viable as such a price level still enjoys broad popular support (LEGCO, 2022). This underscores the argument of the paper regarding prices being a key mechanism to drive the CE practice of reduction for SUPBs in Hong Kong. Additionally, the case of SUPBs indicates that institutional adjustment accounting for involved stakeholder interests leads towards regulatory effectiveness. While statistical data for SUPB waste gen-

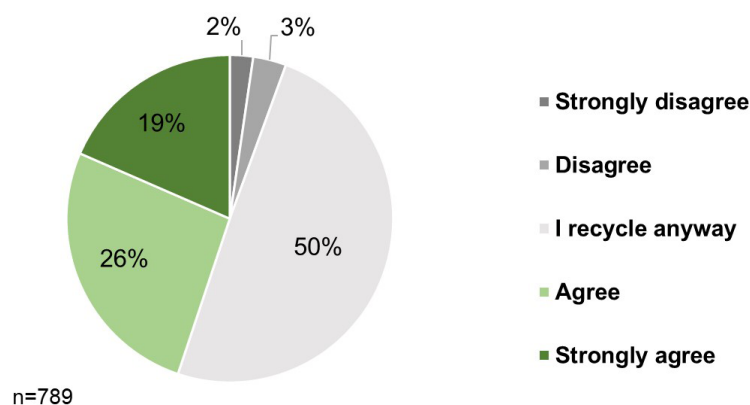


FIGURE 4: Interviewees on whether economic incentives (tax reduction, reimbursement, etc.) motivate individual separation of single-use plastic waste (public opinion survey conducted by the author).

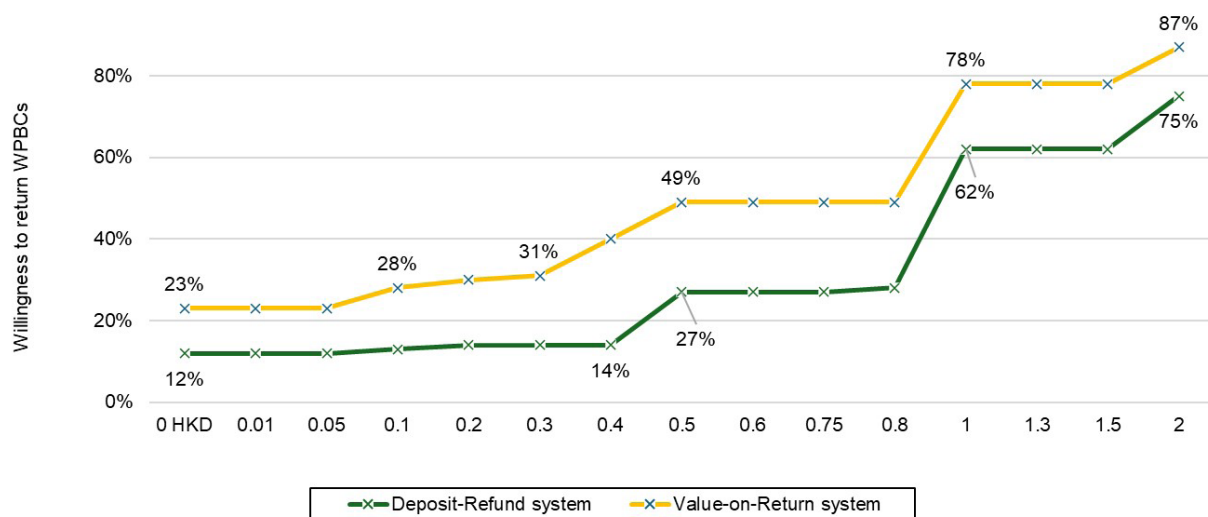


FIGURE 5: Willingness to return WPBCs for financial refunds (reproduced from HKPORI, 2021).

eration for 2023 is not yet available, the comparison with other jurisdictions indicates that the official levy value is set well with international benchmarks. For the purpose of comparison, the levy of each jurisdiction was divided by the Big Mac Index, a means to adjust country differences in consumer purchasing power between different countries. The resulting ratio enables a ranking of each region/ country, while the reduction rate provides an overall indication of the levies' impact (Table 1). So, while Hong Kong ranks well compared to other countries, its low reduction impact must be seen in light of the comparatively short implementation period.

4.2 Waste plastic beverage containers

For the stream of WPBCs, the path of institutional evolution is substantially more complex as preferences of scheme operators and consumers are each impacting CE performance and price setting. The substantially more voiceful stakeholder group were the scheme operators, represented by DWW, which used its notable public relations activities to influence the ongoing PRS design. For this group, the cost element plays a central driver. One factor emphasized by the beverage producers in 2018 was that virgin PET containers cost around 0.014 HKD/unit (Deloitte, 2018). Any redemption value imposed on containers via a PRS would therefore have a notable impact on retail prices and was seen as a potential disincentivizing factor for consumption. Hence the initiative's strategy

consisted of suggesting a redemption value of 0.05. Another argument of DWW for this stance was the potential for system fraud, which was assumed to occur should the redemption value be set too high (DWW, 2020). An online query on that challenge in the context of WPBCs however indicates that fraudulent practices can be easily prevented via digitalization, electronic financial transfers and single unit counting (Tucker, 2022). These measures mirror what the government has outlined in terms of requirements for its PRS (EPD, 2021a and 2021b), which in turn renders this danger relatively minimal. Yet, to DWW's credit, regarding scheme operations, some of its proposed objectives have gone beyond the government's demand, such as the inclusion of all single-use plastic beverage containers in the scheme, the emphasis on recycling network development and inclusion of informal stakeholders (DWW, 2020).

Another economic mechanism promoted by DWW is to replace the initially envisaged DRS with a VRS (DWW, 2021). While this approach has been criticized by green groups as failing to make consumers accountable for their consumption (personal communication with Mr. L., May 2021), there is yet another angle to it. DWW has notably highlighted their intention to include low-income groups, e.g. household helpers, informal collectors and cleaners of residential buildings into their design for a PRS (DWW, 2020). The DWW's argument therefore was that a VRS could induce these stakeholders to recover otherwise discarded containers for a small monetary return. These considerations how-

TABLE 1: Using the Big Mac Index to compare economic viability of SUPB levy benchmarks (the author based on ACE, 2023 and https://scaan.net/plastic_global/).

Country/ city	Implementation (year)	Levy effectiveness period (years)	Levy (EUR)	Big Mac Index (BMI) (EUR, 2023)	Levy/ BMI *100	Reduction
Ireland	2002	5	0.20	4.36	4.59	94%
Hong Kong	2022	0.33	0.11	2.45	4.48	60%
Portugal	2015	2	0.10	4.36	2.29	74%
UK	2015	8	0.06	4.06	1.48	98%
South Africa	2003	9	0.02	2.14	0.93	44%

ever neglect two critical aspects: During the author's field research, it was indeed found that informal collectors and cleaners delivered the majority of WPBCs over the DWW pilot in 2021 amounting to 78-91%wgt. of overall recovered quantities. Yet, once the subsidy ended, collected WPBCs reduced by about 1/3 primarily due to informal collectors ending their engagement (Steuer and Chen, 2023b). As this pattern underscores the critical factor of pricing and value setting for a future PRS in Hong Kong, another aspect of concern is system sustainability. During interviews on the ground, the author and colleagues found that informal collectors and cleaners were mostly about 60 years of age and older. In turn solely relying on a low redemption value to incentivize collection among low-income groups will not be sustainable over the long term and at best constitute a temporal externalisation of WPBC collection.

Given the notable efforts of DWW, the government has picked up several suggestions of the group, for example by leaving the question of DRS vis-à-vis VRS open to scheme operators as well as supporting the DWW as key authority regarding the consultancy for the further PRS design. Yet on the matter of value setting, relevant government documents show a tendency among lawmakers to push for a potential raise of the reimbursement value from 0.1 to 0.2 HKD (0.023 EUR) (LEGCOPEA, 2023). This would imply that the information feedback from the corporate interest group did not fully capture governmental stakeholders' position for decision-making and institutional design.

For consumers, the factor of economic value setting does play a substantially less important role. As indicated in the previous sections, this group clearly supports a PRS for WPBCs. Yet, as a recent findings have shown, to motivate a majority of Hong Kong residents into participation the rebate value has to be set at around 1 HKD (0.12

EUR) (see Figure 5). That level is somewhat corroborated by comparisons with international EPRs for WPBCs. Here again resorting to the Big Mac Index and how it compares to the suggested deposit/ redemption value, the officially suggested 0.1 HKD and 0.2 HKD values appear comparatively low. Rather, a redemption value of around 0.5 HKD would put Hong Kong closer to international best practice systems: As shown in Table 2 below, the Deposit/BMI ratio and the return rate show a strong positive correlation ($r_s=0.854$) for countries with an EPR for WPBCs. Hence, raising bottle deposits in line with the BMI's purchasing power parity benchmark appears to align well with higher recovery rates. Assessed from this angle, Hong Kong's decision-makers' current proposal of 0.1 and 0.2 HKD would thus appear to fall short of getting the prices right, which for the case of WPBCs provides support for the research hypothesis. By implication, the container value should at least be raised to 0.5 HKD (0.054 EUR) to come closer to the international Deposit/BMI median of 3.

4.3 Concluding remarks: The role of financial mechanisms vis-à-vis other institutional solutions

So are prices really the most decisive factor for Hong Kong's CE on plastics? A review of consumer sentiment would on first sight underscore this assessment. Among this group there is a strong support for a PRS on WPBCs and if raised to 1 HKD (0.12 EUR) or even 2 HKD (0.24 EUR) would induce up to 78% and 87% of consumers to return their bottles (Figure 5). Yet, besides purely economic incentives, the government should also incorporate lessons from previous behavioural evidence of this stakeholder group: Prior pilots on the stream failed due to neglect of WM infrastructure providing convenience and accessibility. Moreover, the author's longitudinal analysis of CE preferences among consumers shows that there is interest in WPBC re-

TABLE 2: Correlating international deposit values along the Big Mac Index with WPBC return rates (the author's calculations based on return rates provided by Reloop, 2020).

Country	Deposit Value (EUR)	Return rate (PET) 2016	Return rate (PET) 2019	Big Mac Index (BMI) (in 2020, EUR)	Deposit/BMI*100
Croatia	0.06	87%	89%	2.93	2
Estonia	0.10	87%	86.9%	4.12	2.4
Lithuania	0.10	92%	92%	4.12	2.4
Sweden	0.11	84.9%	84.1%	5.04	2.2
Norway	0.16	88.2%	89.4%	5.16	3.1
Denmark	0.20	90%	94%	4.03	5
Finland	0.20	92%	90%	4.12	4.9
Germany	0.25	98%	97%	4.21	5.9
Netherlands	0.25	95%	95%	4.12	6.1
Median	0.14	89%	90%	4.12	3
Hong Kong (2022) (Pilot: 0.1 HKD)	0.011	n.a.	n.a.	2.22	0.5
Hong Kong (2023) (Official deliberation: 0.2 HKD)	0.023	n.a.	n.a.	2.22	1
Hong Kong (int. standardised benchmark: 0.5 HKD)	0.054	n.a.	n.a.	2.22	2.4

cycling systems, but in a similar manner various reduction approaches to beverage containers as a business concept enjoy support (Figure 3). Indirectly, this particularity points to a rather reasonable assessment that not everything is about economic incentives in the circular economy: Surely, prices play their role in triggering or disincentivising certain behaviours. Yet, potentially more important are questions of overall institutional design. This pertains to developing rule systems and business models that fit into the cultural context of a region where the CE should take hold. More specifically, the very idea of designing a usable solution – a repairable product, a compostable packaging material, a sharable device – in a circular manner that aligns with preferences in the target society are key.

So while SUPB levies are likely to rise and a PRS for WPBCs will most probably be instituted in the near future, currently operated systems to spur recycling are in need of an overhaul. Unfortunate in this regard is the government monitored, privately operated MSW recyclable take-back station network GREEN@COMMUNITY, which has so far failed to incorporate consumer feedback. The network density is low, impairing return delivery convenience; redemption is demonetized by providing GREEN\$, a type of digital reward point, that can be exchanged for food products and other daily necessities; informal collectors and residential cleaners, who deliver the majority of WPBCs, yet prefer to supply the cash-rewarding traditional pre-processor network. As the latter received a median of 600 kg/month, it dwarfed the GREEN@COMMUNITY stations' reclaim performance of 244 kg/month (Steuer and Chen, 2023b). Against the backdrop that the formal institutional development would have to act on two fronts – adjusting prices and developing WM infrastructure – to account for public interest inclusiveness and thereby incentivize participation, the question is whether recycling is the best CE option for managing WPBCs. Previous work of the author and colleagues employing a projective LCA has shown that a combined refuse-reuse scenario with alternative packaging would be environmentally more beneficial than recycling WPBCs (Steuer and Chen, 2023b). Given the high anticipated costs for WM infrastructure development in Hong Kong, alternative CE approaches beyond recycling single-use beverage containers are worth considering to achieve a sustainable, circular system in the city.

What however constitutes a major set-back for Hong Kong's CE ambitions (beyond the single stream of waste plastics), is the repeal of Hong Kong's municipal waste charging scheme, a detrimental decision officially announced on 27 May 2024. The scheme intended to apply the polluter-pays principle by charging households for residual waste not segregated in recycling bins. Without doubt, its implementation would have required more efforts and imposed costs (around 0.11 HKD or 0.013 EUR per litre) on residents. Vice-versa, however, the measure could have effectively paved the way for more elaborate EPR schemes, such as for WPBCs, and reduction efforts by consumers. The simple logic that was missed out on by rescinding the scheme is that making polluters pay enforces stakeholders to rethink consumption patterns. By extension, adequate price-setting in waste charging that accounts for different

income groups, will contribute to resource conservation, which ultimately represents one of the key environmental objectives of the CE. The point to be made is that economic mechanisms can best deliver their impact in a CE, if a regulatory framework sets an effective playing field: Societies have to accept that anthropogenic dynamics affect the natural environment and offsetting these by marked-oriented internalisations will fall short of being effective. In Hong Kong, the shortcomings have been evident for the cases of SUPBs and WPBCs: Low associated 'costs' do not drive consumers or producers to align with CE principles such as refuse, rethink, reduce or recycle. Instead a mandatory framework is necessary to outline stakeholder responsibilities, set resource-efficiency targets and develop a long-term pathway towards sustainable resource use.

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