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DEMAND-PULL INSTRUMENTS TO SUPPORT THE CIRCULAR ECONOMY: A GLOBAL PERSPECTIVE

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ABSTRACT

In recent years, transitioning to a more circular economy has been introduced as a policy objective in many jurisdictions across the globe with a view to achieving a sustainable society. However, the increasing attention paid to this issue has so far not led to a large-scale transformation of production processes and consumption. Instead, many circular economy innovations have remained niche and have not become the mainstream solutions. A plethora of regulatory, market, cultural and technological barriers limit the demand for, and consequently wide-scale adoption of, circular solutions. This article examines the potential offered by regulatory demand-pull instruments to overcome such barriers and to mainstream circular economy solutions. In particular, the article investigates innovative demand-pull instruments that have been used in various jurisdictions globally. This article analyses the instruments according to their types – i.e., command-and-control measures, economic incentives, information tools and public procurement – to gain a better understanding of the rationales, strengths, and limitations of these categories of instruments in creating a stable demand for the circular economy. The lessons learned from the regulatory innovations enable a more critical approach in determining the best combination of instruments and tools to implement sustainable circular solutions on a larger scale.

Keywords: Circular economy; Transition; Demand-pull instruments; Sustainability

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1. INTRODUCTION

Transitioning to a circular economy (CE) is crucial to achieving a more sustainable society. The CE presents pathways to abate the critically increasing environmental impacts of material production and processing. At the same time, circular strategies are becoming increasingly relevant in an era in which materials are extracted from increasingly dispersed sources at ever-escalating economic cost.[1] The CE likewise seeks to address the need to stay within the Earth's ecological boundaries in view of the latter's finite capacity for reproduction and absorption of waste.[2]

Thus, transitioning to a CE has been the subject of many policy objectives in recent years. The European Union (EU), for example, has set an ambitious target to transition to a climate-neutral CE by 2050.[3] Many countries have also set national targets for achieving the CE. Since 2000, Japan has legislated around the concept of a 'sound material cycle society' having many common objectives with CE.[4] China has been promoting the CE by emphasising cleaner production and industrial parks since 2002.[5] CE objectives and approaches have steadily but increasingly been enacted in many legislative frameworks across the globe. In most jurisdictions, however, there is no single legal framework for CE. Instead, CE objectives are being promoted in multiple substantive legal provisions (e.g., law on waste, product design, public procurements). Yet, despite the increasing attention being paid to CE, its implementation remains limited and is far from mainstream.

The barriers that hinder transitioning to CE are manifold and have been discussed in a growing body of literature. They are generally categorized as regulatory, market, cultural and technological barriers, respectively.[6] Rules hamper the CE when they provide misaligned incentives (e.g., subsidies for fossil fuel perpetuate low price levels for virgin materials) or entrench existing paradigms (e.g., regulations that prevent the use of waste as inputs)[7]. Furthermore, high upfront investment costs, market uncertainty, strong path dependencies and lock-ins, market failure to internalize environmental costs, and asymmetric information create significant market barriers for the adoption of the CE.[8] The

1 Julian M Allwood and others, 'Material Efficiency: A White Paper' (2011) 55 Resources, Conservation and Recycling 362, 365-368.
2 Martin Geissdoerfer and others, 'The Circular Economy – A New Sustainability Paradigm?' (2017) 143 Journal of Cleaner Production 757, 759.
3 European Commission, 'A New Circular Economy Action Plan for a Cleaner and More Competitive Europe' (Communication) COM (2020) 98 final 2.
4 Japan Ministry of Environment, 'Sound Material-Cycle Society' <https://www.env.go.jp/en/recycle/smcs/> accessed 8 July 2022.
5 Will McDowall and others, 'Circular Economy Policies in China and Europe' (2017) 21 Journal of Industrial Ecology 651, 652 <https://doi.org/10.1111/jiec.12597> accessed 22 December 2022; Yong Geng and others, 'Towards a National Circular Economy Indicator System in China: An Evaluation and Critical Analysis' (2012) 23 Journal of Cleaner Production 216, 217.
6 Ana de Jesus and Sandro Mendonça, 'Lost in Transition? Drivers and Barriers in the Eco-Innovation Road to the Circular Economy' (2018) 145 Ecological Economics 75; Julian Kirchherr and others, 'Barriers to the Circular Economy: Evidence from the European Union (EU)' (2018) 150 Ecological Economics 264.
7 de Jesus and Mendonça (n 7) 78.
8 Kirchherr and others (n 7) 268–269.

artificially low cost of virgin raw materials makes secondary materials less price competitive on the market, limiting their use.[9] Cultural barriers, in the form of consumer habits and company routines, also hinder CE implementation. Technological barriers prevent the progress of the CE.[10] The lack of awareness of, and low consumer interest in, CE solutions and hesitant company culture are among the biggest barriers to CE implementation.[11] These barriers are interrelated and interact with each other.[12] For example, the low cost of virgin materials makes circular products more expensive, which, in turn, causes a cultural barrier (e.g., lack of consumer interest in the relevant products leads to companies failing to invest in developing them).[13] These barriers negatively affect demand for circular products and services, limiting their diffusion. Hence, it is important to identify areas of legal intervention that could address these barriers and limit the negative chain reactions that hinder the broader CE transition.

Given the foregoing, this article investigates how different jurisdictions globally have used innovative regulatory instruments to address the lack of demand for CE solutions. The objective of this article is to gain a better understanding of the rationale, strengths, and limitations of these different approaches in mainstreaming CE to provide insights for future regulations. However, the functionality of transplanting regulatory solutions utilized in one jurisdiction into another country's legislative frameworks should always be carefully considered before such steps are undertaken.[14] This is in part due to the context-specificity of the factors affecting the demand for CE solutions, as discussed in Section 3.

Regulatory innovations often imply the implementation of something new in an existing system or regulatory framework. In this article, regulatory innovations refer to new ways to intervene to promote a certain objective (in this case, the CE).[15] This does not necessarily mean enacting completely new legislative approaches but may also mean adapting an existing approach to new regulatory objects or areas.[16] It is possible that similar instruments (i.e., taxation) have been enacted to promote other objectives (e.g., pollution abatement), but the approaches may still be considered 'innovative' in terms of promoting the objectives of the CE.

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9 Walter R Stahel, 'Policy for Material Efficiency—Sustainable Taxation as a Departure from the Throwaway Society' (2013) 371 (1986) Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences 1, 8–9.

10 de Jesus and Mendonça (n 7) 21–22; Kirchherr and others (n 6) 268–269.

11 Kirchherr and others (n 7) 267–268, 270; Felix Preston, 'Briefing Paper - A Global Redesign? Shaping the Circular Economy' (2012) Energy, Environment and Resource Governance BP 2012/02 <https://www.chathamhouse.org/2012/03/global-redesign-shaping-circular-economy> accessed 31 October 2022.

12 Kirchherr and others (n 7) 270.

13 ibid.

14 Helen Xanthaki, 'Legal Transplants in Legislation: Defusing the Trap' (2008) 57 The International and Comparative Law Quarterly 659.

15 James J. Patterson, *Remaking Political Institutions: Climate Change and Beyond* (1st edn, Cambridge University Press 2021).

16 Peter John, *How Far to Nudge? Assessing Behavioural Public Policy* (Edward Elgar Publishing Limited 2018); Petrus Kautto and Helena Valve, 'Cosmopolitics of a Regulatory Fit: The Case of Nanocellulose' (2019) 28 Science as Culture 25.

Therefore, we adopt a dynamic notion of 'innovative' as being always time and place dependent.[17]

In this article, different types of innovative regulations that have been or are proposed to be adopted are explored using the typologies of demand-pull instruments to inform the analytical approach. Each of these typologies has its own intervention logic in addressing the underlying conditions affecting the demand (or lack thereof) for circular innovations. This allows examining critically the specific legislative features of the innovative regulations and their intervention logic in addressing these conditions. The article proceeds as follows: Section 2 revisits the rationale of demand-pull regulations in addressing the demand for CE, and its typologies. Section 3 looks at innovative demand-pull regulations across the globe to identify the specific regulatory features addressing the demand conditions for CE. Section 4 discusses the cross-cutting findings and conclusions.

2. DEMAND-PULL INSTRUMENTS FOR THE GENERATION AND DIFFUSION OF CIRCULAR INNOVATION

In order to tackle the challenge posed by resource consumption and its environmental impacts, CE innovations need to be 'generated, bought and applied'.[18] The important role of government policies is acknowledged in overcoming the various barriers to the adoption of CE innovations that affect both suppliers and consumers.[19] CE innovations are here understood as products and services that have been adapted to, or created through processes that, reduce material consumption, increase recycling and use, or expand product lifetimes.

2.1 Rationale of Demand-Pull Instruments

These instruments can be broadly categorized based on their purpose, and in particular on how they stimulate innovation, either as supply-push or as demand-pull policies.[20] Supply-push and technology-push instruments focus on enhancing the supply of innovative technologies

[17] Louise Fromond, Jukka Simila and Leila Suvantola, 'Regulatory Innovations for Biodiversity Protection in Private Forests—Towards Flexibility' (2009) 21 Journal of Environmental Law 1; Jonas Schoenefeld, Mikael Hildén and Kai Schulze, 'Policy Innovation for Sustainable Development' in Duncan Russel and Nick Kirsop-Taylor (eds), *Handbook on the Governance of Sustainable Development* (Edward Elgar Publishing 2022).

[18] Wouter Boon and Jakob Edler, 'Demand, Challenges, and Innovation. Making Sense of New Trends in Innovation Policy' (2018) 45 Science and Public Policy 435, 436.

[19] Kirchherr and others (n 7) 270; Giulio Cainelli, Alessio D'Amato and Massimiliano Mazzanti, 'Resource Efficient Eco-Innovations for a Circular Economy: Evidence from EU Firms' (2020) 49 Research Policy 103827.

[20] Jens Horbach, Christian Rammer and Klaus Rennings, 'Determinants of Eco-Innovations by Type of Environmental Impact — The Role of Regulatory Push/Pull, Technology Push and Market Pull' (2012) 78 Ecological Economics 112; Michael Peters and others, 'The Impact of Technology-Push and Demand-Pull Policies on Technical Change – Does the Locus of Policies Matter?' (2012) 41 Research Policy 1296; Klaus Rennings, 'Redefining Innovation — Eco-Innovation Research and the Contribution from Ecological Economics' (2000) 32 Ecological Economics 319. See also Karoline S Rogge and Kristin Reichardt, 'Policy Mixes for Sustainability Transitions: An Extended Concept and Framework for Analysis' (2016) 45 Research Policy 1620 (who included a third category as systemic instruments).

through factors that affect the generation of new knowledge,[21] such as by reducing the costs of their development through subsidies on research and development and funding demonstration projects.[22] Demand side policies aim to improve 'demand conditions' in order to generate and diffuse innovation.[23] The primary logic behind demand-pull policies is that a growing market incentivizes investment in innovation by increasing its profitability, and facilitates learning through diffusion, which, in turn, informs the innovation process.[24] Conversely, lack or uncertainty of demand deters investment. Thus, demand-side policies primarily aim to identify or create a need for an innovation or support the ability and willingness of potential buyers to adopt an innovation or co-produce it with suppliers.[25] Particular to CE-related innovations, there is growing evidence on the significant role of 'green demand' as a driver of innovation adoption.[26]

Existing literature supports the importance of the role of demand in the mainstreaming of circular innovation. Depending on the industry, demand from key players in the value chain can have a significant role (even more than that of consumer demand) in influencing actors in the value chain to adopt circular innovations.[27] Consumer demand for circular products can also stimulate production and the potential for economies of scale, which, in turn, make take-back systems and recovery activities feasible at an industrial scale.[28] The discovery of new markets provides an important incentive for firms to transition from a traditional business approach to a more circular value proposition.[29]

Recent literature has emphasized that a robust regulatory framework supporting socio-technical transitions requires a policy mix that includes a combination of supply-push and demand-pull instruments.[30] The analysis in this article focuses on demand-pull instruments addressing barriers that affect the demand for CE innovations, and specifically on the innovative features of these instruments.

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21 Gregory F Nemet, 'Demand-Pull, Technology-Push, and Government-Led Incentives for Non-Incremental Technical Change' (2009) 38 Research Policy 700, 701–702.

22 ibid.

23 Boon and Edler (n 19) 436. Demand conditions have been described as referring to the quantity and quality of demand for a particular innovation.

24 Jakob Edler, 'The Impact of Policy Measures to Stimulate Private Demand for Innovation' in Jakob Edler and others (eds), *Handbook of Innovation Policy Impact* (Edward Elgar Publishing 2016).

25 ibid 5.

26 Cainelli, D'Amato and Mazzanti (n 20).

27 Maria A. Franco, 'Circular Economy at the Micro Level: A Dynamic View of Incumbents' Struggles and Challenges in the Textile Industry' (2017) 168 Journal of Cleaner Production 833, 842.

28 ibid.

29 Amir Asgari and Reza Asgari, 'How Circular Economy Transforms Business Models in a Transition towards Circular Ecosystem: The Barriers and Incentives' (2021) 28 Sustainable Production and Consumption 566, 578 <https://doi.org/10.1016/j.spc.2021.06.020> accessed 22 December 2022.

30 Rogge and Reichardt (n 21); Susana Borrás and Charles Edquist, 'The Choice of Innovation Policy Instruments' (2013) 80 Technological Forecasting and Social Change 1513.

2.2. Types of Demand-Pull Instruments

The typologies developed by Hannon and others (2015) divide demand-pull instruments into four main types.[31] The first of these involves command-and-control (CAC) instruments. These instruments stimulate demand by establishing expectations about future markets[32] by defining, or setting the rules of, the market conditions for innovative products and processes.[33] They drive demand for alternative solutions by setting restrictions, standards or performance targets.

The second type refers to economic incentives. These aim to stimulate demand by lowering the entry or life-cycle costs of investments in innovations, making the latter more competitive in the marketplace.[34]

The third type, informative instruments, drive demand by addressing different forms of information asymmetry (e.g., in terms of the relative environmental performance or quality of CE products or services) or awareness deficit (e.g., lack of awareness about or confidence in CE innovations or how they are to be used).[35]

The fourth type of demand-pull instrument is direct public sector purchasing or public procurement. This instrument involves a public authority ordering for its own use or purpose a product or system that at times may not yet exist in the market or is still niche.[36] Hence, while a public procurement policy could also take the form of a CAC or information instrument, its mechanism for triggering broader demand for CE innovations is narrowly focused on using public purchasing as leverage.[37]

Since the CE transition calls for systemic change, a combination of demand-pull instruments (both mandatory and voluntary) targeting different stages of a material's lifecycle will be necessary.

3. DEMAND-PULL POLICIES RESPONDING TO CE BARRIERS: A GLOBAL PERSPECTIVE

3.1 Command-and-Control (CAC) Instruments

CAC instruments create demand for circular products and processes by defining market conditions, for example by prescribing materials, processes or environmental performance in respect of products and services that support circular transition or by regulating user behaviour. Where users and producers resist changing consumption or production patterns, regulations may help facilitate the transition by prescribing the

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31 See Matthew J Hannon, Timothy J Foxon and William F Gale, '"Demand Pull" Government Policies to Support Product-Service System Activity: The Case of Energy Service Companies (ESCos) in the UK' (2015) 108 Journal of Cleaner Production 900.

32 Jakob Edler, 'Review of Policy Measures to Stimulate Private Demand for Innovation. Concepts and Effects' in Jakob Edler and others (eds) Handbook of Innovation Policy Impact (Edward Elgar Publishing 2016).

33 Borrás and Edquist (n 31) 1516.

34 Edler (n 33) 7.

35 Hannon, Foxon and Gale (n 32); Edler (n 33).

36 Borrás and Edquist (n 31) 1519.

37 Edler (n 33) 7.

use of circular designs or materials through design standards or norms.[38] Furthermore, requiring the use of circular-based materials (e.g., minimum recycled content) could increase their availability and consequently cost-competitiveness vis-à-vis linear based materials.[39] Establishing circular standards and performance requirements also helps create certainty as to market expectations and produces reliable information on how products perform.[40] Thus, CAC instruments offer a means by which to overcome path dependency and technology lock-ins, create new markets, enable economies of scale and encourage further investment and innovation. This section looks at the different features of CAC instruments aimed at increasing demand for circular innovation and their implementation challenges.

3.1.1 EU Ecodesign Regulation

A substantial proportion of the environmental impacts of a product's life cycle are decided in the design phase. Therefore, regulating the design of products is an effective way of addressing how CE objectives are implemented in that life cycle. In the EU, product design is currently regulated under the ecodesign framework. This comprises Directive 2009/125/EC[41] and product-specific regulations. The current regulatory framework focuses on the energy consumption of energy-intensive products. To better include CE aspects in the ecodesign regulation, the EU Commission has proposed a new Ecodesign Regulation to repeal the current Directive. The proposal significantly extends the scope of the existing regulatory framework. The proposed Regulation will apply to the broadest possible range of products and will set product-level requirements that not only promote energy efficiency but also circularity to address the most adverse environmental and climate impacts. The requirements are intended to achieve improvements in areas including product durability and reusability, resource efficiency, minimum recycled content, ease of disassembly as well as carbon and environmental footprints.[42] The Regulation would be complemented by product-specific legislation laying down particular requirements for well-defined product groups. The proposal also includes the possibility to enact horizontal ecodesign requirements for a wider range of product groups (e.g., electronic appliances or textiles) where this is reasonable due to technical similarities etc. The methods used to assess the ecodesign requirements would be developed using the experiences from the current ecodesign framework as well as Product Environmental Footprint (PEF) method set

[38] Kris Hartley, Ralf van Santen and Julian Kirchherr, 'Policies for Transitioning towards a Circular Economy: Expectations from the European Union (EU)' (2020) 155 Resources, Conservation and Recycling 104634, 3.

[39] Ibid.

[40] *See* Edler (n 33) 8–9.

[41] Parliament and Council Directive 2009/125/EC of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products [2009] OJ L 285/10.

[42] European Commission, 'Proposal for a Regulation for the European Parliament and of the Council establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EC' COM (2022)142 final art 5.

out in Commission Recommendation (EU) 2021/2279[43] as well as the development of standards by international and European standardization organizations. Providing detailed technical minimum performance levels for different products has huge potential to promote the CE but is a slow measure to implement: different product groups have to be regulated individually and performance levels can only apply to new products. Therefore, even after the introduction of new requirements, it will take some time before the higher performing products conquer the market.

3.1.2 Washington Minimum Recycled Content Requirements

Legally imposed 'minimum recycled content' requirements promote the CE by increasing demand for recycled materials as a substitute for virgin raw materials. These requirements refer to an obligation to use recycled materials as inputs in the manufacture of a product. The coercive nature of the requirement can be particularly effective for materials where the demand for secondary raw materials is not automatically formed. This might be the case where the virgin raw materials have a 'price advantage', for example due to complicated recycling processes or administrative processes connected to the commodification of waste materials. In the United States, the state of Washington laid down mandates on minimum recycled content for certain household plastic products, plastic trash bags and plastic beverage containers. The requirements were included in a wider legal proposal on single-use plastics.[44] This proposal passed into law[45] in April 2021. For each product group a gradually increasing recycled content requirement is laid down ranging from 10% to as high as 50% by 2031.[46] In order for progress to be monitored, producers are required to submit an annual report. A weight-based fiscal sanction is applied to producers that do not meet the minimum requirements. The EU has adopted a similar, albeit less ambitious, requirement for beverage bottles in Directive 2019/904/EU,[47] which also concerns single use plastics. Under the Directive, producers are required to incorporate 25% of recycled plastic in covered plastic beverage bottles from 2025, and 30% in all plastic beverage bottles from 2030.[48] Moreover, in the EU the sanctions imposed on producers that do not meet these targets are determined at national level, which implies varying level of stringency.[49]

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43 European Commission (EU) Recommendation 2021/2279 of 15 December 2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations [2021] OJ L471/1.

44 Concerning the management of certain materials to support recycling and waste and litter reduction, S.B. 5022, 67th Leg. (Washington 2021).

45 Washington Revised Code, ch. 70A.245 (2021).

46 Ibid at Section 3. For cleaning and personal care product containers, 15% by 2025, 25% by 2028, 50% by 2031. For plastic trash bags, 10% by 2023, 15% by 2025 and 20% by 2027. For certain plastic beverage containers, 15% by 2023, 25% by 2026 and 50% 2031. For milk containers 15% by 2028, 25% by 2031 and 50% by 2036.

47 Parliament and Council Directive (EU) 2019/904 of 5 June 2019 on the reduction of the impact of certain plastic products on the environment [2019] OJ L155/1 [hereinafter "Directive (EU) 2019/904"].

48 Directive (EU) 2019/904, art. 6.

49 Directive (EU) 2019/904, art. 14.

Minimum recycled content requirements have mostly been discussed with regard to plastics, but the idea could also be extended to other materials and several US states have, for example, introduced a minimum recycled glass content requirement. The state of New Jersey recently required manufacturers to ensure that all glass containers sold or offered for sale in the state shall contain at least 35% postconsumer recycled content, or 25% if mixed-colour cullet is used.[50] This followed a similar requirement enacted in California.[51] However, the objective of increasing recycled material content should not lead to poorer product quality or the recirculation of harmful chemical substances to the detriment of human or environmental health. Thus, mixing requirements can be unsuitable for some product categories: for example, under Commission Regulation (EU) No 2022/1616[52] only those recycled plastics that meet stringent quality requirements and recycling processes can come into contact with foodstuffs.[53] There is also a need to assess whether the use of recycled content for specific product categories is the most environmentally beneficial solution. For example, there are questions over whether the use of recycled glass in containers would divert its use into cement production, which could potentially have higher emissions savings.[54]

3.1.3 France's Repairability Index

Product life extension has been found to be the more environmentally desirable end-of-life treatment option compared to various modes of recycling based on certain product characteristics.[55] France's Reparability Index is the first mandatory labelling regulation relating to product lifespans to be implemented in Europe.[56] It requires covered manufacturers to disclose the reparability performance of their products from a scale of 1 to 10 based on a set of reparability criteria.[57] The objective of the regulation is to nudge consumers towards preferring products with lifespans that can be extended beyond their expected service life through repair, and to encourage consumers to extend the lifetimes of their products. The law did not impose technical standards on the products themselves, rather it

50 New Jersey Statutes Ann. 13:1E-99136-157, § 5 (Updated 2022).

51 CA Pub Res Code § 14549 (b) (2021).

52 Commission Regulation (EU) 2022/1616 of 15 September 2022 on recycled plastic materials and articles intended to come into contact with foods, and repealing Regulation (EC) No 282/2008 [2022] OJ L243/3.

53 Topi Turunen, Milja Räisänen and Petrus Kautto, 'Need for Speed? Meeting the New Recycling Targets for Plastics' (2022) 1/2022 Ympäristöjuridiikka 39, 43 <https://www.edilex.fi/ymparistojuridiikka/1000660003> accessed 22 December 2022. The interviewees within the study agreed that recovered plastics should not be 'forced' to adopt certain purposes of use.

54 See Dylan D Furszyfer Del Rio and others, 'Decarbonizing the Glass Industry: A Critical and Systematic Review of Developments, Sociotechnical Systems and Policy Options' (2022) 155 (111885) Renewable and Sustainable Energy Reviews 1, 10 (the authors discussed multiple uses of recycled glass, including construction).

55 Frithjof Laubinger and Peter Börkey, 'Labelling and Information Schemes for the Circular Economy' 34 <https://doi.org/10.1787/abb32a06-en> accessed 22 December 2022.

56 Ibid 39.

57 Art. R. 541-210 C. environnement; Loi n° 2020-105 du 10 février 2020 Relative à la Lutte Contre le Gaspillage et à L'économie Circulaire (Law against Waste and for the Circular Economy) 2020 (hereinafter 'Loi n° 2020-105'), art 16.

prescribess the information that should accompany the covered products. The law prescribes the criteria that must be considered in evaluating the reparability of products, the methodology used in carrying out such assessment, and how the information on reparability is to be communicated to consumers. The reparability criteria include the availability of technical documentation relevant for the repair of a product, availability and pricing of spare parts, ease for disassembling and product-specific criteria.[58] As from 2024, the Reparability Index will be replaced by a Durability Index, which will combine both reparability and reliability aspects of a product.[59] Aside from setting the reparability criteria, the law also specifies which product groups will have better overall environmental performance through extension of their lifespans. Currently, France's Reparability Index covers a limited number of household electronic and electrical devices.[60]

Several studies have found that lifespan labelling influences purchasing decisions in favour of products with longer lifespan, although this may vary depending on the product category.[61] Despite this, voluntary product labels that include reparability criteria have so far resulted in a poor adoption rate among manufacturers.[62] The French index addresses this issue by making the use of the index mandatory for certain products. Furthermore, the French label tackles the issue of information asymmetry by prescribing a uniform criterion for product groups and by requiring the information to be set out in the form of a score. This makes the information comparable and easy for users to understand, and thus helpful in their decision-making.

However, preliminary studies after a year of implementation show that the current criteria may need to be more robust to further distinguish ratings among products. In respect of lawnmowers and washing machines, on which most manufacturers already register high scores, the criteria may need to be more ambitious to incentivize continuous improvements.[63] Ensuring and maintaining credibility is another important challenge for the French label. The obligation to assess the reparability of products falls on the manufacturers themselves.[64] While the law contains safeguards, in the form of the possibility to impose sanctions, against the use of fraudulent

[58] Art. R. 541-214 (I), C. environnement.
[59] Loi n° 2020-10, art 16.
[60] The list includes front-loading washing machines, smartphones, laptops, TV monitors and electric lawn mowers.
[61] European Economic and Social Committee, 'The Influence of Lifespan Labelling on Consumers' (2016) <https://data.europa.eu/doi/10.2864/29757> accessed 22 December 2022; María Bovea and others, 'Incorporation of Circular Aspects into Product Design and Labelling: Consumer Preferences' (2018) 10 (2311) Sustainability <https://doi.org/10.3390/su10072311> accessed 22 December 2022.
[62] Laubinger and Börkey (n 56) 39.
[63] Halte à L'obsolescence Programmee, 'The French Repairability Index: A First Assessment – One Year after Its Implementation' 3 <https://www.halteobsolescence.org/wp-content/uploads/2022/02/Rapport-indice-de-reparabilite.pdf> accessed 22 December 2022.
[64] France, 'Notification to the Commission: Decree Relating to the Repairability Index of Electrical and Electronic Equipment' para 8 <https://ec.europa.eu/growth/tools-databases/tris/en/search/?trisaction=search.detail&year=2020&num=468%20> accessed 26 September 2022.

scores or failure to display the scores, the credibility of the index will depend on how rigorous the government is in investigating fraudulent cases and the extent to which market actors are vigilant in policing their competition.[65]

3.1.4 Pros and Cons of Using CAC Instruments

CAC instruments have a high degree of efficacy because of their mandatory nature, which also entails certain challenges. From the environmental perspective, there is a need to ensure that the binding circular requirements are suitable to produce optimal environmental impacts.[66] The approaches required to determine which CE strategies will produce the desired environmental impacts vary greatly at both material and product levels. In relation to minimum recycled content, it is important to ascertain whether the policy (i.e., recycling) will promote the best circular strategy for the material, whether using it in a specific product (i.e., containers) will be the most optimal use for it, and whether such use will prevent other strategies (i.e., the use of less packaging) from being deployed. In relation to the reparability index, it is also important to assess whether promoting reparability will result in burden-shifting of the environmental impacts from the production to the use stage. As the example of the EU Ecodesign Regulation demonstrates, the foregoing requires the use of sophisticated methodologies to assess life cycle impacts under various regulatory scenarios. Furthermore, because the policy offers the least flexibility among market actors, CACs can face market resistance and accordingly demand huge political will to bring into effect. Thus, the adoption and implementation of circular CACs may be a slow process.

With a view to achieving wide adoption, CAC instruments should prescribe an ambitious level of environmental performance, but which is not impossible to achieve.[67] Further, as the French reparability index illustrates, the applicable performance standards should leave room for manufacturers to strive to improve their performance. Technology-specific

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65 In other countries, repairability is promoted via taxation. Sweden has introduced a value added tax (VAT) deduction on repairs and an income tax deduction for working costs for repairs. The VAT on repairs of, for example, textiles, shoes, leather products and bicycle is reduced from 25% to 12% and households can deduct up to 50% of the working costs of repairs on certain white goods and consumer electronics (Lag (2016:1055) om ändring i inkomstskattelagen). According to the first analyses these tax deductions have not had significant impact yet; Carl Dalhammar and others, 'Promoting the Repair Sector in Sweden' (2020) <https://lucris.lub.lu.se/ws/portalfiles/portal/77933910/Promoting_the_repair_sector_in_Sweden_2020_IIIEE.pdf> accessed 22 December 2022; Leonidas Milios, 'Towards a Circular Economy Taxation Framework: Expectations and Challenges of Implementation' (2021) 1 Circular Economy and Sustainability 477; The effectiveness of tax reductions requires further validating to what extent repair costs have a significant impact on consumers' decisions whether to repair which products.

66 Petrus Kautto and others, 'The Circular Economy and Product Policy' (Finland Prime Minister's Office 2021) <http://urn.fi/URN:ISBN:978-952-383-283-1> accessed 22 December 2022; Harri Kalimo and Eleanor Mateo, 'Framing Circular Economy Laws for Sustainability' (2022) 52 Environmental Law Reporter 10922.

67 See David Popp, Richard G Newell and Adam B Jaffe, 'Energy, the Environment, and Technological Change', in Bronwyn Hall and Nathan Rosenberg (eds), *Handbook of the Economics of Innovation* 885 (vol 2, Elsevier 2010).

CAC instruments could be beneficial in terms of diffusion[68], by generating market and legal certainty for suppliers, and in ensuring the availability of the product (i.e., recycled packaging) on the market. Such certainty will help hasten the market transition. However, CAC instruments need to be used cautiously as they could also lead to technology lock-ins, which might prevent other circular or more sustainable strategies from being implemented. It is, thus, important that CAC instruments are used where there are clear environmental benefits from a life-cycle perspective, i.e., where the technology and its impacts are well understood. Such clear demonstrable environmental benefits could also help generate the requisite political support for restrictive regulations. At the same time, there is a need for mechanisms to ensure dynamic efficiency so that CAC instruments do not deter further innovation once the standards or performance requirements are met.[69] CAC instruments that prescribe circular targets or standards need to be reviewed periodically to allow for upward adjustment to promote continuous market development.

3.2. Economic Instruments

From a demand-pull perspective, the main objective of using economic instruments is to make circular products more attractive (compared with their linear counterparts) in the marketplace. The demand for low-resource solutions and recovered materials is hindered by the relatively low price of virgin materials.[70] There are many factors that contribute to this. First, recycling high-quality materials requires high-level sorting. This is a labour-intensive process that renders such materials expensive.[71] Second, primary production makes use of fossil-based energy, which is highly subsidized, contributing to artificially low prices.[72] Furthermore, the pricing of raw materials often fail to internalize the environmental costs of resource extraction and use. Typically, these instruments promote the CE through financial incentives and disincentives to induce different types of economic actor to use or prefer options that reduce resource consumption and wastage. Broadly speaking, this entails increasing the costs of, or eliminating existing fiscal incentives and subsidies accorded to, resources and/or resource-intensive activities; or directly reducing the costs of circular products (e.g., durable, reused, recycled and remanufactured products) and activities. Thus, unlike conventional environmental taxes, the aim of the instruments goes beyond merely discouraging different kinds of emission, effluent and pollutive

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68 See Ángeles Pereira Santos and Xavier Vence, 'Environmental Policy Instruments and Eco-Innovation: An Overview of Recent Studies' (2015) 25 Innovar 65, 69-70.

69 Pablo del Río, Javier Carrillo-Hermosilla and Totti Könnölä, 'Policy Strategies to Promote Eco-Innovation: An Integrated Framework' (2010) 14 Journal of Industrial Ecology 541, 548 <https://doi.org/10.1111/j.1530-9290.2010.00259.x> accessed 22 December 2022.

70 See Walter R Stahel, 'Policy for Material Efficiency—Sustainable Taxation as a Departure from the Throwaway Society' (2013) 371 (1986) Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences 1, 8–9.

71 Ibid.

72 Xavier Vence and Sugey de Jesus López Pérez, 'Taxation for a Circular Economy: New Instruments, Reforms, and Architectural Changes in the Fiscal System' (2021) 13 (8) Sustainability 1, 10 <https://doi.org/10.3390/su13084581> accessed 22 December 2022.

discharges.[73] The instruments could be linked to specific activities across the life cycle of products[74] (e.g., resource extraction, use or consumption, as well as tax on end-of-life activities) or to specific enterprise undertakings (e.g., investments in resource-efficient technologies)[75]. This section investigates the various types of innovative economic instrument, their key legislative features in stimulating demand, and current challenges.

3.2.1 Swedish Virgin Material Taxes (VMT)

Sweden introduced a gravel tax in 1996 to address concerns about resource scarcity in natural sand and gravel in various parts of the country and to advance environmental protection.[76] The tax also aimed to promote substitution of natural gravel by crushed rocks and alternative recycled materials. The policy objective was to achieve a ratio of 30:70 between the use of natural gravel and substitute materials, with a 15% sub-target for the use of recycled materials.[77] The tax, which was increased over time, aimed to close the price gap between gravel and its closest substitute (e.g., crushed rock).[78] The tax increased the price of natural gravel because anyone exploiting a gravel extraction site that requires a permit under the Swedish Environmental Code[79] is obliged to pay it. According to evaluations, the tax had a modest effect in reducing the use of natural gravel. It was difficult to isolate the impact of the tax in terms of the use of substitutes.[80] Alongside and even before the imposition of the gravel tax, Sweden also implemented changes in road building material policies and tightened the permit regime. The combination of the tax, building and permit regulations, as well as procurement preferences, contributed to increasing demand for gravel substitutes.[81] Despite this, however, it is unclear whether the 15% target for the use of recycled aggregates has been met.[82] This has been attributed in part to the low replacement rates of buildings in the country, which limited the source for recycled aggregates.[83] In Denmark, where similar gravel taxes were imposed, the use of a waste tax and the imposition of a regulatory requirement to sort construction and demolition waste at source helped increase the availability and use of recycled aggregates in construction.[84] Furthermore, despite the Swedish VMT's success in terms of conserving natural gravel, there was also evidence showing that the use of crushed rock as an alternative had resulted in extraction processes involving greater energy use due to

73 Iibid 7.
74 See Milios (n 66) 480.
75 See Vence and López Pérez (n 73) 11.
76 Lag (1995:1667) om skatt på naturgrus (Act on Tax on Natural Gravel).
77 European Environment Agency, 'Effectiveness of Environmental Taxes and Charges for Managing Sand, Gravel and Rock Extraction in Selected EU Countries' (2008) No 2/2008 30 <https://www.eea.europa.eu/publications/eea_report_2008_2/file> accessed 22 December 2022.
78 Patrik Söderholm, 'Taxing Virgin Natural Resources: Lessons from Aggregates Taxation in Europe' (2011) 55 Resources, Conservation and Recycling 911, 916.
79 Ds 2000:61.
80 European Environment Agency (n 78) 31–32.
81 Ibid; Söderholm (n 79) 916.
82 Söderholm (n 79) 917.
83 Ibid.
84 Ibid 918.

crushed rock requiring more energy per tonne than natural gravel.[85] However, this was partly offset by shorter transportation distances. The Swedish tax, which was imposed on the volume of gravel extracted, supported a gradual decline in the use of natural primary raw materials and increased demand for substitutes, but highlighted the need for complementary policies to bolster the supply of more sustainable alternatives.[86]

3.2.2 UK Plastic Packaging Tax

The use of economic instruments to increase demand for recycled materials is increasingly prevalent in the plastics industry. The UK recently brought in a tax on plastic packaging aimed at curbing the use of new plastic materials and increasing demand for recycled plastic in the manufacture of plastic packaging. UK government estimates indicate that the tax will bolster the use of recycled plastic in packaging by up to 40%.[87] This in turn is expected to foster increased collection and plastic recycling, further contributing to the goal of diverting plastic from landfill and incineration. The tax is imposed on domestic manufacturers of plastic packaging and importers of plastic packaging.[88] Under the law, a finished plastic packaging component is taxable if it does not contain at least 30% recycled plastic by weight.[89] Chargeable plastic packaging components are taxed at a rate of £200 per metric tonne.[90] However, the ambition of the 30% recycled content threshold has been questioned given that some brands and retailers have already voluntarily pledged to reach this threshold by 2025.[91] The law also aimed to narrowly target single-use packaging by carving out exemptions to exclude plastic packaging that are designed to be suitable for reuse or to fulfil functions other than packaging as well as packaging for medicinal products.[92] Similar proposals have been advanced in Italy, Spain and the Netherlands. In Italy, a plastic tax is imposed to curb the consumption of single-use plastic manufactured goods.[93] The tax applies to products composed of, whether fully or partially, organic polymers of synthetic origin which have the function of containing, protecting, handling or delivery of goods or foodstuffs, and which are not

85 Ibid 916–917.
86 European Environment Agency (n 78) 8, 10, 30, 32, 33.
87 'Policy Paper: Introduction of Plastic Packaging Tax from April 2022' (*GOV.UK*, July 2021) <https://www.gov.uk/government/publications/introduction-of-plastic-packaging-tax-from-april-2022/introduction-of-plastic-packaging-tax-2021> accessed 23 September 2022.
88 Finance Act 2021 (UK) section 44.
89 Finance Act 2021 (UK) section 47(1).
90 Finance Act 2021 (UK) section 45. The UK government preferred to use a single rate to lower the costs of compliance and administering the tax.
91 UK HM Treasury, 'Plastic Packaging Tax: Summary of Responses to the Consultation' para 3.12 <https://www.gov.uk/government/consultations/plastic-packaging-tax> accessed 23 September 2022.
92 Finance Act 2021 (UK) section 52. See UK Her Majesty's Revenue and Customs, 'Explanatory Memorandum to the Plastic Packaging Tax (General) Regulations 2022' <https://www.legislation.gov.uk/uksi/2022/117/pdfs/uksiem_20220117_en.pdf> accessed 23 September 2022.
93 Bilancio di previsione dello Stato per l'anno finanziario 2020 e bilancio pluriennale per il triennio 2020-2022 (hereinafter 'L 160/2019'), art 1, paras 634–58.

intended for repeated use.[94] The tax rate is set at 0.45 Euro per kilogram of single-use plastic material contained in the manufactured goods.[95] The tax does not apply to compostable single-use plastics, medical devices and those used to contain medical formulations and those derived from recycling processes.[96]

In terms of stimulating demand, a plastic packaging tax is less stringent than a minimum recycled content mandate. However, such flexibility could be beneficial when considering the industry's capacity to produce recycled plastic on an industrial scale. From the environmental perspective, one of the issues debated at EU level is that of whether chemical recycling is more environmental than other options, such as promoting the reuse of plastics.[97] Chemical recycling could have higher environmental impacts for certain impact categories (e.g. acidification) than incineration.[98] The UK tax, for example, leans heavily towards incentivizing the use of recycled plastics by basing the tax threshold on minimum recycled content, while Italy's tax appears to support broader alternatives by taxing based on the volume of single-use plastic, and exempting alternatives such as non-single use, compostable and recyclable plastics.

3.2.3 Dutch Tax Deductions

To increase the demand for environmentally friendly investments, the Netherlands has introduced tax reliefs schemes in the form of an Environmental Investment Allowance (*Milieu Investeringsaftrek*, MIA) and arbitrary depreciation of environmental investments (*Willekeurige Afschrijving Milieu-investeringen*, VAMIL).[99]

Under the MIA scheme, Dutch companies may deduct a percentage (up to 45% in 2022) of eligible investment costs from their taxable profits.[100] This allows companies to reduce the costs of eligible investments.[101] The level of deductions is based on (i) the environmental performance of the investment; (ii) the level of innovativeness; and (iii) the level of the price

94 L 160/2019, art. 1, para 634.

95 L 160/2019, art. 1, para 640.

96 L 160/2019, art. 1, para 634.

97 See Robert Hodgson, 'Analysis: Why Debate over Chemical Recycling of Plastic Is Heating up as Packaging Rules Take Shape' (*Ends Europe*) <https://www.endseurope.com/article/1750004/analysis-why-debate-chemical-recycling-plastic-heating-packaging-rules-shape> accessed 22 June 2022.

98 Harish Jeswani and others, 'Life Cycle Environmental Impacts of Chemical Recycling via Pyrolysis of Mixed Plastic Waste in Comparison with Mechanical Recycling and Energy Recovery' (2021) 769 [144483] Science of the Total Environment 1, 13.

99 Regeling van de Staatssecretaris van Infrastructuur en Waterstaat van 14 december 2018, nr. IENW/BSK-2018/261579, tot wijziging van de Aanwijzingsregeling willekeurige afschrijving en investeringsaftrek milieu-investeringen 2009 (Environmental List Adoption 2019), *Stcrt.* 2018, 69481.

100 'MIA and VAMIL' (*Rijksdient voor Ondernemend Nederdland*, 27 December 2021) <https://english.rvo.nl/subsidies-programmes/mia-and-vamil> accessed 22 December 2022.

101 Rijksdient voor Ondernemend Nederdland, 'MIA \ Vamil: Brochure en Milieulijst 2022 (Brochure and Environmental List' 7 <https://www.rvo.nl/sites/default/files/2022-07/MIAVamil-Brochure-en-Milieulijst-2022.pdf> accessed 22 December 2022. If your project does not generate profit, you may settle this with previous years (carry back) or upcoming years (carry forward).

gap against a conventional alternative.[102] Costs that can be deducted under the scheme include purchase costs, production costs, modification costs, the cost of purchasing new components and the cost of environmental consultancy (only for SMEs).[103] The MIA scheme offers tax deduction for investments of at least €2,500, but not exceeding €50 million, per business asset per year.[104] To qualify for the preferential tax scheme, the investment must pertain to capital assets listed on the Dutch Environment List (*Milieulijst*).[105] The list includes assets that promote circularity:[106] examples are raw materials saving industrial equipment, production equipment for (products of) biobased plastics, equipment producing durable products with take back guarantees.[107] In parallel, eligible companies can also apply for the VAMIL scheme. The VAMIL scheme allows entrepreneurs to deduct 75% of their investment expenses and decide when exactly to write off these expenses. This offers lower interest payments and improved liquidity for the companies. The VAMIL scheme applies to the same costs eligible under the MIA. Like MIA, the VAMIL scheme also applies to capital assets from the Dutch Environment List and for purchases of at least €2,500 per year.[108] Both MIA and VAMIL are applied by notifying the Netherlands Enterprise Agency within three months of the purchase of the new business asset.[109] The scheme has had multiple effects on both the demand and supply of covered assets: the Dutch Environmental List has served as a marketing tool for covered assets, which has led to increased turnover for suppliers. This, in turn, has further encouraged suppliers to continue developing environmentally friendly equipment, particularly those aimed primarily at the Dutch market. The list has also lent credibility to the assets' environmental performance and served as an indicator of the future direction of the government's environmental policy.[110]

3.2.4 Pros and Cons of Using Economic Instruments

The regulatory examples show the nuances of using economic instruments to influence demand for circular products. While taxes can reduce the price difference between new and circular products, this does not automatically lead to substitution. Actual substitution may depend on factors such as the demand elasticity of the product or material taxed, the

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102 European Commission - Environment, 'Case 6: VAMIL and MIA, The Netherlands' 6 <https://ec.europa.eu/environment/archives/sme/cases/cases06_en.htm> accessed 24 September 2022.

103 Rijksdient voor Ondernemend Nederdland (n 91) 10.

104 'Voorwaarden MIA\Vamil' (*Rijksdient voor Ondernemend Nederdland*, 30 June 2022) <https://www.rvo.nl/subsidies-financiering/mia-vamil/ondernemers/voorwaarden> accessed 24 September 2022. For certain business assets, the maximum amount is set at €25 million.

105 'MIA and VAMIL' (n 101).

106 Rijksdient voor Ondernemend Nederdland (n 102) 17–18.

107 See 'Milieu- En Energielijst (Environment and Energy List) 2022' (*Rijksdient voor Ondernemend Nederdland*) <https://data.rvo.nl/subsidies-regelingen/milieulijst-en-energielijst/2022?goals=32115&type=miavamil> accessed 24 September 2022.

108 'Voorwaarden MIA\Vamil' (n 105).

109 Ibid.

110 Robert Vergeer, Martijn Blom and Ellen Schep, 'Beleidsevaluatie: MIA\Vamil' (CE Delft 2018) <https://cedelft.eu/wp-content/uploads/sites/2/2021/03/CE_Delft_7M95_Beleidsevaluatie_MIA_Vamil_DEF.pdf> accessed 22 December 2022.

availability of circular alternatives or substitutes, as well as whether the fiscal [dis]incentives are substantial enough to bring about changes in behaviour. As the Swedish VMT example shows, an economic instrument might require complementary policies, such as regulations that enable the production of circular products, to produce its intended effects. Price was not the only barrier for using recycled aggregates in Sweden, as lack of accessible sources was also a factor. The VMT was not suitable to address the latter. The importance of understanding the contextual barrier to a desired circular solution cannot be overemphasized.

The examples also show the challenge inherent in designing economic instruments that are also optimal for the environment because of their "impreciseness" in targeting the factors that affect the desired environmental objectives.[111] In the VMT and UK tax examples, the taxes had a narrow environmental focus, such as reduced use of primary materials and use of recycled substitutes. The narrow focus provided a clear signal as to the direction of government policy and eased the administrative burden, but there was a risk that the taxes might not result in optimal environmental outcome. The Dutch MIA and VAMIL show how a tax benefit can be further nuanced based on the environmental performance of assets. The foregoing highlights the need for rigorous debate on the actors and activities penalized or incentivized by the economic instruments based on their life-cycle impacts, but also on the important role of monitoring and review mechanisms.

3.3. Information Instruments

Information instruments are demand-pull policy instruments whose aim is to reduce the information asymmetries that hinder the adoption of circular innovations. The use of CE labels, information schemes and awareness campaigns could help to correct information asymmetries and ameliorate the problems caused by poor communication between users and producers. CE labels and information schemes comprise 'labels, certifications, standards of information schemes that fully or at least partially address one or more resource efficiency or circular economy elements'.[112] As a steering tool, information instruments do not necessarily directly impact the circularity of products. However, these instruments use different types of information to influence different CE actors, including consumers, businesses and governments. This section examines innovative information instruments in terms of the circular services covered, the kinds of information made available to users, and the mechanisms through which information is made accessible to different users.

3.3.1 Proposed EU Digital Product Passport

Digital product passports are a modern tool for information distribution, labelling and tagging which can facilitate achievement of the

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[111] Söderholm (n 79); Teresa Domenech and Bettina Bahn-Walkowiak, 'Transition Towards a Resource Efficient Circular Economy in Europe: Policy Lessons from the EU and the Member States' (2019) 155 Ecological Economics 7, 15.

[112] Laubinger and Börkey (n 56) 9.

CE objectives in many ways and have been presented as solutions for many of the CE's problems, including such matters as unique item-level identification and detection of environmental parameters[113] and tracking chemicals through product life-cycle.[114] The EU's Sustainable Product Policy Initiative[115] proposes that digital product passport would be the norm for all product regulated under the proposed Ecodesign Regulation.[116] The proposed digital product passport would be an important tool for making information available to actors along a product's entire life-cycle and value chain. The passport should help consumers make informed choices by improving the availability of relevant information on the product, while also allowing operators such as repairers and recyclers as well as authorities to access information on it. The Ecodesign Regulation proposal states that information about a product's durability, reliability, reusability and repairability, and the presence of substances of concern etc. could be included in the product passport. The parameters chosen to measure the performance of the product would be examined on a case-by-case basis as different parameters are relevant for different product groups. The products could only be placed on the market or put into service if a product passport were available. The proposed regulation does not prescribe an exact form for the passport. Nonetheless, the Commission has suggested that the passport should be easily accessible by scanning a data carrier such as watermark or a QR code.[117] The Commission also suggested that the data in the digital product passport could help in setting mandatory green public procurement criteria and in preventing destroying unsold consumer products.

3.3.2 Portugal's Organized Waste Market

One way to promote the CE is by providing a supportive framework for industrial symbiosis. Portugal has enacted various instruments to promote the formulation of such a framework. One of the most distinctive instruments is the organized waste market (*Mercado Organizado de Residuo*). The Portuguese Decree Law 178/2006[118], as amended, provides for the establishment of a voluntary online market to serve as the central platform for the buying and selling of various secondary materials. The market was established to promote the reintroduction of secondary materials into the

113 Nenad Gligoric and others, 'SmartTags: IoT Product Passport for Circular Economy Based on Printed Sensors and Unique Item-Level Identifiers' (2019) 19 (3) Sensors <https://doi.org/10.3390/s19030586> 23 December 2022; Thomas Adisorn, Lena Tholen and Thomas Götz, 'Towards a Digital Product Passport Fit for Contributing to a Circular Economy' (2021) 14 (8) Energies <https://doi.org/10.3390/en14082289> accessed 23 December 2022.

114 Commission, 'On Making Sustainable Products the Norm (Communication)' COM (2022) 140 final [hereinafter "COM (2020) 142 final"]; Thomas de Römph, *The Legal Transition towards a Circular Economy: EU Environmental Law Examined* (DLaw, KU Leuven 2018) 210, 371–72. See also Commission, 'European Resource Efficiency Platform: Manifesto & Policy Recommendation' (2012) 7.

115 COM (2022) 140 Final' (n 115).

116 Ibid; Commission, 'Proposal for a Regulation for the European Parliament and of the Council Establishing a Framework for Setting Ecodesign Requirements for Sustainable Products and Repealing Directive 2009/125/EC' COM (2022) 142 final.

117 COM (2022) 140 final (n 115); COM (2022) 142 final (n 117) recital 31.

118 <https://data.dre.pt/eli/dec-lei/178/2006/09/05/p/dre/pt/html> accessed 22 December 2022.

economy and thereby reduce the need for virgin raw materials. Sellers can post their secondary materials online, creating visibility regarding the various possible sources of secondary materials. The Portuguese law also provided for financial and administrative incentives to facilitate the use of the platform. For example, the law provides the possibility to exempt users who adhere to the conditions of the trading platform from licensing requirements for non-hazardous waste recovery operations.

It has been argued that Portugal still has strategic, technical, fiscal, social, and process gaps in its industrial symbiosis framework.[119] These are issues that information instruments cannot resolve on its own and which require complementary approaches. At EU level, other instruments that are relevant for industrial symbiosis and are implemented in all Member States include, for example, regulation on differentiating by-products from 'waste' and regulation on industrial emissions and Best Available Techniques (BAT).[120] These latter instruments help improve the technical and process gaps in implementing industrial symbiosis. In addition, industrial symbioses may, for example, be promoted by setting out different financial incentives or indirectly encouraging market actors via land-use regulation and planning.[121]

3.3.3 Germany's Blue Angel Certification Scheme for Car-Sharing

The CE also includes business models that are based on providing access to users instead of transferring ownership. By utilizing operational strategies that rely, for example, on increased utility or product-life extension, these business models can promote resource efficiency while meeting a need or performing a function. However, not all access-based services result in positive environmental impacts. Hence, it is also crucial that users can distinguish and prefer those services that are circular and sustainable.[122] In Germany, the reach of the Blue Angel certification scheme has been extended to cover car-sharing services. The environmental objectives of certification under this scheme include reducing resource use by enabling people to live without car ownership, saving space on the road while reducing air pollution, CO_2 emissions and energy consumption.[123] The objectives are operationalized through technical requirements imposed in respect of the car-sharing fleet. For example, any new diesel vehicle added to the fleet should comply with maximum NOx and particulate emissions limits. The car-sharing operator must also phase out diesel

[119] Juan Henriques, Paulo Ferrão and Muriel Iten, 'Policies and Strategic Incentives for Circular Economy and Industrial Symbiosis in Portugal: A Future Perspective' (2022) 14 (11) Sustainability 1, 18–20 <https://doi.org/10.3390/su14116888> accessed 23 December 2022.

[120] Industrial symbiosis is mentioned in Article 5 of the EU Waste Directive regarding by-products and the recitals of the 2018 amendments to the Directive; Helena Dahlbo and others, *Promoting Non-Toxic Material Cycles in the Preparatuin of Best Available Technique Reference Documents* (Finnish Environment Institute 2021) <http://urn.fi/URN:ISBN:978-952-11-5402-7 http://hdl.handle.net/10138/329318> accessed 22 December 2022.

[121] Suvi Lehtoranta and others, 'Industrial Symbiosis and the Policy Instruments of Sustainable Consumption and Production' (2011) 19 Journal of Cleaner Production 1865, 1873.

[122] Kautto and others (n 67) 103–105.

[123] Blue Angel, 'Car Sharing: Basic Award Criteria' 5–6 <https://produktinfo.blauer-engel.de/uploads/criteriafile/en/DE-UZ%20100-201801-en-Criteria-V4.pdf> accessed 3 December 2022.

vehicles or at least ensure that all its diesel vehicles comply with the maximum NOx emission limits by 2021.[124] Operators that have more than 50 vehicles are also subject to a requirement to increase the percentage of electric vehicles in the overall composition of the fleet, which should be charged using 100% renewable energy.[125] The label also has requirements to use compact vehicles, for example 45% of the vehicles in a fleet should be from the mini and small cars segments as defined by the German Federal Motor Transport Authority.[126] This facilitates the use of trip-appropriate, small and less material-intensive vehicles, which also contributes to reducing operational CO_2 emissions. To further support the deployment of sustainable car-sharing, the city of Bremen linked the use of the label as a condition for awarding parking privileges.[127]

The Nordic Swan Ecolabel is also currently investigating how to develop ecolabels for businesses based on sharing, such as e-bike-sharing.[128] Going beyond emissions, the label is looking at whether the material efficiency criteria can be extended to require that the product (e.g., bikes) be made from recyclable or renewable components, that operators undertake to maintain, repair and reuse parts, and that discarded parts be recycled in a way that retains their highest value.[129] These two examples show how material efficiency and other environmental criteria can be combined and developed to help users identify services that are truly circular and sustainable.

3.3.4 Information Requirements on Substances of Concern – the EU's SCIP Database

The EU has recently introduced a requirement for all companies that place articles and products on the EU market to notify the European Chemicals Agency if those articles and products contain substances that have been identified as substances of very high concern under the REACH Regulation[130].[131] The information is published in the Substances of Concern in Products (SCIP) database, which is publicly available. Following the introduction of the SCIP database much more information on the presence of substances of very high concern in the products placed on the EU market

124 Ibid 10–11.
125 Ibid 11–12.
126 Ibid 12.
127 Kalimo and Mateo (n 67).
128 Matthias Vang Vestergaard, Jesper Minor and Dilek Turan, 'Ecolabel Potentials of Sharing Economy Services in the Nordics: A Study into the Potential Framework for Ecolabelling of Sharing Based Services in a Circular Economy Perspective' (2020) Nordic Working Paper <http://dx.doi.org/10.6027/NA2020-906> accessed 23 December 2022.
129 Ibid.
130 Parliament and Council Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (as amended) [2006] OJ L 396/1.
131 Parliament and Council Directive 2008/98/EC of 19 November 2008 on waste and repealing certain Directives [2008] OJ L312/3 (as amended), art. (9)(1)(i).

is now available.[132] One of the aims of the European SCIP database is to help waste operators ensure that substances of very high concern are not present in recycled materials. Secondary materials may contain chemical substances that pose risks to human health or the environment. The presence of hazardous substances in and even the mere absence of information on the chemical composition of the secondary materials can limit their use and hinder material circulation. At the same time, it would be too costly to require every batch of a potential secondary material to undergo chemical analysis.

One way to tackle the problem is to set out information and traceability requirements as regards the presence of hazardous substances in the products from which the secondary materials originate. Better information on the safety of the recycled materials is crucial to foster demand for the secondary materials as it increases market operators' confidence in using secondary materials and helps to minimize both the risks related to the safety of the materials and the related business risks. Mere uncertainty as to the possible existence of residues of hazardous substances may prevent the circulation of an otherwise useful secondary material. The SCIP database is a good first step towards achieving a better information flow concerning the presence of hazardous substances in the material circles. However, as it sets requirements only as regards substances of very high concern it covers only a small proportion of all the hazardous substances that may be present in secondary materials and is, therefore, not in itself a sufficient measure. Thus, some scholars have taken the view that the SCIP database does not provide sufficient information for recyclers, for example because the product information in the database is not specific enough and the information on the chemical composition is limited to substances of very high concern.[133]

3.3.5 Pros and Cons of Using Information Instruments

The various examples of information instruments set out above show the broad spectrum of how they could be used to mainstream the CE. The Blue Angel example demonstrates the role of labels in creating awareness of the fact that not all circular services are sustainable, and in distinguishing those that are sustainable.

Identifying environmentally superior circular products requires the development of methodologies by which to measure environmental impacts and standards and translate this information in a way that is meaningful for the targeted actors. These could provide the basis for regulating new circular aspects and developing new demand-pull regulations. Thus, new information on CE products, materials and services can also create new regulatory objects. The information that a digital

[132] European Chemicals Agency, '7 Million Searchable Articles in SCIP Database Improve Transparency on Hazardous Chemicals' (*European Chemicals Agency*) <https://echa.europa.eu/-/7-million-searchable-articles-in-scip-database-improve-transparency-on-hazardous-chemicals> accessed 26 September 2022.

[133] Henning Friege and others, 'The New European Database for Chemicals of Concern: How Useful Is SCIP for Waste Management?' (2021) 21 (100430) Sustainable Chemistry and Pharmacy 1 <https://doi.org/10.1016/j.scp.2021.100430> accessed 23 December 2022.

product passport scheme would make it possible to obtain could support the development of more sophisticated regulations and circular public procurement. Furthermore, information instruments can help support compliance, but also improve the monitoring of the environmental impacts of other demand-pull instruments.

Information instruments play an important role where the barriers for CE adoption are not based (at least exclusively) on economic logic, including such matters as lack of market information, technical know-how and cultural barriers. The Portuguese example of promoting the organized waste market and the SCIP database example demonstrate the importance of creating spaces, physically or virtually, where various CE actors can obtain relevant information to facilitate CE objectives. In the Portuguese example, it was information as to the availability, supply, and demand for certain waste materials to facilitate industrial symbiosis that was important, while in respect of the SCIP database the presence of information regarding the hazardous contents of products offered a means of increasing confidence in secondary materials and facilitating their use. The examples provided also hint at the need to ensure the accessibility of CE-relevant information: this entails organizing, centralizing, and linking information or databases.

The SCIP database example also shows that using information instruments to increase the demand for circular products need not necessitate the development of new regulatory frameworks. Instead, existing information infrastructure can be utilized to allow for the collection of CE-relevant information.

3.5 Public Procurement Instruments

Public procurements have significant potential as a driver of the CE transition because the volume of procurements made by different public authorities is substantial. By favouring CE solutions and products in their purchases public authorities can therefore create demand and markets for CE industry. Furthermore, by applying Circular Public Procurement (CPP) the public sector actors can lead by example and thereby also encourage private sector actors to favour circular solutions and products in their procurement.[134]

CPP is a dimension of a wider green public procurement concept in which public authorities seek to procure goods, services and works that have a reduced environmental impact throughout their life-cycle when compared with goods, services and works with the same primary function that would otherwise be procured.[135] It also falls within the sustainable public procurement concept which covers environmental, social and

[134] See e.g. Mervin Jones, 'Harnessing Procurement to Deliver Circular Economy Benefits' (2017) 5 <https://sustainable-procurement.org/resource-centre/?c=search&category=tool_guidance&topic=circular_economy&p=2> accessed 23 December.

[135] European Commission, 'Public Procurement for a Better Environment (Communication)' COM (2008) 400 final 4.

economic sustainability.[136] CPP can be defined as 'procurement of competitively priced products, services or systems that lead to extended lifespan, value retention and/or remarkably improved and non-risky cycling of biological or technical materials, compared to other solutions for a similar purpose on the market'.[137] The CE can be promoted in the context of public procurement by setting specific circularity criteria for the acquired products, by procuring services instead of products (e.g., by applying different product-service systems), by using public procurement as a platform for piloting new and innovative products, services and materials, or by promoting industrial symbiosis and circular ecosystems in the public procurement.[138] CE objectives can therefore be promoted in the public procurement as well by applying circular procurement models (e.g., renting or leasing), by setting requirements for the life-cycle of the products (e.g., take-back mechanisms and disassembly or reparability requirements), or setting requirements for the materials used (the procured product must contain recycled materials and/or the materials used must be recyclable).[139]

3.5.1 Circular Public Procurement (CPP) in the Netherlands

CPP in the Netherlands has been promoted under the government-wide CE programme which aims at achieving a fully circular economy by 2050.[140] The Netherlands uses information-based instruments such as circular public procurement guidelines to promote CPP.[141] This approach is similar to that taken by countries like Finland, which relies less on legislative amendments and more on informational guidance aimed at contracting authorities and bidders to promote CPP.[142] The Netherlands has also launched a Green Deal for Circular Procurement. This established a network among public and private actors for them to learn about the application of circular principles in procurement and exchange best practices. It also supports innovative circular pilot projects.[143]

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136 United Nations Environment Programme, United Nations Office and others, 'Buying for a Better World: A Guide on Sustainable Procurement for the UN System' (2011).

137 Katrina Alhola and others, *Circular Public Procurement in the Nordic Countries* (Nordic Council of Ministers 2017) 12 <https://norden.diva-portal.org/smash/get/diva2:1092366/FULLTEXT01.pdf> accessed 5 July 2022.

138 Katriina Alhola and others, 'Exploiting the Potential of Public Procurement: Opportunities for Circular Economy', (2019) 19 Journal of Industrial Ecology 96, 101-104 <https://doi.org/10.1111/jiec.12770> accessed 23 December 2022; Kautto and others (n 67) 103–105.

139 European Commission, 'Circular Procurement for a Circular Economy: Good Practice and Guidance' (2017) 6 <https://ec.europa.eu/environment/gpp/circular_procurement_en.htm> accessed 23 December 2022.

140 'Circular Dutch Economy by 2050' (*Government of the Netherlands*) <https://www.government.nl/topics/circular-economy/circular-dutch-economy-by-2050#:~:text=The%20Netherlands%20aims%20to%20have,and%20raw%20materials%20are%20reused.> accessed 7 October 2022.

141 See e.g. Cecilia van Oppen and others, *Circular Procurement in 8 Steps* (Rijkswaterstaat 2018).

142 Topi Turunen, Leila Suvantola and Seita Romppanen, 'Well Defined Is Half Solved? The Regulatory Barriers for Circular Economy Business' (2021) (1) Nordic Environmental Law Journal 93, 108 <https://nordiskmiljoratt.se/earlier-issues.html> accessed 23 December.

143 INTERREG Baltic Sea Region, 'State-of-the-Art on Circular Procurement Policy in the Baltic Sea Region' (2019) 40 <http://circularpp.eu/wp-content/uploads/2019/06/Summary-Report-WP-2.1-State-of-the-art-of-Circular-Procurement-Policy.pdf> accessed 22 December 2022.

Local authorities also play an important role in using CPP to advance CE targets as they could have more ambitious targets and provide more targeted guidance than national authorities. In the Netherlands, the city of Amsterdam aims to implement 100% circular procurement by 2030.[144] The city uses public procurement as a way of building knowledge and technical know-how for circular solutions. It also supports innovative circular products and services by serving as its first significant or 'launching' customer.[145] Amsterdam has adopted a policy of according precedence to circular solutions such as 'products as a service' and the utilization of used and/or reusable and refurbishable products.[146] These targets are operationalized and focus on four sectors: construction, consumer goods, food and waste, which were chosen based on their economic and environmental significance to the city.[147]

Zooming in on one of the city's priority sectors – the built environment – the city has published a comprehensive, step-by-step guide on how to conduct circular construction procurements.[148] The guide used a life-cycle approach in implementing circular procurement taking into account the different stages of the construction phase.[149] It sets out four key principles of circular buildings that are intended to guide procuring authorities' decision-making: (i) reduce initial demand for materials; (ii) look for synergies in the use of resources (i.e. sharing, reuse); (iii) when synergy effects are exhausted, use clean, renewable or otherwise ecologically beneficial sources; and (iv) manage the impacts by ensuring reliable feedback through transparent data and efficient information networks.[150] These principles underpin 32 circular criteria that may be used when designing a circular tender. The topics covered by these criteria include, for example, design for disassembly, use and capture of scarce and critical materials, and use of secondary materials for the building process.[151] Amsterdam's approach of learning by doing fills an important knowledge gap in the construction sector. For example, reuse of building materials has remained niche despite potential benefits simply due to lack of technical know-how.[152] The city plans to evaluate the guidance based on the experienced gained from at least three tenders, as well as from transformation, renovation, and demolition projects.

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[144] City of Amsterdam, 'Amsterdam Circular 2020-2025 Strategy' (City of Amsterdam 2020) 17 <https://assets.amsterdam.nl/publish/pages/867635/amsterdam-circular-2020-2025_strategy.pdf> accessed 7 October 2022.

[145] Ibid 52.

[146] Ibid.

[147] Ibid 8.

[148] City of Amsterdam, 'Roadmap Circular Land Tendering": An Introduction to Circular Building Projects' (n.d.) <https://www.metabolic.nl/wp-content/uploads/2019/02/roadmap_circular_land_tendering.pdf> accessed 7 October 2022

[149] Ibid.

[150] Ibid 13.

[151] Ibid 16-17.

[152] Katrin Knoth, Selamawit Mamo Fufa and Erlend Seilskjær, 'Barriers, Success Factors, and Perspectives for the Reuse of Construction Products in Norway' (2022) 337 (art. 130494) Journal of Cleaner Production 1, 5.

3.5.2 Circular Public Procurement in South Korea

In South Korea, circular procurement falls within the broader ambit of the country's policy of promoting green public procurement, which is tied strongly to the use of ecolabels.[153] The 2005 Act on the Promotion of Purchase of Green Products (as amended) serves as the main legislative instrument for the implementation of green public procurement. Under Article 6 of the Act, public institutions are required to purchase 'green products' unless there is a compelling reason not to do so, such as lack of availability. Under the Act, green products refer to those certified under the Korea Eco-Label or Good Recycled Mark certification, or those that meet other environmental criteria set by the Ministry of Environment, in consultation with the heads of other relevant ministries.[154] This is similar to Japan's approach of developing green procurement criteria based on ecolabels (e.g., Eco Mark, Green Mark and Recycle Mark).[155] Sector-specific requirements were introduced under the 2005 Construction Waste Recycling Promotion Act, which required the use of recycled aggregates certified either by the Korea Eco-Label or the Green Recycled Mark in the procurement of construction works.[156] Korea's Eco-Label System involves a third-party authority identifying products that have lesser environmental impact throughout their life-cycles.[157]

Through its procurement policy, Korea has supported the development of the market for its ecolabelled products. During its conception, the Korea Eco-Label covered only four product categories. By 2016, the label's scope had expanded to cover 161 categories.[158] The market for Korea Eco-Label products has also increased tenfold from USD 3 billion in 2005 to USD 34 billion in 2013.[159] The South Korean example shows how public procurement can be linked with certification systems to support the market for circular products and services.

3.5.3. Pros and Cons of Using CPPs

CPP helps mainstream CE beyond establishing a market for CE products. CPP, particularly through the development of circular criteria, signals to suppliers the policy objectives and direction that the government wants to support. The Amsterdam example demonstrates how CPP can be

[153] See Harri Kalimo and others, 'Hiili- ja ympäristöjalanjälki hankinnoissa – lainsäädäntö ja mittaaminen' (Finland Prime Minister's Office 2021) 114 <http://urn.fi/URN:ISBN:978-952-383-097-4> accessed 23 December 2022.

[154] 2005 Act on the Promotion of Purchase of Green Products, art. 2.

[155] United Nations Environment Programme, 'Comparative Analysis of Green Public Procurement and Ecolabelling Programmes in China, Japan, Thailand, and the Republic of Korea: Lessons Learned and Common Success Factors' (2017) 40 <https://wedocs.unep.org/handle/20.500.11822/33377> accessed 7 October 2022. Kalimo and others (n 154) 114.

[156] United Nations Environment Programme, 'Green Public Procurement in the Republic of Korea: A Decade of Progress and Lessons Learned' (2019) 23 <https://wedocs.unep.org/20.500.11822/32535> accessed 23 December 2020.

[157] Korea Ministry of Environment and Korea Environment Institute, 'Eco-Label Certification System (ECS) in Korea' (2016) Korea Environmental Policy Bulletin 41, Vol. XIV Issue 1 5 <https://me.go.kr/home/file/readDownloadFile.do?fileId=148570&fileSeq=1> accessed 22 December 2022.

[158] Ibid 7.

[159] United Nations Environment Programme (n 157) 26.

used as a means of building knowledge to close technological and information gaps, which could benefit the industry at large and potentially serve as the basis for future regulations.

The foregoing also validates earlier findings that using CPP to promote the CE does not necessarily require the introduction of new legislation or amendment of existing legislation. As the Netherlands example shows, increased collaboration between the procurer and potential suppliers throughout the procurement process can help facilitate circular procurement but requires mutual commitment.[160] This is particularly true in complex circular solutions, such as in construction, which include aspects that cannot be easily covered by ecolabels or standards. The South Korean example demonstrates how to achieve synergies with ecolabels and procurement policies to support circular products. The mandatory use of labelled products facilitated the identification and verification of environmentally superior products during the procurement process. On the other hand, South Korea's public procurement policy guarantees demand for, and encouraged suppliers to invest in the development of, circular products and services and simplified the procurement process for the staff of procuring authorities. However, exclusive reliance on ecolabels may limit the scope of products and services that could be the subject of CPP.[161] It may also hamper suppliers' flexibility in meeting environmental requirements and hinder motivation to look for better and more innovative approaches.

Another dimension that the Amsterdam example highlights is the importance of creating priority and influencing demand for circular solutions that have better environmental impacts, for example by establishing the four key principles when procuring for construction or by adopting a policy of purchasing fewer new products. This also encourage suppliers to invest in circular strategies that are higher in the hierarchy (i.e., reduce, reuse, etc.).

Finally, the examples show the complementary roles of national and local governments in supporting circular solutions through CPP. Local governments are better equipped than national ones to understand which CE solutions need to be prioritized and in which sectors in the context of CPP from an environmental perspective. However, national CPP targets help provide regulatory certainty.[162]

4. CONCLUSION: DEFINING THE ROLE OF DEMAND-PULL INSTRUMENTS IN MAINSTREAMING THE CIRCULAR ECONOMY

This article has examined the four main types of demand-pull instruments to promote the CE. It has looked at innovative examples from different jurisdictions and examined how they addressed the needs of the

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[160] Sjors Witjes and Rodrigo Lozano, 'Towards a more circular economy: Proposing a framework linking sustainable public procurement and sustainable business models' (2016) Resources, Conservation and Recycling 37-44, 41-42.
[161] United Nations Environment Programme (n 156) 63, 96.
[162] Kalimo and others (n 154) 63-64.

CE transition. The regulatory examples were not intended to be showcased as viable solutions in all jurisdictions. Rather, the aim was to highlight the innovative elements of the various approaches and the challenges and pathways for improvement. None of the regulatory innovations discussed provide the key to the CE transition in themselves, but they can be utilized as part of the solution. However, before enacting any of the identified regulatory approaches as legal transplants in another jurisdiction, whether combined with other regulatory tools or applied for different regulatory objects, a thorough evaluation of its impacts (direct and indirect), legitimacy and applicability will be needed.

All the examples offered demonstrate that mainstreaming the CE requires the balancing of various factors. These include creating sufficient legal certainty and incentives for market operators, ensuring feasibility while supporting the possibility of further innovation as well as ensuring that the approach taken is geared to producing positive environmental outcomes. From the outset, it is important that life cycle environmental impacts inform decisions as to which CE strategies are mainstreamed[163] and through which instruments.

Furthermore, it is crucial to identify and have a holistic understanding of the nature of the barriers to the implementation of specific aspects of the CE: lack of technical and organizational know-how, socio-cultural barriers, economic and regulatory disincentives require different approaches and therefore different instruments. The presence of multiple barriers also signifies the limitations involved in using a single instrument and the need for complementary policies. Indeed, the examples show that many demand-pull instruments have in fact complementary roles and can be utilized to achieve synergies. The deployment of instruments can be phased based on technological/market readiness and availability of data, including data on environmental impacts. Information instruments, such as ecolabels, certifications, and digital product passports can be used to develop life-cycle analysis methodologies and standards that could support public procurement, or later inform CAC instruments, or as a basis for awarding economic incentives. Economic instruments can be supplemented by information and CAC instruments to overcome non-economic barriers. Information instruments and public procurement can also be used to build technical know-how and experiment with solutions to test their environmental impacts. Where the technological capability to supply circular solutions on a wider scale is relatively well developed and there is clear understanding of the concomitant environmental impacts, CAC instruments can be used to achieve more efficient adoption and mainstreaming of circular solutions. These instruments are slow to implement and are most restrictive. Hence, softer information instruments can be used to build understanding and bring about gradual acceptance to counter cultural resistance.

The discussions above also highlight that most regulatory frameworks still offer only limited examples of policies to support a shift

[163] See Kalimo and Mateo (n 67).

towards what Stahel labels as 'sufficiency'.[164] Sufficiency represents not just using less resources to produce a product, but also possibly reducing consumption itself. Examples of this approach include not replacing products until they become functionally obsolescent and shifting from products to services to reduce the material stock of a product over time. This approach requires, for example, thinking not only about how to maximize the use of recycled content in packaging but also about how to reduce the need for packaging itself.[165] This also presents a notable challenge when conceptualizing demand-pull instruments. Beyond information instruments, there is a need to further understand to what extent demand-pull instruments, and which types, can support 'sufficiency' approaches. What solutions, activities or alternatives promote sufficiency, and which are not linked to consumption? What role and how could regulations enable and support these innovations in consumption, and who might be the relevant actors and regulatory subjects in promoting this shift? Further research is needed to understand the suitability and design of demand-pull instruments that mainstream solutions based on non-consumption.

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[164] Walter Stahel, 'Sufficiency Strategies for a Sustainable and Competitive Economy Reversed and Inversed Incentives'(Proceedings Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing conference, Tokyo, December 2001) <https://ieeexplore.ieee.org/document/992428> accessed 7 October 2022.

[165] Nancy MP Bocken and Samuel W Short, 'Transforming Business Models: Towards a Sufficiency-Based Circular Economy' in Miguel Brandão, David Lazarevic and Göran Finnveden, *Handbook of the Circular Economy* (Edward Elgar Publishing 2020) 254.

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AUTHORS' DECLARATIONS AND ESSENTIAL ETHICAL COMPLIANCES

Authors' Contributions (in accordance with ICMJE criteria for authorship)

Contribution	*Mateo*	*Turunen*	*Alaranta*
Conceived or design the research analysis	Yes	Yes	Yes
Collected the data	Yes	Yes	Yes
Contributed to data analysis and Interpretation	Yes	Yes	Yes
Wrote the article	Yes	Yes	Yes
Critical revision of the article	Yes	Yes	Yes
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