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Rosalind Malcolm

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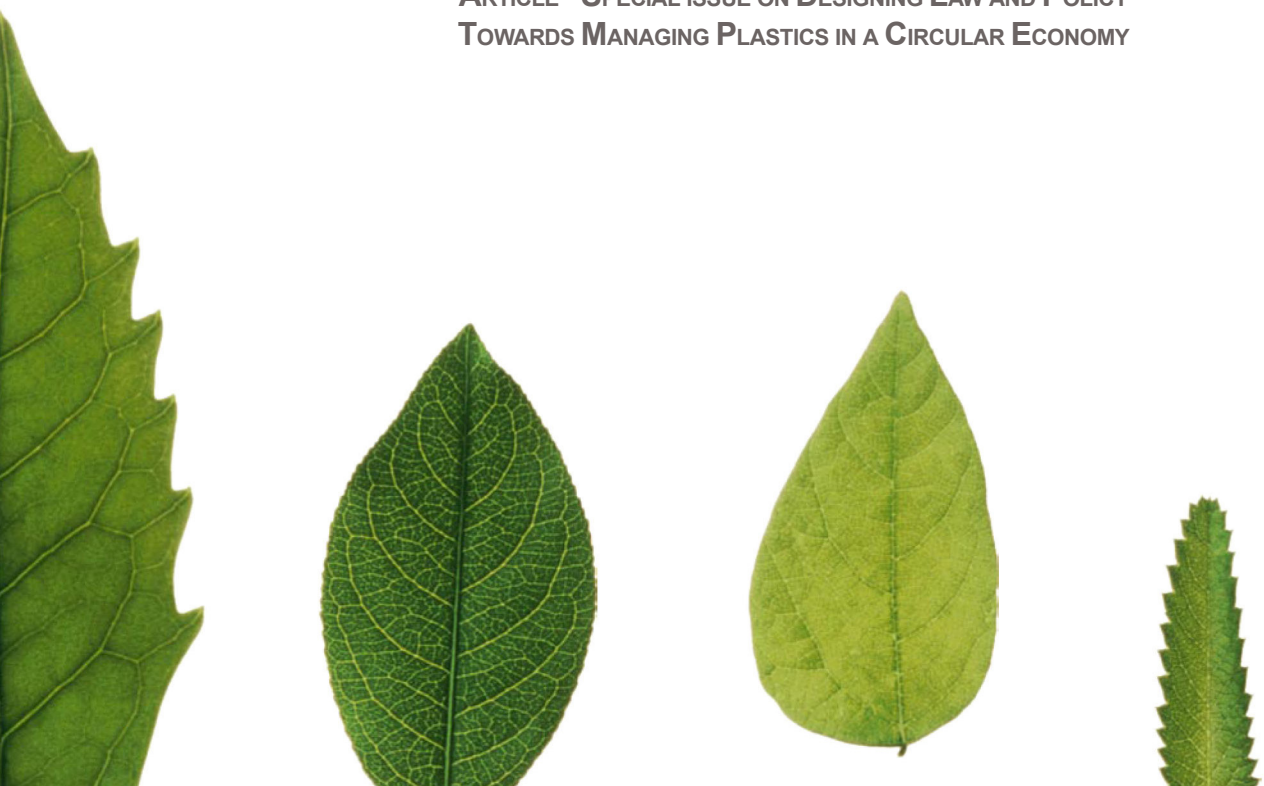

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Rosalind Malcolm, Environmental Regulatory Research Group, School of Law, University of Surrey, Guildford, Surrey GU2 7XH, UK Email: r.malcolm@surrey.ac.uk

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1 INTRODUCTION

All creatures including birds, animals and humans are at risk from plastic waste in the environment and the challenge of preventing it entering rivers, oceans, the atmosphere and land is urgent requiring our full attention.[1] Yet, at the same time, plastics are a valuable material for preserving food, and they are used in textiles, transportation, construction and personal care products. Indeed, a world without plastics is unimaginable. The challenge then, is to deal with the escape of waste plastics in a way which enhances the circular economy – a closed-loop system where end-of-service-life objects become a resource. For most plastics like packaging, closed-loop systems already exist which can be improved through increasing collection and reuse/recycling. However, there are also uncontrolled losses of plastic materials that happen as "fugitive" emissions like tyre-wear or when laundering garments made from plastic. The problem of plastics waste is linked to the issue of mass consumption in the industrialised world, which has led to increasing production, the proliferation of goods, and the generation of waste. In highly industrialised societies, products are often treated as throwaway or 'single-use' items which not only increase the waste burden including fugitive emissions during their use phase, but also use raw materials in their manufacture thereby depleting the virgin resources of the planet. In the developing world, these problems exist too but are often exacerbated by the import and accumulation of plastic waste from the global north despite recent bans on such trade.[2]

Following the publication of figures for the production of plastics waste, there has been a plethora of policies produced at the UK and European Union levels. These include the UK Government's 25 Year Environment Plan, which sets a target of working "towards eliminating all avoidable plastic waste by end of 2042".[3] Bans, such as that on the manufacture and sale of cosmetics containing micro-plastic beads,[4] and financial instruments[5] are also part of the UK approach. The UK Government's Waste and Resources Strategy[6] includes two key ambitions: to work towards all plastic packaging placed on the market being recyclable, reusable or compostable by 2025; and to eliminate avoidable plastic waste over the lifetime of the 25 Year Environment Plan. Alongside these, a holistic approach, which transforms the perception of plastic waste from "*mere garbage*" into something which "*should be regarded as a resource*",[7] is part of the drive towards a circular economy approach at the EU level. Sustainability leadership is needed to facilitate the establishment of a 'framework of actions to ensure a holistic circular economy approach with proportionate and complementary policies which combine better regulation; market-based instruments; research and innovation; incentives; measures of performance; and information exchange.'[8] Further activity at EU level includes a policy on the minimisation of plastics waste and the development of a circular economy. In December 2015, the European Commission adopted

1 Kara Lavender Law, 'Plastics in the Marine Environment' (2017) 9 Annual Review of Marine Science 205–229; Roland Geyer, Jenna R Jambeck and Kara Lavender Law, 'Production, Use, and Fate of All Plastics Ever Made' (2017) 3/7 Science Advances 1-5; Ellen MacArthur Foundation, *The New Plastics Economy: Rethinking the Future of Plastics & Catalysing Action* (Ellen MacArthur Foundation 2017).

2 See for example, 'India Bans Imports of Waste Plastic to Tackle Environmental Crisis' *The Independent*, 7 March 2019 available at <https://www.independent.co.uk/environment/india-plastic-waste-ban-recycling-uk-china-a8811696.html>.

3 HM Government, A Green Future: Our 25 Year Plan to Improve the Environment (UK Government 2018) 83.

4 The Environmental Protection (Microbeads) (England) Regulations 2017.

5 UK Treasury, 'Tackling the plastic problem. Using the tax system or charges to address single-use plastic waste' (UK Government 2018) available at <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/690293/PU2154_Call_for_evidence_plastics_web.pdf>.

6 HM Government, Our Waste, Our Resources: A Strategy for England (UK Government 2018) 17.

7 European Parliament resolution of 14 January 2014 on a European strategy on plastic waste in the environment (2013/2113(INI)) 2016/C 482/09.

8 Department for Environment, Food and Rural Affairs, European Economy Circular Economy Package - UK response to European Commission public consultations on the circular economy and on the functioning of waste markets (DEFRA 2018).

an EU Action Plan for a circular economy.[9] In that plan it identified plastics as a key priority and committed itself to 'prepare a strategy addressing the challenges posed by plastics throughout the value chain and taking into account their entire lifecycle'. In 2017, the Commission confirmed it would focus on plastics production and use and work towards the goal of ensuring that all plastic packaging is recyclable by 2030.[10] This culminated in the 2018 Communication setting out the policy on the treatment of plastics in a circular economy.[11]

These policies show good will and good intent on the part of governments towards seeking a solution to the problem of plastic products and the waste generated from them. It is undeniably essential to control more effectively the environmental impacts of production and consumption,[12] and it is argued here that the way to do so is through regulatory measures which adopt a radical new approach by addressing the product in a holistic fashion rather than focussing from a legal perspective on specific points during its lifetime or introducing ad hoc prohibitions. Here, the regulatory focus will be on the product and it will impact during the design phase. Lifecycle thinking in the form of a Product Impact Assessment will be applied to the product at the design stage influencing its final form and this assessment, while intended to be wider in scope than questions about the use of plastics in the product, will incorporate questions about the use of plastics in the product.[13] This new approach will provide the opportunity for the type of plastic to be addressed alongside issues around fugitive emissions during use and then disposal of the plastic components at the end of life whether of the individual component (business-to-business) or the product (business-to-consumer) itself. Currently, sectoral laws provide, for example, for the management of waste,[14] and the control of pollution to air and water[15] caused by manufacturing industry but fail to take a holistic approach to the environmental impact of products throughout their lifecycle and beyond. The laws, which seek to focus on the end of the lifecycle, fail to be effective in bringing the product and its embedded energy back into the commercial cycle and do not address at all the waste burden of plastic products during their use phase. End of life legislation[16] can trigger design changes but are not focussed on achieving this outcome – rather they focus on recovery operations. Indeed, the weakness of sectoral laws is that they are mischief-led – they focus on the particular problem whether that be, for example, a polluted river, poor air quality or climate change and address that problem to the exclusion of others. A life cycle approach

9 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 'Closing the loop - An EU action plan for the Circular Economy', COM (2015) 614 final.

10 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 'Commission Work Programme 2018 – An agenda for a more united, stronger and more democratic Europe', COM (2017) 650 final.

11 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 'A European Strategy for Plastics in a Circular Economy', COM (2018) 28 final.

12 UN Sustainable Development Goal 12 sets targets in relation to sustainable consumption and production patterns. See <https://sustainabledevelopment.un.org/sdg12>.

13 It is intended that, as with the REACH legislation - Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Product Impact Assessment will apply to new products at first but will eventually extend after a transition phase, to existing products which are still marketed.

14 Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste [Waste Framework Directive].

15 Directive 2010/75/EU of the European Parliament and the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) [Industrial Emissions Directive or IED]; Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy [Water Framework Directive].

16 For example, Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 (as amended by Decisions 2002/525/EC, 2005/437/EC and 2005/438/EC) on end-of-life vehicles; Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electronic and electrical equipment; and European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging waste.

applied as a regulatory tool to a product would look across the spectrum of impacts from resource use to end of life and thus require design changes to a product to balance and mitigate those impacts. This approach will drive circularity in that it will incorporate not only environmental impacts but also such features as longevity and durability.[17] It has long been recognised that an integrated approach to environmental control is essential and this has emerged in terms of production processes from as long ago as the 1990s. The original UK concept of integrated pollution control,[18] which was subsequently adopted and expanded at EU level into integrated pollution and prevention control,[19] focussed on production and its impacts. It is not suggested here that this proposal for a product law (a *codex rerum*) will replace those integrated controls although it is likely to reduce some of the impacts during the winning of materials and the manufacture of the product. Rather this proposal will introduce a layer of regulatory control, which focusses on the product and fills the gaps, which the industrial process and production legislation leave out – notably the use phase of a product but also the integration of all phases across its life cycle.

Informing appropriate laws and policies to tackle the better management of plastics waste requires multi-disciplinary insights – we need an understanding of legal mechanisms and socio-economic considerations, as well as the physical properties of plastics and wastes underpinned by a life cycle approach so that those laws can be well designed to prevent harm. Evaluating the impact of a product involves engineering and science in relation to the type of materials such as plastics used in its manufacture. Intelligence regarding the way in which consumers use a product is also required involving behavioural science. And the psychology of consumerism needs also to be recognised in the design of a product if manufacturing industry is to be engaged with this new approach. This multidisciplinary background is recognised in this article which focuses on the proposal for a regulatory approach to the mitigation of the environmental impacts of a product.

Outline of Argument

This article addresses the specific question of a regulatory procedure which could be adopted to promote the development of a circular economy in plastics by controlling the product, whether that incorporates plastics as one of its components or which is made entirely from plastic. In Part 2 it addresses the development of integrated product policy – an approach which focuses regulatory controls on the product – and the development of the concept of producer responsibility. The implementation of this policy into the ecodesign laws is considered alongside its limitations. Part 3 considers life cycle approaches and the way in which life cycle assessment is needed to underpin an environmental product policy as part of a new model law relating to products (described here as a law of things or *codex rerum).* A procedural approach described as a Product Impact Assessment is sketched. Part 4 discusses different styles of regulation and advocates a licensing regime for the *codex rerum*. Part 5 examines the use of voluntary agreements incorporated into agreed standards as part of the process of a Product Impact Assessment and this discussion is further developed in part 6 which considers the Ecodesign regime and the extent to which that can inform the new law for things or *codex rerum.* Part 7 applies the proposed model to plastics. Part 8 concludes by arguing that a new model law dealing horizontally with products (the *codex rerum*) is required to shift the nature of the market from one based on a linear production model centred on 'GDP growth' to a system where resources move round a loop with the aim of generating zero waste[20] in the process. This will address the use of plastics as one material in products.

17 Klaus Tonner and Rosalind Malcolm, 'How an EU Lifespan Guarantee Model could be Implemented Across the European Union' (JURI Committee of the European Parliament 2017).

18 The Environmental Protection Act 1990, Part I. For the importance and radical nature of this legislative approach at the time, see Michael Purdue, 'Integrated Pollution Control in the Environmental Protection Act 1990: A Coming of Age of Environmental Law?' (1991) 54/4 Modern Law Review 534-551.

19 Directive 2008/1/EC1 of the European Parliament and the Council of 15 January 2008 concerning integrated pollution prevention and control.

20 Zero waste (and zero waste economy) is used throughout this article as short-hand for a circular economy which seeks to minimise waste to the lowest possible level consistent with the laws of thermodynamics.

2
INTEGRATED PRODUCT POLICY

Mass consumption with its proliferation of waste has brought to the forefront ideas of achieving sustainable production and consumption and, as Davidson argues, the question of 'how we should arrange our systems of production and consumption to ensure the sustainability of the Earth under conditions of conspicuous and pressing environmentally limiting conditions'[21] is now a key question. As part of this thinking, a new approach is emerging which seeks to address the regulation of the environmental impacts of products.[22] As Orwat and Karl suggest, 'Although environmental policy has traditionally focused mainly on production and the supply side, it is now beginning to address issues related to products and the demand side.'[23] In regulatory terms this approach has been seen in European proposals for an Integrated Product Policy which had been flagged in the 6th Action Programme for the Environment, "Environment 2010: Our Future, Our Choice".[24] This proposed, as one of five approaches to achieving environmental improvement, that business and consumers should play a greater role in achieving more environmentally sound products and consumption and advocated the development of product-related environmental policies, which would promote the development of a market for greener products. Product related laws became part of EU policy and the potential for development of these laws to provide an effective regime for controlling the impact of products on the environment is now fast developing.[25]

Regulation represents a traditional approach to the achievement of environmental protection and, providing it is clear, is usually approved by industry. The new approach, however, originally to be found in the 6th Action Programme, reflected in the European Union's development of an Integrated Product Policy and further developed in the 7th Programme,[26] marked a change from this traditional approach. In general, existing environmental laws and policies work in two ways: either on sectoral lines according to the environmental medium (e.g. water, air, waste) in question; or, on vertical lines impacting at strategic points during the lifecycle of products. Integrated Product Policy took a horizontal approach based on life cycle thinking and, in this, represented a new paradigm for regulation.[27] But Integrated Product Policy did not progress sufficiently the potential for keeping products and their embedded energy in the economy – it was horizontal across the flat life span of the product rather than being circular so as to drive a continual flow of materials. There is a need to change the regulatory approach to drive an end result which retains products as stock within a circular economy, thus minimising both their impact on the environment and the depletion of virgin resources.

21 John Davidson, 'Sustainable Development: Business as Usual or a New Way of Living?' (2000) 22/1 Environmental Ethics 45-71; Robert G Lee, 'Look at Mother Nature on the Run in the 21st Century: Responsibility, Research and Innovation' (2012) 1 Transnational Environmental Law 105-117.

22 Eléonore Maitre-Ekern, Carl Dalhammar and Hans Christian Bugge (eds) *Preventing Environmental Damage from Products - An Analysis of the Policy and Regulatory Framework in Europe* (Cambridge University Press 2018).

23 Carsten Orwat and Helmut Karl, 'European Environment: Integrated Product Policy and the Environment' (1999) 9/5 Special Issue of Environmental Policy and Governance 171-173, at 171.

24 Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions on the sixth environment action programme of the European Community 'Environment 2010: Our future, Our choice' – The Sixth Environment Action Programme, COM (2001) 31 final.

25 Rosalind Malcolm, 'Integrated Product Policy: Products and their Impact on Energy' (2011) 3/1 International Journal of Law in the Built Environment 48-64; Dirk Scheer and Rubik Frieder (eds), *Governance of Integrated Product Policy: In Search of Sustainable Production and Consumption* (Greenleaf Publishing 2006); Frans Oosterhuis, Rubik Frieder and Gerd Scholl, *Product Policy in Europe: New Environmental Perspectives* (Kluwer Academic Publishers 1996).

26 Decision No. 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet' 2012/0337 (COD). The 7th Environmental Action Programme no longer references Integrated Product Policy. Instead it includes reference to the Ecodesign regime as part of the focus on production and consumption patterns and the improvement of product environmental efficiency.

27 Rosalind Malcolm, 'Environmental Product Policy: A New Regulatory Paradigm for a Consumer Society' [2005] European Environmental Law Review 134-144.

This raises some questions: what regulatory frameworks are necessary to control the impact of products on the environment on a whole life basis? How can laws, policies, and administration be altered, directed and strengthened to effectively regulate the development of greener plastic products? How can such laws make a major contribution to sustainable development within an economy which circulates goods and materials thus avoiding the use of virgin resources and the generation of plastics waste both during the use phase of the product and at end of life?

Integrated Product Policy works at two levels: one is concerned with reducing the environmental impact of a product; the other seeks to attribute the costs of such impacts appropriately. In other words, it rests primarily on two principles: preventive and polluter pays. Both principles can be found in the earliest examples of EU environmental policy,[28] and now are enshrined in the Lisbon Treaty.[29] The preventive principle is at the heart of Integrated Product Policy: once environmental impacts are identified along the life cycle, then steps may be taken which are designed to reduce or eliminate them. The polluter pays principle is also fundamental to an understanding of Integrated Product Policy. The precautionary principle seeks to avoid impacts even where there is scientific uncertainty but has yet to feature explicitly in the application of Integrated Product Policy.[30]

The objective of Integrated Product Policy is to achieve a 'greening' of products. It is a policy which is designed to function within a market economy where it is essential that consumption and production patterns are sustained in an economic sense. It is not aimed at achieving a reduction in the consumption of products – such a result would be politically and economically unacceptable. Its object is to achieve 'better' products, i.e. those which are environmentally sustainable. Indeed, it was offered to industry as a policy which would enhance competitiveness: "In a competitive business world, environmental performance can be a factor giving companies or their products a competitive edge. Integrated Product Policy can help such companies by giving them more visibility".[31]

The impetus for a 'greener' product must occur primarily at the design stage in order to prevent products which are environmentally damaging entering the market and the use stage will also need to be addressed during the Product Impact Assessment to ensure that consumers use products in the least environmentally damaging fashion, for example, in a way which avoids the fugitive emissions which can result from the use of plastics. This can be built into the design stage but can also rely on good labelling with clear information for the consumer. But leaving such choices to the consumer is not the safest way to assure environmental gains, and the design stage should be utilised to ensure that the consumer is left with no or little choice to use the product other than in an environmentally sound manner. The design stage must take account of each life cycle phase in an integrated fashion to ensure that any impacts identified are not simply moved along the life cycle. It must include consideration of the disposal stage to achieve the best possible outcome in terms of remanufacturing, recycling or other forms of re-use. A clear advantage of a formal standard-setting approach as part of an Integrated Product Policy is that, whereas at the moment a 'greener product' has to compete against other 'less green' products, leaving the choice to the consumer who may exercise that on the basis of preference, price, fashion or some other variable,[32] Integrated Product Policy will eliminate the 'less green'

28 First Environmental Action Programme, [1973] OJ C112/1.

29 Treaty on the Functioning of the European Union, Title XX 'Environment'.

30 See *Rio Declaration on Environment and Development*, United Nations Conference on Environment and Development 1992 (UNCED), Principle 15. It reads: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". See also Elizabeth Fisher, Judith S Jones and René von Schomberg (eds), *Implementing the Precautionary Principle: Perspectives and Prospects* (Edward Elgar 2006); Ronnie Harding and Elizabeth Fisher, *Perspectives on the Precautionary Principle* (Federation Press 1991); Tim O'Riordan and James Cameron (eds), *Interpreting the Precautionary Principle* (Earthscan Publications 1994).

31 Margot Wallström (Environment Commissioner), 'Integrated Product Policy; Commission outlines its strategy to stimulate greener products', EU Institutions Press Release DN IP/03/858, 18 June 2003.

32 Tim Jackson, 'Motivating Sustainable Consumption – A Review of Evidence on Consumer Behaviour and Behavioural Change', Report to the Sustainable Development Research Network (ESRC Sustainable Technologies Programme, January 2005).

product dictating choice at the point of the buying decision.[33] Producer responsibility is a key element of Integrated Product Policy. Primarily initiated in Sweden and under development since the 1990s across Europe and the USA, producer responsibility (sometimes described as 'extended producer responsibility') is part of an approach towards the achievement of sustainable development within a sustainable consumption framework. Preceding the development of the Integrated Product Policy, it was the first step in the EU in this direction. It has been described as:

> An environmental protection strategy to reach an environmental objective of a decreased total environmental impact of a product by making the manufacturer of the product responsible for the entire life-cycle of the product and especially the take-back, recycling and final disposal of the product.[34]

The polluter pays principle is sharply in focus in this approach and operates as a theoretical principle underpinning both this policy area and the regulatory framework for the *codex rerum* by transferring the external costs, which are normally borne by society to the manufacturer. In this way, a paradigm shift occurs from regulatory emphasis on the process to the product. It is informed by the public interest theory of regulation, which seeks to correct market failures such as the cost of the waste burden on both industry and society. There are conflicts of views arising here as the manufacturer sees the consumer as part of the problem since it is during the use phase that environmental impacts can also arise as well as during production and disposal. This raises the question of 'who is the polluter?' Producer responsibility in its developed form fails to deal with this question and does cause confusion around the principle if it is to be used as the core underlying basis for legislation. But a holistic view which informs the development of the *codex rerum* is that it is the product which is the source of the problem – not the consumer. If the product did not exist, then the consumer could not pollute the environment by using it. So, if manufacturers make products, then the burden should be shifted to them to design those products which do not pollute during their consumption and all other phases. The dynamic approach of producer responsibility is that producers have the financial responsibility for the end of life environmental costs of their products and will therefore be forced to design them in ways, which minimise these financial costs. If industry must pay collectively for the environmental impact of waste products, then it will put its mind to designing products with fewer impacts.

In the last decade, the increasing concern about plastics waste has reached a crescendo,[35] but the concern about waste in general dates back much earlier. In the 1990s, the EU began to express concern about the large amounts of waste being generated noting that the volume of waste was continuing to increase despite attempts to minimise it. Dutch environmental policy implemented an approach, which included the costs of disposal at the end of life into the price of new products – an experimental approach, which recognised that the polluter pays principle reflected both pollution by the manufacturer and the consumer. Other countries such as Japan, Taiwan, Korea, Brazil and Peru also witnessed attempts to introduce systems of producer responsibility.[36] In the US, California has led the way on the development of recycling laws.

End of life legislation (or take-back legislation) is an example of producer responsibility and there is a batch of laws around this point in the life cycle of a product. Producer responsibility in its early form is demonstrated in the 'take-back' legislation in directives

33 Principles surrounding the science of econometrics are relevant to an economic modelling of the supply and demand characteristics of products based on these criteria but are not within the scope of this article.

34 Chris van Rossem, Naoko Tojo and Thomas Lindhqvist, 'Extended Producer Responsibility: An Examination of its Impact on Innovation and Greening Products', The International Institute for Industrial Environmental Economics – Internationella Miljoinstitutet, Report commissioned by Greenpeace International, Friends of the Earth Europe and the European Environmental Bureau (Vedant Goyal 2006). See also Carl Dalhammar, 'Extended Producer Responsibility' in Ludwig Krämer and Emanuela Orlando (eds), *Principles of Environmental Law*, Elgar Encyclopedia of Environmental Law Series (Edward Elgar 2018).

35 See, for example, BBC *Blue Planet II*, Series 1.7.

36 Yasuhiko Ogushi and Milind Kandlikar 'Assessing Extended Producer Responsibility Laws in Japan' (2007) 41/13 Environmental Science & Technology 4502-8.

such as for packaging, waste from electrical and electronic equipment, and vehicles, included labelling obligations as well as obligations to take responsibility for physical take-back and financial responsibility. Various expressed objectives of producer responsibility list items such as waste reduction; increased recycling as a method of waste disposal; improved resource use through eco-design; technological innovation; and, the generation of financial resources, which could be committed to recovery.[37] While these obligations did address the critical end of life problems of products, what they did omit, however, was the whole life approach to assessing the environmental impact of products and forcing design improvements to retain the product and its embedded energy within a circular economy and eliminate waste to a point consistent with the laws of thermodynamics.

Sometimes the terminology of 'producer responsibility' can be problematic. As it has been used in the EU, it has largely come to refer to take-back legislation – a term used for the obligations to recover products at the end of their life whether physically or by providing an economic framework. The reason for this is that end of life, and waste in general, is perceived as being the most potentially damaging stage in a product's life. For this reason too, waste legislation generally requires management responsibilities for all those handling waste and creates a framework of offences both in relation to the requirement for licensing and for general environmental offences.[38] By contrast, 'extended producer responsibility' can be used to refer to the whole life cycle of the product and all those involved in that cycle – not just the producer. This is problematic in that it downgrades the influence the producer has over the product and its impacts. It is to be distinguished from Integrated Product Policy, which clearly places responsibility on the producer.[39]

Producer responsibility as enacted in the EU clearly focuses on the final stage of the product while some of the objectives indicate a creeping integration of product policy across the life cycle with responsibility bearing on the individual producer. The *codex rerum* addresses not just the environmental impacts across the whole lifecycle but also takes the product round a loop within a circular economy and unequivocally puts the responsibility on the manufacturer of the product to retain the product and its embedded energy within that industrial system.

So, Integrated Product Policy as set out in two Communications from the European Commission,[40] presents an entirely new approach to the regulation of environmental impacts. It represents a radical and innovative way of controlling environmental pollution by looking at the impacts, which individual products will have on the environment along their full supply chain throughout their lifetime. At its heart is a life cycle approach, which requires an evaluation of the impacts a product will have at each stage.[41] Its preventive approach applies an assessment of environmental impacts to the product at each stage; i.e. from cradle to grave. The long supply chain involves the winning of the raw materials for the product; their processing; the manufacture of the product itself; its usage; and, finally its disposal, with at each point, consequent impacts on the environment. Further, in between each stage are sub-stages; for example, transportation or storage or repair. Each of these stages, under Integrated Product Policy, should be included in a life cycle assessment.

It is necessary to explain life cycle thinking given its importance to Integrated Product Policy and broader environmental product policies including the *codex rerum*.

37 Reid Lifset, 'Take it Back: Extended Producer Responsibility as a Form of Incentive-Based Policy' (1993) 21/4 Journal of Resource Management and Technology 163-175; Knut F Kroepelien, 'Extended Producer Responsibility — New Legal Structures for Improved Ecological Self-Organization in Europe' (2000) 9/2 Review of European Community & International Environmental Law 165-77.

38 See, for example, The Environmental Protection Act 1990, Part II.

39 Lifset (n 37).

40 'Green Paper of 7 February 2001 on integrated product policy' (presented by the Commission), COM (2001) 68 final; Communication from the Commission to the Council and the European Parliament, 'Integrated Product Policy: Building on Environmental Life-Cycle Thinking', COM (2003) 302 final.

41 Henrikke Baumann and Anne-Marie Tillman, *Hitch Hiker's Guide to LCA: An Orientation in Life Cycle Assessment Methodology and Application* (Studentlitteratur AB 2004).

3
LIFE CYCLE APPROACHES

The notion of a holistic environmental product policy refers to a fully integrated approach which addresses all aspects of the impact of a product.[42] Life cycle thinking is integral to this approach and is at the core of Integrated Product Policy as well as the *codex rerum*. The holistic approach refers to the identification of all environmental impacts throughout the lifetime of a product – that is cradle to grave, or more appropriately when driving towards a circular economy – cradle to cradle. Life cycle thinking addresses the whole life implications of activities, without necessarily pursuing the formal quantitative approach of a life cycle assessment study (see below), and has become a mainstay of policy in this field.[43] The holistic approach to the assessment of a product and its impact on the environment means that all the point controls, which are normally separately regulated, are integrated into the design stage of the product. So, impacts arising from the sourcing of the resources necessary for the production of the product; during its usage in the hands of those down the supply chain; and its disposal, are considered and acted upon even before the product is launched onto the market. This holistic life cycle thinking approach applied as part of the proposed Product Impact Assessment draws upon the learning acquired from environmental impact assessment (EIA) and strategic environmental assessment (SEA),[44] and is intended to be based on the preventive principle. Both the EIA and SEA Directives are based on the principle that all environmental impacts of projects, plans and policies should be assessed prior to implementation and public consultation plays a key element in these procedures.

Life cycle assessment is a quantitative manifestation of life cycle thinking. It is a tool which can be used in various ways such as for comparison between products or for single assessments. Life cycle thinking can be addressed in different forms through the analytical and quantitative tool of life cycle assessment. An international standard provides guidelines.[45] Life cycle assessment enables identification and, ideally, quantification of the environmental benefits of keeping the product and its embedded energy in circulation without using new resources thus minimising the generation of waste. It is complicated but this is bound to be the case as there are several stages and accompanying impacts which a product will have during its lifetime. "Aggregation", i.e. the extent to which distinct environmental impacts can be combined or traded off, is a specific problem in life cycle assessment.

The comparative approach of life cycle assessment is most likely to be used in retrospective situations where products are being compared for some reason such as, for example, a buying decision in a public procurement context. A single life cycle assessment can be used as a proactive and prospective tool to identify which are the greatest environmental impacts in a product's life cycle.[46] It is within the prospective context where its use is advocated as part of the proposed *codex rerum* where it is targeted at the design phase of a product as a pre-condition to its entry into the market. The use of life cycle assessment tools would be aimed at

42 This article is only concerned to argue the case for the application to products but it is conceived that this approach could ultimately apply also to services.

43 Guido Sonnemann et al, 'Life Cycle Thinking and the Use of LCA in Policies around the World' in Michael Z Hauschild, Ralph K Rosenbaum and Stig Irving Olsen (eds), *Life Cycle Assessment: Theory and Practice* (Springer 2018) 429; Walter Kloepffer, 'Life Cycle Sustainability Assessment of Products' (2008) 13 International Journal of Life Cycle Assessment 89-95.

44 Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment ['Environmental Impact Assessment' or EIA Directive], or for public plans or programmes on the basis of Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment ['Strategic Environmental Assessment' or SEA Directive].

45 ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework. See also ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines; ISO/TR 14047:2003 Environmental management - Life cycle impact assessment - Examples of application of ISO 14042; ISO/TS 14048:2002 - Environmental management - Life cycle assessment - Data documentation format.

46 Usually, the terms used are 'accounting LCA' and 'consequential LCA' (or change-oriented LCA). See, for example, chapter 3 in Baumann and Tillman (n 41).

ensuring that no product enters the market unless it has been satisfactorily demonstrated that its environmental impacts have been minimised and any other benchmarking criteria enabling circularity throughout its lifetime(s) have been satisfied. In the context of plastic products, this requirement means that such products will not generate waste in any of the forms in which that can occur in respect of waste throughout their lifetime. It may also reflect innovations such as new and developing types of plastics, which degrade more effectively.[47] Further requirements are that such plastic products use no new resources and the product (and its embedded energy) is capable of being returned to beneficial use as part of a circular economy. This process of evaluation under the *codex rerum* is described here as the 'Product Impact Assessment'.

Under the Product Impact Assessment, as part of the analysis, a calculation would be made which includes the generation of waste and emissions throughout the life of the product. This calculation is likely to include the resources used across the supply chain.[48] But the goals behind a Product Impact Assessment can be various and should include such matters as: resource efficiency, waste minimization and circularity, durability and longevity, reusability and recyclability as well as generalised reduced environmental impact. These features are determined during the goal and scope phase when conducting a Life Cycle Assessment. During a Product Impact Assessment, the necessary goals and scope of the process in relation to any particular product could be determined by the Technical Committee which would be set up at the outset to undertake the technical aspects leading to the assessment. But whatever the goals of the Product Impact Assessment are determined to be, the approach exemplifies the application of the preventive principle since the process must be completed at the design stage. One example of this is a seven-stage approach advocated by the Danish Environmental Protection Agency, which actually proposes applying this to either a product already on the market or one still at the design stage. The steps start with (1) a description of the product's use and functionality and (2) the creation of an overview of its environmental impacts across its (linear) product life cycle. An environmental profile is then created as part of step 3 with the impacts identified in step 2 sorted into categories and types. Step 4 involves sketching the stakeholder network so as to identify which of them influence environmental impacts and how possible improvements can be achieved at different points throughout the product's lifetime. Step 5 is an estimated quantification of environmental impacts (in this model designed for internal consumption and guidance rather than in accordance with formal methodological techniques such as the ISO standards). The final two tasks involve (6) creating solutions for the product and its life cycle which can lead to environmental improvements and finally (7) developing an environmental strategy which is an action plan for the environmental efforts of the company.[49] As an example of a model for the method for applying Product Impact Assessment, this is informative and demonstrates a practical way in which it can be implemented. The point at which the *codex rerum* departs from this approach is that Product Impact Assessment will be part of a regulatory framework and, as argued in the next part of this article, will be a mandatory requirement before a product can enter the market.

4 HOW TO REGULATE UNDER THE CODEX RERUM?

There is a range of regulatory styles and within the context of the *codex rerum* a command and control style within a permissive licensing regime is

47 For a discussion of the different types of plastics and their uses, see Roland Clift et al, 'Managing Plastics: Uses, Losses and Disposal' in this issue of LEAD Journal.

48 Baumann and Tillman (n 41); Roland Clift et al, 'Inventory Enhancement: A Summary of the Results of the Working Group on Inventory Enhancement' (1999) 10/3 SETAC-Europe News 14-20.

49 Tim C McAloone and Niki Bey, Environmental Improvement through Product Development: A Guide (Danish Environmental Protection Agency 2009).

advocated.[50] A key basis for such regulation would be the requirement for a Product Impact Assessment to be undertaken for all products and for compliance with that Product Impact Assessment to occur before market launch and throughout the ongoing marketing of the product. In other words, it is a mandatory process which bites at inception and continues for as long as the product is offered for sale – no Product Impact Assessment, no market; no continuing compliance with the Product Impact Assessment, no sales. So, regulation would be used to enforce certain essential characteristics and to keep a product off the market if it failed to comply. The design aspects of the product would be addressed, as in the Ecodesign regime and in voluntary Environmental Product Declarations,[51] using innovative technological approaches and this stage would be managed by Technical Committees. The essential requirements established under the Product Impact Assessment must be met before the product could be marketed – and they must continue to be met. In effect, the process results in a grant of a licence subject to conditions to market the product. Such a process to be mandatory and fit under the command and control style of regulation must be accompanied by an effective and respected enforcement framework. Thus, where a product has been licensed under the *codex rerum,* then breach of the license would be controlled through either administrative processes, comprising service of an administrative notice specifying the breach and requiring compliance within a set period of time, or criminal prosecution. As with current licensing enforcement procedures, where the terms of such a licence are breached then enforcement by a designated enforcement agency would follow. So, monitoring of the market is a necessary corollary to licensing and enforcement. Finally, it is proposed that there should be a transitional period for the implementation of the *codex rerum* with new products covered first and existing products drawn into it in stages.

5 VOLUNTARY AGREEMENTS AND STANDARDISATION

Many products have in fact been standardised – a 'secret' development in product policy.[52] In the European context this has worked as part of a process of identification of common interests in achieving technical solutions. In a single market context this ensures that products are accessible to all the national markets so national standards are increasingly being replaced by European standards to achieve uniform applicability. It is often the case that to ensure a product can enter international markets it also conforms to international standards. The European Committee for Standardisation (CEN), the European Committee for Electrotechnical Standardisation (CENELEC) and the European Telecommunication Standardisation Institute (ETSI) are recognised as the bodies for the development of European standards.[53] CEN has a Strategic Advisory Board for the Environment and the CENELEC has a Working Group of the Technical Board "Environmental Standardisation". Both bodies also have environmental databases and guides for the incorporation of environmental impacts into the standardisation process.

50 Neil Gunningham 'Environment Law, Regulation and Governance: Shifting Architectures' (2009) 21/2 Journal of Environmental Law 179-212; C Sabel and J Zeitlin, 'Learning from Difference: The New Architecture of Experimentalist Governance in the EU' (2008) 14/3 European Law Journal 271-327; Joanne Scott and Jane Holder, 'Law and Environmental Governance in the European Union' in Grainne De Burca and Joanne Scott (eds), *Law and New Governance in the EU and the US* (Hart Publishing 2006) 211; Nicholas A Ashford 'Government and Environmental Innovation in Europe and North America' in Mathias Weber and Jens Hemmelskamp (eds) *Towards Environmental Innovation Systems* (Springer 2005) 159.

51 See Part 5 of this article.

52 Opinion of the European Economic and Social Committee on the 'Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee on the Integration of Environmental Aspects into European Standardisation', COM (2004) 130 final. See also Communication from the Commission to the Council, the European Parliament and the European, Economic and Social Committee, 'Integration of Environmental Aspects into European Standardisation' SEC (2004) 206.

53 Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

Standards are an important element in any product policy since they establish the basic criteria on which product development can be based. They may establish all aspects of a product from the way it is made to the way it is disposed of and, of particular interest to an environmental product policy, they may define what materials it can use and other matters which may have an impact on the environment. The process of standard setting is critical for the development of an environmental product policy and is important in contributing to sustainable development policies.[54] Current standards in use are either mandatory and are set out in regulation, or voluntary and agreed by trade associations, companies or under the aegis of standardisation bodies. The Ecodesign Directive[55] is an illustration of this standards-based approach used in a regulatory context. Environmental Product Declarations are also examples of voluntary standard setting and, as a concept, are strongly linked to the proposed Product Impact Assessment. Environmental Product Declarations are approved through an independent process. They are registered and give information about the life-cycle environmental impact of products. ISO 14025 is the comparable standard for Environmental Product Declarations ('type III environmental declarations') making the process formalised and transparent. But, Environmental Product Declarations remain voluntary so have little impact on transforming the market even though they may appear in public procurement schemes. They are also largely confined to business-to business contexts (rather than business-to-consumer). So, where Environmental Product Declarations part company with Product Impact Assessments is that the former are voluntary and the latter mandatory.

In general, European standards are voluntary agreements developed through a system of consensual workshops organised by the European standardisation bodies. They are distinct from legislation which incorporate standards or parameters. Standardisation offers a different approach from legislation and can be an alternative or complementary. A legal framework as demonstrated by the Ecodesign regime[56] can incorporate a series of voluntarily agreed standards thereby keeping legislation oriented towards performance and under a process of swift and straightforward review to keep abreast of technical developments. Usually a five year review period is in place for reviewing standards and this can involve a review of the environmental impacts of a product.

There are a growing number of European standards, for example, with CEN having in the region of 7000 European standards and they cover a range of issues such as product design, energy efficiency, end-of-life and other processes. Measuring environmental impacts is a growing area of CEN and other standards. The New Approach directives introduced in 1985,[57] and the New Legislative Framework introduced in 2008[58] have also seen the growth of standards adopted on a voluntary basis which can then be used as evidence of compliance with the legislative requirements. Product standards represent a very significant part of European standards covering areas such as safety and compatibility with other components. The potential for developing environmental standards is great with the possibility presented of reducing environmental impacts, reducing energy use and so on. Life cycle approaches are also coming to the forefront where standards are integrating environmental aspects into the design stage and are underpinning Ecodesign approaches.

54 Communication from the Commission, 'A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development', COM (2001) 264 final.

55 Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products.

56 The Ecodesign Directive is a framework directive. Under Article 16(1), Working Plans form part of the process by rolling out the standardisation requirements to more product groups. Following the Communication from the Commission to the Council and the European Parliament, 'Establishment of the working plan for 2009 – 2011 under the Ecodesign Directive', (COM (2008) 0660), two further Working Plans have been developed: Commission Staff Working Document, Establishment of the Working Plan under the Ecodesign Directive, '2012-2014 Working Plan' SW9(2012) 434 final) and the third Working Plan 2016-2019 (COM (2016) 773) issued on 30 November 2016.

57 European Committee for Standardisation, 'New Approach and Other Directives', available at <https://www.cen.eu/work/supportlegislation/directives/pages/default.aspx> accessed 5 July 2019.

58 European Commission, 'New Legislative Framework', available at <https://ec.europa.eu/growth/single-market/goods/new-legislative-framework_en> accessed 5 July 2019.

The advantage of using the European approach is that expertise on environmental impacts can be easily incorporated as part of the process which has become highly specialised, systemised and expert. For example, CEN has standardised a test method for potassium content which can be used for sludge, biowaste or soil. This not only works as a test which is acceptable across a number of industries but also aids market development by removing uncertainty – industry may rely on results based on this standardised testing approach. They have a basis for differentiating between products or services which are or are not based on such standardised processes. Environmental technologies in the field of energy use, for example, can also be differentiated based on standardised approaches to their testing and measurement.[59] As a verification tool, standardization can be immensely useful to industry and can achieve significant environmental benefits without much outlay where the standardised methods have been developed with the objective of minimising environmental impacts.

In addition to technical and scientific expertise, the standardisation process has the facility to incorporate other users of the products so consumer interests can be represented as well as political and other interest groups.[60] The European Environmental Citizens Organisation for Standardisation (ECOS) has been set up which is a consortium of environmental organisations. It is mandated to build membership of NGOs involved in the standardisation process and to establish a network and technical work programme and undertake training of experts to build expertise in environmental impacts of standardisation. This broad range of interests helps to ensure public acceptability of the standard and the product or service, which incorporates it. However, it is important that lack of resources, both in terms of time and finance does not limit such involvement – the standardisation process is expensive.[61]

The development of standards, which incorporate environmental concerns, does depend on the availability of expertise and awareness of these matters. The complementary use of standards and legislation is therefore the most effective process for developing such environmentally aware standards. The legislation imposes the requirement to establish a standard requiring certain environmental parameters to be agreed and the standard, agreed through the voluntary process chaperoned by the standardisation body fills in the detail. This provides an interesting mix between regulatory and voluntary approaches and can be seen at work in the Ecodesign regime, which is considered further in section 6.

6 THE EU LEGISLATIVE FRAMEWORK FOR THE ECODESIGN OF PRODUCTS

The Integrated Product Policy Green and White Papers and the subsequent studies and research were eventually followed by the implementation in 2005 of the first framework directive[62] - Directive 2005/32/EC on the eco-design of Energy-using Products. This directive was a first step in the implementation of Integrated Product Policy and sought to improve the environmental impacts of energy-using products by adopting a lifecycle approach at the inception stage of a product. Part of the single market approach, it adopted criteria for energy-using products applicable at member state level. A promising start to the adoption of an Integrated Product Policy, it was replaced in 2009 by the Ecodesign Directive,[63] which extended the remit of the original directive beyond energy-using products to 'any goods having an impact on energy consumption during use'. The Ecodesign Directive is now part of a catalogue of legal instruments

59 Communication from the Commission to the Council and the European Parliament, 'Stimulating Technologies for Sustainable Development: An Environmental Technologies Action Plan for the European Union', COM (2004) 38 final.

60 'Service Contract for the Integration of Environmental Requirements in the European Standardisation Process', OJ 2002/S 173-137828.

61 Report of 13 May 1998 from the Commission to the Council and the European Parliament, 'Efficiency and Accountability in European Standardisation under the New Approach', COM (1998) 291 final, 11.

62 Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of eco-design requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council.

63 Directive 2009/125/EC (n 55).

covering ecolabelling,[64] energy performance of buildings,[65] waste,[66] and environmental management and auditing.[67] These deal with whole life rather than end of life such as the extended producer laws on packaging,[68] waste from electrical and electronic equipment, end of life vehicles,[69] batteries,[70] and restriction on hazardous substances.[71]

7 APPLYING THE *CODEX RERUM* TO PLASTICS

The focus and context of this article is the particular and difficult problem of pollution of the environment by plastics waste whether as a result of fugitive emissions or at the end of life. In themselves, plastic products tend not to be an environmental problem – their resource base is not an exploitative use of rare raw materials and their production is not more or less environmentally damaging than any other process. The problem is, as described in the introduction, one relating to their discarding whether at end of life or during usage as fugitive emissions. It is unlikely, given their growth since initial development, that it will be possible to remove plastics from the economy despite the various bans that can be identified across the world.[72] The ultimate objective must be to prevent plastics leaking into the environment as waste. This is where Product Impact Assessment becomes a useful tool applying to all products including plastics. Applying a life cycle approach to a product will involve an examination of its use of plastics – whether plastics are the material used for a component or the whole product. Product Impact Assessment will operate on the final product but it will encompass its constituent parts. So, it might identify that certain components which are likely to leak as fugitive emissions should be replaced by other less environmentally damaging parts made, for instance, from different materials or from different types of plastics. Recognising different types of plastics during this regulatory phase is key to Product Impact Assessment control and that, as with many regulatory interventions, may lead to the promotion of innovative approaches as well as to new types of plastics. Further, the life cycle approach embedded in Product Impact Assessment will require end-of-life solutions to be explicit in the design of products so reuse and recyclability will be dominant drivers in Product Impact Assessment approvals. Moves to ban single-use plastics are now being seen worldwide so it is less likely that Product Impact Assessment will be needed to achieve control of such items (although their replacement by other single-use items made from other materials may long remain an area necessary for Product Impact Assessment in order to achieve a transformation from linear to circular economy models beyond the immediate plastic problem).

As described above, Product Impact Assessment would apply initially to new products with existing

64 Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products; and Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel. See on the topic of ecolabelling, Mauro Cordella et al, 'Improving Material Efficiency in the Life Cycle of Products: A Review of EU Ecolabel Criteria' [2019] The International Journal of Life Cycle Assessment 1-15.

65 Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings.

66 The Waste Framework Directive (n 14).

67 Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC.

68 Directive (EU) 2018/852 of the European Parliament and of the Council of 30 May 2018 amending Directive 94/62/EC on packaging and packaging waste.

69 Directive 2000/53/EC (n 16).

70 Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC.

71 Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

72 Kenya, for example, along with other African countries such as Rwanda and Tanzania, introduced on 28 August 2017 a ban on anyone producing, selling or possessing a plastic bag subject to a penalty of up to four years' imprisonment or a fine of $40,000.

products drawn in over a lengthy transitional period.[73] So, the approach which will focus on regulation of the end product emerging from the design stage will not immediately impact on the current wide range of plastic products; nor will it deal with the current problem of marine plastic waste which will require simple clean-up approaches driven by regulation and agreement on the international stage. But what it will do is subject to life cycle controls all new products entering the market so the new models will be impacted. Given the way in which the market is dominated by novelty and innovation, this is likely to have a swifter impact than might, at first, be expected.

8 CONCLUSION

In achieving a rearrangement of our systems, at the heart of a holistic environmental product policy based on life cycle thinking and a new model law dealing horizontally with products (a law for things or *codex rerum*) must be the imperative to shift the nature of the market from one based on a linear production model with its mantra of 'GDP growth' to a system where resources move round a loop with the holy grail of generating zero waste in the process. The laws of thermodynamics may prevent a completely closed loop zero waste economy[74] but the aim of the *codex rerum* is twofold: to minimise waste as far as possible; and, to avoid the use and exploitation of virgin resources by extending product life and circling products round a loop in which they are recycled, remanufactured or otherwise renewed. The codex must seek to ensure that materials including plastics are reused, building in innovation such as technological advances in the nature of plastics as part of the whole life loop with the necessary incentives. In relation to plastics, an environmental product policy would require a Product Impact Assessment of products which utilise plastics in their manufacture. Standardisation of this process would require that no fugitive emissions of plastics waste occur during the use phase and that all recovery systems are triggered to recover and reuse such plastic as is left at the end of the lifecycle of the particular product.

The key characteristics of the *codex rerum* would be that it would be based on a licensing approach which adopts a style of regulation which is both reflective and 'command and control'. The licence to manufacture and market the product would only be granted once the process of a Product Impact Assessment had been completed and approved. The process of approval would rest upon the Product Impact Assessment and the extent to which the regulatory body considers that it has satisfactorily ensured that the product and its embedded energy will be renewed or otherwise remanufactured and circulated without the use of virgin resources or the generation of waste as far as reasonably practicable. This procedural stage would enable the reflective process to be fully engaged and stakeholders including citizen groups and industry representatives would be fully involved. This Product Impact Assessment would be based on a life cycle approach which would require technical development by the relevant regulatory body. The development of this life cycle approach underpinning the Product Impact Assessment would involve technical criteria and scientific committees. So, the procedural nature of the *codex rerum* would involve: development of the product; application for licence; Product Impact Assessment (undertaken by regulatory body with Stakeholders' and Scientific / Technical Committees); issuing of licence (with or without conditions) dependent on satisfactory outcome of Product Impact Assessment; marketing of product; and, finally monitoring.

As discussed above, if the problem is the failure to deal with waste generated from plastic products then regulation is required. It is the product which must be regulated before its production. This approach is coupled with, and integral to, the drive towards a circular economy. The linear process of control stems from the Victorian era of the industrial revolution in the UK and Europe where the immediate necessity was to control the external impacts of production processes and to make towns and cities better places to live and work as well as to ensure the health and safety of workers in the factories. So, inspectorates focusing on health and safety and atmospheric controls were

73 See Part 4 of this article.

74 Roland Clift and Julian Allwood, 'Rethinking the Economy' (2011) 837 TCE: The Chemical Engineer 30.

established. More basic than our current attention to smart and sustainable cities this was about fundamental public health concerns and the need to have a healthy and live workforce.[75] As a result, the product was not the centre of concern – rather the production process including the extraction of materials was - the classic linear model of control. The product, once out on the market, was largely unregulated.[76] One answer to our current problems related to plastics waste caused by insatiable consumption is to regulate the product not just for single-use plastics or fugitive emissions but for all aspects of its impact on the environment.

The proposal is, therefore, for a new paradigm for the regulation of the environment described here as a new law for things and of things - a *codex rerum* - a law which is concerned with sustainable consumption and production and which only permits the marketing of sustainable products which have been licensed following a Product Impact Assessment.

Equally, it is clear, that there is not a one-stop solution based on regulation or other approaches. Market instruments have their role to play, but regulation is absolutely essential to a framework of tools - not as one of the tools - but to make the other tools work. Regulation needs to be primary with other instruments available to complement it. Regulation needs to start with government policy and a government determination to achieve a framework in which environmental measures are seen as an integral and indispensable part of the economy in order to advance technological development and generate a thriving market for such developments.[77] Environmentally focussed policies have failed in themselves to achieve wholesale environmental behavioural change and the market has failed in achieving material change in the nature of products. Where there is such market failure in achieving green products, other mechanisms must be sought and regulation must be the primary driver.

The current UK government and the EU have responded to the attention being given to the problem of plastics waste.[78] What is now essential is a meeting of minds between government and its policy makers, the manufacturers and the regulators. So, the next step is to establish a clear mandate for regulatory bodies to be able to regulate and enforce the *codex rerum* so that they are free to make appropriate judgments. Current proposals to reduce the environmental impact of plastics need to be followed up with a clear regulatory response based on a new paradigm for the regulation of products.

75 Rosalind Malcolm and John Pointing, 'Statutory Nuisance: The Sanitary Paradigm and Judicial Conservatism' (2006) 18/1 Journal of Environmental Law 37-54. See also Karl Marx, 'The State of British Manufacturing Industry' *New-York Daily Tribune*, No. 6016 (London, 6 August 1860) in *Marx and Engels Collected Works* (Vol 17, Progress Publishers 1980).

76 Rosalind Malcolm, 'Ecodesign Laws and the Environmental Impact of our Consumption of Products' (2011) 23/3 Journal of Environmental Law 487-503.

77 Tonner and Malcolm (n 17).

78 See Introduction.

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