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**Waste prevention through product ecodesign regulation in Brazilian and
European environmental law**

Doctoral dissertation

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European environmental law**

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ABSTRACT

Tasso Alexandre Richetti Pires Cipriano. Waste prevention through product ecodesign regulation in Brazilian and European environmental law. 241p. Doctorate – Faculty of Law, University of São Paulo, and Faculty of Law, University of Bremen, 2017.

The present study deals with the issue of waste prevention in Brazilian and European environmental law. Prevention, understood as the taking of action before a problem arises, is unquestionably the cornerstone of environmental law. In waste law, this is no different. Yet, much as the best waste is repeatedly described as being that which is never produced, it is a commonplace both in theory and in practice of environmental law that waste prevention still remains wishful thinking. The focus of this dissertation lies on quantitative (as opposed to qualitative) prevention of waste materials (i.e. matter as opposed to energy) by improving the ecodesign of the products. By drawing on the relationship between law and economics to explain the insufficiency of the traditional approach to the environmental and waste problems, an alternative theoretical framework providing a more adequate account of, and effective solutions to, those problems is searched for. At the centre of such a framework are the contribution of ecological economics and the adoption of the so-called integrated (i.e. metabolic and life cycle) perspective in environmental regulation. Based on this theoretical reconstruction, a comparative and dogmatic legal analysis of Brazilian and European waste as well as product-related environmental law is performed. After the functions of waste law and the very legal concept of waste are revisited in light of the so-called integrated waste management paradigm, waste prevention is defined by changes in the production and consumption of products so that fewer materials (i.e. resources) are consumed. Improvements in product ecodesign are instrumental in bringing about such changes and they are best addressed by product-related regulation. A few attempts to regulate the ecodesign of products are found in the European setting, from which Brazilian environmental law could learn.

Keywords: Environmental law. Waste law. Waste prevention. Product regulation. Ecodesign. Brazil. European Union.

RESUMO

Tasso Alexandre Richetti Pires Cipriano. Prevenção de resíduos por meio da regulação do ecodesign dos produtos no direito ambiental brasileiro e europeu. 241p. Doutorado – Faculdade de Direito, Universidade de São Paulo, e Faculdade de Direito, Universidade de Bremen, 2017.

O presente estudo trata da prevenção de resíduos no direito ambiental brasileiro e europeu. Prevenção, entendida como a tomada de ação antes do surgimento de um problema, é inquestionavelmente a pedra angular do direito ambiental. No direito dos resíduos, isso não é diferente. No entanto, por mais que se repita ser o melhor resíduo aquele que nunca é gerado, é um lugar comum tanto da teoria como da prática do direito ambiental o fato de a prevenção de resíduos ainda ser uma utopia. O foco do presente trabalho é a prevenção quantitativa (em contraposição à qualitativa) de materiais (portanto, de matéria, em contraposição a energia) residuais por meio de melhorias no ecodesign dos produtos. Recorrendo à relação entre direito e economia para explicar a insuficiência da abordagem tradicional dos problemas ambientais e dos resíduos, busca-se um arcabouço teórico alternativo a fornecer uma explicação mais adequada e soluções mais efetivas para esses problemas. No centro desse arcabouço estão a contribuição da economia ecológica e a adoção da chamada perspectiva integrada (isto é, metabólica e de ciclo de vida) na regulação ambiental. Com base nessa reconstrução teórica, procede-se a uma análise jurídica dogmática e comparada do direito dos resíduos e do direito ambiental dos produtos brasileiro e europeu. Após uma revisitação das funções do direito dos resíduos e do próprio conceito de resíduos à luz do paradigma da chamada gestão integrada de resíduos, a prevenção de resíduos é definida em função das mudanças na produção e no consumo de produtos de modo a diminuir o consumo de materiais (ou seja, recursos). Melhorias no ecodesign dos produtos conduzem a tais mudanças e elas são melhor endereçadas por uma regulação de produtos. Algumas tentativas de regular o ecodesign dos produtos são encontradas no contexto europeu, com as quais o direito ambiental brasileiro poderia aprender.

Palavras-chave: Direito ambiental. Direito dos resíduos. Prevenção de resíduos. Regulação de produto. Ecodesign. Brasil. União Europeia.

ZUSAMMENFASSUNG

Tasso Alexandre Richetti Pires Cipriano. Abfallvermeidung durch die Regulierung des Ökodesigns von Produkten im brasilianischen und europäischen Recht. 241S. Promotion – Juristische Fakultät, Universität São Paulo, und Fachbereich Rechtswissenschaften, Universität Bremen, 2017.

Die vorliegende Arbeit befasst sich mit der Frage der Abfallvermeidung im brasilianischen und europäischen Umweltrecht. Prävention, verstanden als Maßnahmen, die dem Entstehen eines Problems vorbeugen, ist zweifellos der Grundstein des Umweltrechts. Im Abfallrecht ist dies nicht anders. Auch wenn stets jener als der bester Abfall bezeichnet wird, der gar nicht erst produziert wird, ist es in der umweltrechtlichen Theorie und Praxis eine Binsenweisheit, dass Abfallvermeidung nach wie vor Wunschdenken bleibt. Der Schwerpunkt dieser Dissertation liegt auf der quantitativen (im Gegensatz zur qualitativen) Vermeidung von Abfallstoffen (d.h. Materie im Gegensatz zu Energie) durch die Verbesserung des Ökodesigns von Produkten. Die Arbeit untersucht die Beziehung zwischen Recht und Ökonomie, um die Unzulänglichkeiten des traditionellen Ansatzes zur Lösung von Umwelt- und Abfallproblemen zu erklären und einen alternativen theoretischen Rahmen zu entwickeln, der eine angemessenere Berücksichtigung dieser Probleme sowie wirksame Lösungsansätze ermöglicht. Im Mittelpunkt eines solchen theoretischen Rahmens stehen der Beitrag der ökologischen Ökonomie und der sogenannte integrierte (d.h. metabolische und lebenszyklusbezogene) Ansatz zur Umweltregulierung. Auf der Grundlage dieser theoretischen Rekonstruktion wird eine vergleichende und dogmatische Analyse des brasilianischen und europäischen Abfallrechts sowie des produktbezogenen Umweltrechts durchgeführt. Nachdem die Funktionen des Abfallrechts sowie des rechtlichen Abfallbegriffes im Lichte des sogenannten integrierten Abfallwirtschaftsparadigmas erneut überdacht werden, wird Abfallvermeidung als jene Veränderungen in der Produktion und dem Verbrauch von Produkten definiert, die den Verbrauch von Materialien (d.h. Ressourcen) verringert, definiert. Verbesserungen im Ökodesign von Produkten tragen maßgeblich dazu bei, solche Veränderungen herbeizuführen. Sie werden am besten durch eine produktbezogene Regulierung vorgenommen. Im europäischen produktbezogenen Umweltrecht finden sich Beispiele für

die Regulierung des Ökodesigns von Produkten, von denen das brasilianische Umweltrecht lernen könnte.

Stichwörter: Umweltrecht. Abfallrecht. Abfallvermeidung. Produktregulierung. Ökodesign. Brasilien. Europäische Union.

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To you all, my heartfelt and affectionate *thanks!*

LIST OF ABBREVIATIONS

AbfallR	<i>Zeitschrift für das Recht der Abfallwirtschaft</i>
ADIn	<i>ação direta de inconstitucionalidade</i>
ANEC	European Association for the Coordination of Consumer Representation in Standardisation
BGBI.	<i>Bundesgesetzblatt</i>
BMU	<i>Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit</i>
CEDOUA	<i>Centro de Estudos de Direito do Ordenamento, do Urbanismo e do Ambiente</i>
CEN	<i>Comité Européen de Normalisation</i>
Conama	<i>Conselho Nacional do Meio Ambiente</i>
cont.	continuation
Des.	<i>Desembargador(a)</i>
DfE	design for environment
DOU	<i>Diário Oficial da União</i>
DVBl.	<i>Deutsches Verwaltungsblatt</i>
EABS	European Association for Bioeconomic Studies
EAP	Environmental Action Programme
ECOS	European Environmental Citizens Organisation for Standardisation
ECR	European Court Reports
EEA	European Economic Area
EEB	European Environmental Bureau
EEE	electrical and electronic equipment
EIA	environmental impact assessment
elni	Environmental Law Network International
EN	European norm (standards)
ETSI	European Telecommunications Standards Institute
EU	European Union
EUI	European University Institute
EurUP	<i>Zeitschrift für Europäisches Umwelt- und Planungsrecht</i>
IEEP	Institute for European Environmental Policy
inpEV	<i>Instituto Nacional de Processamento de Embalagens Vazias</i>

IPTS	Institute for Prospective Technological Studies
IWM	integrated waste management
JEEPL	Journal of European Environmental & Planning Law
JEL	Journal of Environmental Law
JIE	Journal of Industrial Ecology
JRC	Joint Research Centre
ISO	International Organisation for Standardization
LCA	life cycle assessment
LCI	life cycle inventory assessment
LCIA	life cycle impact assessment
MCT	<i>Ministério da Ciência, Tecnologia, das Inovações e Comunicações</i>
MDIC	<i>Ministério da Indústria, do Comércio Exterior e dos Serviços</i>
MEErP	methodology for the ecodesign of energy-related products
Min.	<i>Ministro(a)</i>
MME	<i>Ministério de Minas e Energia</i>
n.d.	no date
No.	number
n.p.	no place or no publisher
NVwZ	<i>Neue Zeitschrift für Verwaltungsrecht</i>
OECD	Organisation for Economic Co-operation and Development
OJ	Official Journal of the European Union
OwiG	<i>Gesetz über Ordnungswidrigkeiten</i>
p.	page
POPs	persistent organic pollutants
PNRS	<i>Política Nacional de Resíduos Sólidos</i>
PRO	producer responsibility organisation
RE	<i>recurso extraordinário</i>
rel.	<i>relator(a)</i>
RECIEL	Review of European Community & International Environmental Law
Rn.	<i>Randnummer</i>
RoHS	restriction of (the use of certain) hazardous substances
SETAC	Society of Environmental Toxicology and Chemistry
STF	<i>Supremo Tribunal Federal</i>
STJ	<i>Superior Tribunal de Justiça</i>

TEC	Treaty establishing the European Community
TEU	Treaty on the European Union
TFEU	Treaty on the Functioning of the European Union
TJPR	<i>Tribunal de Justiça do Estado do Paraná</i>
UBA	<i>Umweltbundesamt</i>
UNEP	United Nations Environment Programme
UPR	<i>Umwelt- und Planungsrecht</i>
U.S.	United States of America
vol.	volume
WEEE	waste electrical and electronic equipment
WFD	Waste Framework Directive
ZAU	<i>Zeitschrift für angewandte Umweltforschung</i>
ZfU	<i>Zeitschrift für Umweltpolitik & Umweltrecht</i>
ZUR	<i>Zeitschrift für Umweltrecht</i>

TABLE OF CONTENTS

ABSTRACT	5
RESUMO	6
ZUSAMMENFASSUNG.....	7
ACKNOWLEDGEMENTS.....	9
LIST OF ABBREVIATIONS.....	11
TABLE OF CONTENTS	14
INTRODUCTION.....	16
Chapter One – The traditional economic-legal approach to the environmental and waste problems	20
A. The economic-legal approach.....	20
B. Environmental economics	24
C. The legal parallel: managerial, single-point, pollution-oriented, production-related environmental law	29
D. The insufficiency of the traditional approach.....	32
E. Summary	33
Chapter 2 – Theoretical reconstruction: sustainable development and its legal implementation	36
A. Sustainable development in context	36
B. Sustainable development in environmental-economic theory	40
C. Sustainable development in ecological-economic theory and the contribution of Nicholas Georgescu-Roegen: ‘matter matters’	42
D. The ‘ecologisation’ of environmental law and its methodological corollaries	52
E. Summary	57
Chapter Three – Integrated waste management as the protagonist of integrated environmental law	60
A. Integrated waste management	60
B. The functions of waste law: a dichotomy	68
C. Waste: a legal creation.....	72
D. Waste prevention through product eco-design	84
E. Indirect product design intervention: extended producer responsibility (EPR).....	94
I. EPR as incentive-based environmental policy: origins and rationale.....	95
II. Products covered by EPR	98
III. What does EPR stand for?.....	100
1. <i>Extended</i> producer responsibility	100
2. <i>Extended producer</i> responsibility	105
a) Who is the producer?.....	105
b) Producer, product or shared responsibility?.....	110
3. <i>Extended producer responsibility</i>	112
a) Physical responsibility.....	116
aa) Physical responsibility in the EU	117

bb) Physical responsibility in Brazil	120
cc) Targets	122
b) Financial (and economic) responsibility	124
aa) Financial responsibility in the EU	124
bb) Financial responsibility in Brazil	126
c) Informational responsibility	130
IV. Conjugating physical and financial responsibility	132
V. Implementing EPR: individual versus collective responsibility	137
F. Summary	144
Chapter 4 – selected examples of direct ecodesign regulation in Product-oriented environmental law	148
A. Direct ecodesign regulation in European and Brazilian EPR legislation	148
B. The European Ecodesign Directive	156
I. Descriptive overview of the Ecodesign Directive	156
II. Discussion on the much-lauded potential of the Ecodesign Directive: the ‘Super Directive’?	164
1. Standard setting and regulatory unambitiousness: impetus to eco-innovation?	164
2. From energy efficiency to non-energy environmental aspects	168
a) Ecodesign performance requirements	169
aa) Implementing measures	169
bb) Self-regulatory measures	171
b) Ecodesign information requirements	172
aa) Implementing measures	172
bb) Self-regulatory measures	183
c) Appraisal	184
3. Methodological challenges	187
4. Regulatory context and legislative coordination: fine-tuning environmental legislation or simply shifting the burden?	189
5. Scope expansion	192
6. Room for national ecodesign requirements?	193
7. Concluding remarks on the Ecodesign Directive	202
C. Excursus: the case of mobile phone chargers in the EU	203
D. Summary	206
CONCLUSION (THESES)	209
LIST OF REFERENCES	216

INTRODUCTION

The present study deals with the issue of waste prevention from a legal perspective.

Prevention, understood as the taking of action before a problem arises, is unquestionably the cornerstone of environmental law. In waste law, this is no different. Prevention emerges as the preferred solution to the problematic of waste as soon as waste ceases to be seen exclusively as – firstly – a sanitary and – secondly – pollution issue, thus having to be eliminated (i.e. disposed of),¹ and starts to be regarded as being a symptom of a larger problem, namely the depletion of resources resulting from ever-increasing production and consumption patterns.²

Much as the best waste is repeatedly described as being that which is never produced, and much as this is reflected in the so-called waste hierarchy³ adopted by waste law in most nations worldwide, it is a commonplace both in theory and in practice of environmental law that waste prevention still remains wishful thinking.

In Brazil, this is arguably attributable to the relative novelty of waste law, as illustrated by the enactment of Federal Law No. 12,305 establishing the so-called National Solid Waste Policy only in August 2010. This statute has been strongly inspired by waste law of the European Union, which now enjoys over four decades of existence and whose protagonism is widely well known. A decision has thus been made to look at and compare both Brazilian and European environmental law as regards waste prevention with a view to finding out whether and to which extent Brazilian law should look up to European law.

European efforts to foster waste prevention are found not only in waste law but also and especially in product-related environmental law. Product regulation is of the essence of the European Union (EU) for the obvious reason of establishing and ensuring the functioning of the integrated internal market. Environmental concerns motivate European product regulation indeed, but whether it effectively handles waste prevention is questionable.

The main research questions may be then enunciated as follows: what is waste prevention and how is it to be achieved in the wider context of environmental law? Are

¹ See chapter 1, section C, *infra*.

² See chapters 2 and 3, *infra*.

³ See chapter 3, section A, *infra*.

Brazilian and EU environmental law (really) concerned about waste prevention? What lessons can Brazilian environmental law learn from European environmental law, if any?

Answers to these questions are sought based on a legal-economic approach to environmental problems. The approach is economic in that legal analysis feeds on the knowledge provided by economics,⁴ which is not surprising given that environmental law is by definition economic law.⁵ Besides, interdisciplinarity, of which the dialogue between law and economics engaged in by this dissertation is an example, is fundamental for a better comprehension and tackling of environmental problems. This is particularly true when finding answers to the first research question ('what is waste law and how is it to be achieved in the wider context of environmental law?'), as shall be seen in different parts of this work.

The legal approach consists in a comparative dogmatic analysis of Brazilian as well as European positive and case law plus a review of the relevant legal literature. Much as comparison is made between Brazilian and EU law, analysis rests heavily on legal commentary made by German scholars on both EU and (mainly) German waste law. Reasons are threefold. Firstly, German waste law is widely known to have shaped EU waste law. Secondly, to my knowledge, including the fact that I do not know all the official languages of the EU, legal scholarship on waste law has been most developed in Germany. Thirdly and lastly, the present dissertation is part of a *cotutelle* doctoral study involving a German university, so that it is directed primarily, albeit not exclusively, at a German audience. Be the case as it may, the proposed comparative-dogmatic legal analysis is instrumental in seeking answers to the second and third research questions. Particularly in relation to the second question ('are Brazilian and European environmental law (really) concerned with waste law?'), the hypothesis provides a negative answer as concerns Brazil and a positive answer as concerns the EU.

This study concentrates on consumer waste as opposed to production waste, that is, waste arising from the use of (end) products instead of that resulting from production activities. The choice to focus on consumer waste is explained by the fact that environmental law has traditionally paid more attention to the latter than to the former activities,⁶ and the operational conceptualisation of waste⁷ corroborates this finding.

⁴ See chapter 2, section A, *infra*.

⁵ See Nusdeo, 2010 and 1975. Similarly, see Robbers, 2006, p. 120.

⁶ See chapter 1, section C, *infra*.

⁷ See chapter 3, section C, *infra*.

Prevention of waste shall refer to preventing the squandering of materials as opposed to that of energy. In physical terms, this means that attention is directed at matter as opposed to energy. Much as energy aspects play a central, if not superordinate, role in environmental protection,⁸ it constitutes a topic that is alien to, and therefore usually examined separately from, that of waste law.

A distinction must be made between quantitative and qualitative waste prevention.⁹ Whilst the former is about reducing the amount of materials becoming waste, the latter deals with the reduction of their hazardousness. Qualitative aspects are much more familiar to, and have thus far been more frequently and satisfactorily addressed by, environmental law, also because hazardousness concerns connect more directly with human health protection issues. This is true in relation to both production-related, pollution-oriented environmental law¹⁰ and product-related law¹¹. Environmental law hesitates to make use of quantitative regulations,¹² which is explained in part by the fact that they do not fit in the liberal mould of the traditional economic approach.¹³ Quantitative prevention lies at the centre of the present study because it is less explored than qualitative prevention.

As for the addressees of waste prevention law (i.e. stakeholders), and based on the *summa divisio* between production and consumption that marks both legal and economic systems of our industrialised society, it is the decisions made by producers as to the design of the products they place on the market that the investigation conducted herein proposes to address. A model for identifying producer decisions in the context of waste prevention strategies as well as the reasons for concentrating on them are elaborated on in chapter 3, sections D and E.I, *infra*.

Being so delimited, this dissertation is composed of four parts.

Chapter 1 explores how economics and law have traditionally dealt with environmental problems in general and the waste problem in particular. It provides a description of the main features of the conventional economic and legal approaches individually while drawing attention to the parallels existing between them, including as regards their insufficiency.

⁸ See chapter 2, section C, *infra*.

⁹ See chapter 3, section D, *infra*.

¹⁰ See chapter 1, section C, *infra*.

¹¹ See chapter 3, section D, *infra*.

¹² See chapter 3, sections D and E, as well as chapter 4, sections A and B, *infra*.

¹³ As expressly noted in chapter 2, section C, *infra*.

In light of this inadequacy, chapter 2 looks at alternative, unorthodox theoretical references providing a more comprehensive account of environmental and the waste problems. Such theories are situated in the context of the debate on sustainable development, which, in turn, is also contextualised. Special attention is turned to ecological economics and the seminal contribution of economist NICHOLAS GEORGESCU-ROEEN. Chapter 2 keeps up with the interdisciplinary dialogue between law and economics engaged in chapter 1 by building on the analogies that ecological economics makes between the ecological and economic systems in order to draw parallels to environmental law in general and overcome the shortcomings of the traditional legal approach.

Chapter 3 bridges the theoretically reconstructed economic-legal approach to the environmental and waste problems with the more practical, comparative and dogmatic legal analysis of Brazilian and European environmental law in connection with waste prevention. It does so by examining waste law of both legal orders thoroughly. In light of the concept of integrated waste management, central issues in waste law such as waste hierarchy, the functions of waste law, the legal concept of waste as well as the notion and legal operationalisation of waste prevention are discussed by analysing the relevant legislation, case law and legal commentary. The chapter ends with an in-depth examination of the main instrument provided by waste law to promote waste prevention, namely extended producer responsibility (EPR).

Chapter 4 looks at waste prevention beyond waste legislation. Based on the findings of the preceding chapter that waste prevention is best grasped and operationalised by changes into the production and consumption of products, its three instruments of product-related environmental law are scrutinised. The first one concerns the product ecodesign mandates found in Brazilian and European end-of-life (i.e. EPR) legislation. The second and third instruments are exclusive to the European setting. They are, respectively, the Ecodesign Directive and the regulation of mobile phone chargers.

The study concludes with the enunciation of the main theses in a summary-like fashion and the ensuing identification of needs for future research.

CONCLUSION (THESES)

The purpose of the present dissertation has been to study both Brazilian and European environmental law in connection with waste prevention. The study has been based, on the one hand, on a dialogue between law and economics considering not only the intrinsic relationship between the two disciplines in the context of environmental policy but also that interdisciplinarity is essential for the comprehension and tackling of environmental problems. The economic-legal approach has been instrumental in finding an answer to the research question of waste prevention means and how it is to be achieved in the wider context of environmental law. On the other hand, the study has consisted in a comparative dogmatic legal analysis of both Brazilian and European environmental as well as waste law with the aim of answering the research question of whether these legal orders adequately address the issue of waste prevention. The initial hypothesis has answered this latter question negatively in relation to Brazil and positively in relation to the European Union (EU). Analysis has confirmed the initial hypothesis in relation to Brazil but negated it in relation to the EU.

The overall conclusion of this study is that Brazilian environmental law does not currently address the issue of waste prevention at all, reason for which it should look up to the initiatives taken by European environmental law, even if it does not wholly address the issue. This neglect has to do less with the relative novelty of Brazilian waste law than with the fact that material and product-related environmental law in Brazil is still to be developed. For (quantitative) waste prevention, which is best understood by changes to the production and consumption of products throughout the economic circuit with a view to reducing the overall use of materials, requires coherent material and product-related legislation dealing with the life cycle environmental impacts of specific materials and products on a case-by-case basis.

Waste prevention is not yet an everyday reality in the EU either. Despite its protagonism in the regulation of waste, European environmental law still does not tackle consumer waste prevention adequately enough, at least concerning the quantitative prevention of materials. Products and resource-related environmental concerns are high on the political agenda of the EU, but this is not reflected, or at least not fully crystallised, into environmental legislation. Much as end-of-life legislation is an attempt to, and the

Ecodesign Directive has paved the way for, a life cycle tackling of all environmental aspects of products, there is still much to do.

Brazil should pass a framework statute on the environmental impacts of products in general, one enabling the imposition of duties on producers and its suppliers of concrete products, for example on the basis of life cycle assessments. By the same token, the EU should take advantage of the experience gained by the Ecodesign Directive and, based on already existing proposals to improvements to the MEERp, expand the scope of the Ecodesign Directive to all products. The setting of reuse targets in the context of EPR could be an interesting complementary strategy. This should constitute a sensible step towards to implement sustainable development as recommended by ecological economists.

That being said, the theses of the present study are enunciated below:

Theses in relation to chapter 1 ('The traditional economic-legal approach to the environmental and waste problems')

A. There is a clear parallel between the traditional economic and legal approaches to the environmental problem in general and the waste problem in particular. Environmental law has been informed as well as has served as a means to implement the environmental protection measures proposed by economics.

B. Environmental economics, which is the branch of neoclassical economics dealing with environmental issues, corresponds to the traditional economic approach.

C. The traditional legal approach consists in a managerial (i.e. end-of-pipe), single-point, pollution-oriented, production-related regulation of environmental problems.

D. Both traditional economic and legal approaches provide an insufficient account of, and inadequate solutions to, environmental problems, including the waste problem. The insufficiency lies fundamentally in the methodological split that marks both approaches: environmental problems are addressed and treated separately and differently depending on whether they affect the environment in its source or sink function. The waste problem puts this division at stake because it is both a pollution *and* resource problem.

Theses in relation to chapter 2 ('Theoretical reconstruction: sustainable development and its legal implementation')

A. Responses to the insufficiency of the traditional economic and legal approaches to the environmental and waste problems are found in the context of the debate on a sustainable development. Such a debate is originally and *par excellence* an economic one, for it builds on the discussions about economic development.

B. In environmental economics, sustainable development is treated as a matter of ensuring current and future utility and based on the admissibility of compensation between those items providing utility, including the environment. Accordingly, the environment need not be protected at all (weak sustainability), or at least not in its entirety (strong sustainability), in order for economic development to be sustainable provided that something else compensates for the (total or partial) loss of environmental resources and/or quality.

C. In contrast, ecological economics in general, and the work of economist NICHOLAS GEORGESCU-ROEGEN in particular, identifies sustainable development as a resource conservation agenda. The acknowledgement of the entropic nature of the economic process is one of GEORGESCU-ROEGEN's main contributions to economic theory, if not the central one. The entropic predicament, however pessimistic it is, pinpoints the relationship between the economic and ecological systems in general, and the limits posed by the latter on the former in particular, thereby shedding light on environmental problems and pointing to more unorthodox, courageous solutions thereto, including, but not limited to, quantitative regulations to combat resource depletion, the elimination of fashion, and the need for durable and repairable products, as put forward by the author.

D. The legal implementation of a sustainable development requires the adoption of an integrated approach to environmental law. Integration consists in combining the metabolic perspective underlying the entropic analysis provided by ecological economics with a life cycle perspective. In practical terms, this means that facility and media-related regulations typical of traditional environmental law need to be complemented by materials and product-related regulations. An approach looking at the life cycle of materials and products requires much more from jurists, including interdisciplinary dialogues with other branches of (economic) law and non-legal disciplines.

Theses in relation to chapter 3 ('Integrated waste management as the protagonist of integrated environmental law')

A. Integrated waste management, understood as the life cycle management of materials from cradle to grave, illustrates the protagonism of waste law towards an integrated environmental law, as epitomised by the waste hierarchy laid down in both EU and Brazilian waste law: unless otherwise specified by a life cycle assessment, waste management should be carried out in a predetermined order whereby waste prevention takes precedence over waste recovery, and waste recovery, in turn, takes precedence over waste disposal (*presumptio iuris tantum*).

B. Waste law is law on materials, more specifically materials following a path on which their potential to cause damage increases or by virtue of which resources are prematurely depleted. It serves a dual purpose, namely human health and environmental protection (waste law as law on harmful materials), on the one hand, and resource conservation (waste law as law on scarce materials), on the other hand. The two functions of waste law are complementary rather than conflicting.

C. Waste is a legal creation. Both the concept of waste and its associated legal regime are dispensable in a truly integrated environmental law. The more materials/substances and products are addressed by facility, media, materials/substance and/or product-related regulations, the less they need to be covered by waste law, except for when their secondary use is unknown. Since in a diversified economy this is the default situation, waste is broadly defined as 'anything that anyone destines or intends to destine or is required to destine for a purpose' and removal of the waste status occurs on an exceptional, case-by-case basis. Anyway, economic production and consumption activities should be more, and not less, regulated *vis-à-vis* their environmental impacts.

D. Waste prevention is best grasped positively, that is, by changes into the production and consumption of materials/substances and products so that fewer materials/substances and products are used (materials prevention) and therefore less waste is generated (waste prevention). Waste prevention law is by definition material and product-related environmental law, at least as regards consumer waste. Modifications may be made at different 'steps' preceding the discarding of things ('step 5') – from making products repairable, more durable and/or apt to be used collectively as well as having them repaired and used longer and collectively ('step 4') through reducing their material intensity or increasing their recycled content ('step 3') to eliminating the need for a product by

providing a service ('step 2') or eliminating the need altogether ('step 1') – and they entail concrete materials/substance and product-related duties imposed on both producers and consumers with regard to their decisions as to whether, what, how much and how to produce and consume. Decisions made by producers about the design of the products they place on the market are central to the attainment of materials and waste prevention and should therefore be regulated by law. In the EU, aspirations for an integrated product policy and a resource-efficient Europe have long been high on the political agenda but they have not been translated into coherent legislative action yet. Product-related environmental regulation in the EU occurs in a patchwork fashion and a systematic legal approach to resource protection is mostly a theoretical endeavour made by German scholars. This is not consistent with the lessons taken from ecological economics, in particular those by economist NICHOLAS GEORGESCU-ROEGEN.

E. Extended producer responsibility (EPR) may be defined as the placing on agents upstream the consumer in the economic circuit of positive duties to manage the products those agents place on the market at end of life (physical responsibility) as well as to bear the costs of said management (financial responsibility). It is a waste-related instrument aimed at incentivising producers to improve the ecodesign of their products and hence achieve materials and waste prevention. Whilst EPR (just like waste law) is a relatively recent element of Brazilian environmental law, European legislation on EPR has now over two decades of regulatory experience. In order for EPR to reach the goal of product ecodesign improvement, not only should both physical and financial responsibility be kept connected but responsibility should also take the form of individual responsibility. This means making producers responsible for their own products or making collective schemes individual-friendly. The latter option involves the introduction of mechanisms allowing the individualisation of materials and/or products managed collectively by the so-called producer responsibility organisations (PROs), including identification technologies and improved financing formulae, so that investments in ecodesign can be rewarded (through reduced fees to PROs) and laggards penalised (through increased fees to PROs). This is known as eco-modulation, which is nonetheless still in its infancy in a few Member States of the EU. Another proposal to advance materials and waste prevention through EPR is the establishment of quantitative reuse targets, but this has remained wishful thinking. Both topics merit further attention by future research.

Theses in relation to chapter 4 ('Selected examples of direct ecodesign regulation in product-oriented environmental law')

A. In parallel to EPR, both Brazilian and European end-of-life (i.e. waste) legislation contains product-related ecodesign mandates. These attempt to regulate product ecodesign in a more direct fashion as opposed to the incentive-based logic of EPR. Two types of requirements exist. The first type tackles product hazardousness. Requirements take the form of substance bans and/or restrictions with a view to preventing the release of hazardous substances into the environment and facilitating recovery, especially recycling, of products at end of life. The second type addresses quantitative rather than qualitative aspects. Requirements of this second type are more diverse and relate to either the physicochemical composition of products or their construction with a view to reducing their material intensity/increasing their recycled content or enabling reusability/recoverability, respectively. Quantitative mandates lack enforceability because, unlike hazardousness requirements, they are worded vaguely and are not accompanied by compliance mechanisms. One exception in this sense concerns recoverability/recyclability requirements for end-of-life vehicles, which are dealt with by product-related regulations establishing mechanisms for controlling the technical aspects of vehicles. This once again points to the need for more, and not less, regulation, especially quantitative ones if we are to take the recommendations of ecological economists seriously.

B. In the EU, the Ecodesign Directive is to date the central piece of product-related environmental legislation. It provides a framework for the setting out of ecodesign requirements for products by self-regulatory and/or implementing measures. In that the Ecodesign Directive establishes a comprehensive list of parameters for the adoption of self-regulatory and/or implementing measures laying down ecodesign requirements for all environmental aspects of all life cycle stages of products, it has been praised for its potential to solve all environmental problems. Yet, this potential has been underused. Not only is the scope of application of the Ecodesign Directive very restricted, a fact that is aggravated by the many substantive and procedural conditions for the adoption of measures setting down ecodesign requirements, but the statute is also focused on energy aspects during product use. Non-energy, resource-related requirements are exceptional and have been imposed for a very few products in respect of which industry standards covering the requirements introduced already existed, which reinforces the importance of the 'methodology for ecodesign of energy-related products' (MEErP) in shaping the content of

implementing measures. Hazardousness aspects aside, no ecodesign (quantitative) requirements on the material composition of products exist, which once again does not accord with the tenets of ecological economics.

C. Much as focus of this study is on ‘step 3’ (material input of products), the case of mobile chargers in the EU represents a pioneering legal attempt to address ‘step 1’ (needs) through product ecodesign regulation, albeit not a very successful one. It shows that legislation, or more precisely the threat of regulation, may push producers to improve the ecodesign of their products.

‘Cross-sectoral’ theses, including in relation to the need for further research

A truly integrated approach to environmental regulation depends on material and product-specific analyses of their life cycle environmental impacts. Integrated environmental law, including the law on integrated waste management, also known as waste prevention law, relies heavily on scientific knowledge, of which – firstly – the introduction of recoverability/recyclability targets for end-of-life vehicles, – secondly – the laying down of material consumption and durability requirements for imaging equipment and vacuum cleaners, respectively, under the Ecodesign Directive and – thirdly – the limitations of the MEErP and its reflexes in the implementing measures adopted under the Ecodesign Directive are illustrative examples. Further research is needed as to what life cycle assessment – and related environmental studies – is, how it is done and whether/how it can be used in environmental law.

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