

Table of Contents

[Cover](#)

[Table of Contents](#)

[Title Page](#)

[Copyright Page](#)

[Foreword](#)

[Introduction](#)

[Elements of definition](#)

[Purpose and structure of the book](#)

[1 The Environmental Impact of the Contemporary Economic Model](#)

[1.1. The negative effects of the economic model on the environment](#)

[1.2. A society that pollutes](#)

[1.3. A sustainable economic model?](#)

[1.4. Conclusion](#)

[2 Eco-design: Definitions and Theoretical Outlines](#)

[2.1. Eco-design: a plural concept](#)

[2.2. Technocentric eco-design: a dominant approach](#)

[2.3. The contribution of eco-design to environmental innovations](#)

[2.4. Conclusion](#)

[3 Eco-design in Companies: Practices and Decisive Actions](#)

[3.1. A systemic approach to innovation](#)

[3.2. Eco-design in socio-technical systems](#)

[3.3. Visible aspects of eco-design practices in socio-technical systems](#)

[3.4. Conclusion](#)

[4 Questions and Perspectives on Eco-design](#)

[4.1. Technocentric eco-design: an insufficient solution to the ecological transition](#)

[4.2. The contribution of eco-design to the circular economy](#)

[4.3. The solutions enabled by sustainable design in the ecological transition perspective](#)

[4.4. Perspectives](#)

[4.5. Conclusion](#)

[Conclusion](#)

[References](#)

[Index](#)

[Other titles from iSTE in Innovation, Entrepreneurship and Management](#)

[End User License Agreement](#)

List of Tables

Chapter 1

[Table 1.1. Manufacturing output per capita \(base UK 1900 = 100\) \(from Bairoch ...](#)

[Table 1.2. Global waste generation by region in 2016 \(from Silpa et al. \(2018\)...](#)

[Table 1.3. Global waste treatment by region in 2016 \(from World Bank \(2018\)\).](#)

[Table 1.4. E-waste: generation, collection and recycling by continent in 2016 ...](#)

[Table 1.5. Non-hazardous waste treatment in the European Union, 2004-2018 \(bas...](#)

[Table 1.6. Non-hazardous waste treatment in France, 2004-2018 \(based on Eurost...](#)

[Table 1.7. Origin of waste in France in 2017 \(according to ADEME \(2020b\) and o...](#)

[Table 1.8. Main air pollutants and their main sources \(from ADEME \(2020a\)\).](#)

[Table 1.9. Major air pollutants by continent per capita \(from Our World in Dat...](#)

[Table 1.10. Examples of European waste directives by the type of product](#)

Chapter 2

[Table 2.1. Eco-design tools \(from Debref \(2018\) and Bellini and Janin \(2019\)\)...](#)

[Table 2.2. Impact criteria \(from ADEME 2022a; Pôle éco-conception \(2022b\)\)...](#)

[Table 2.3. Life cycle assessment for the “Do Chair” \(from Steelcase \(2022\)\)...](#)

[Table 2.4. Definitions of the circular economy.](#)

[Table 2.5. Circular economy activities](#)

[Table 2.6. Keywords for the circular economy \(from Aurez and Georgeault \(2016a...](#)

[Table 2.7. Objectives and main characteristics of innovations related to the c...](#)

Chapter 3

[Table 3.1. Purchase of everyday consumer products with a sustainable purpose i...](#)

[Table 3.2. Networks of actors around eco-design \(from Bellini and Janin \(2019\)\)...](#)

[Table 3.3. Waste prevention actions \(from Berneman and Vernier \(2014\)\).](#)

Chapter 4

[Table 4.1. Eco-design situations \(from Abrassart and Aggeri \(2008\)\).](#)

[Table 4.2. Circular economy business models and product design](#)

List of Illustrations

Chapter 2

[Figure 2.1. Technocentric eco-design and sustainable design \(from Spangenberg ...](#)

[Figure 2.2. Typology of innovation \(from OECD 2009\)](#)

Chapter 3

[Figure 3.1. The elements of the socio-technical system \(from Geels \(2004, p. 9...](#)

[Figure 3.2. Scenario “if tomorrow we had no more steel or energy”, according t...](#)

[Figure 3.3. The vegetal city \(Guyon company\), sketches by Philippe Moine and F...](#)

Smart Innovation Set

coordinated by
Dimitri Uzunidis

Volume 42

Eco-Design and Ecological Transition

Questioning the Economic Model

Marie-France Vernier

ISTE

WILEY

First published 2023 in Great Britain and the United States by ISTE Ltd and John Wiley & Sons, Inc.

Apart from any fair dealing for the purposes of research or private study, or criticism or review, as permitted under the Copyright, Designs and Patents Act 1988, this publication may only be reproduced, stored or transmitted, in any form or by any means, with the prior permission in writing of the publishers, or in the case of reprographic reproduction in accordance with the terms and licenses issued by the CLA. Enquiries concerning reproduction outside these terms should be sent to the publishers at the undermentioned address:

ISTE Ltd
27-37 St George's Road
London SW19 4EU
UK

www.iste.co.uk

John Wiley & Sons, Inc.
111 River Street
Hoboken, NJ 07030
USA

www.wiley.com

© ISTE Ltd 2023

The rights of Marie-France Vernier to be identified as the author of this work have been asserted by her in accordance with the Copyright, Designs and Patents Act 1988.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s), contributor(s) or editor(s) and do not necessarily reflect the views of ISTE Group.

Library of Congress Control Number: 2023943095

British Library Cataloguing-in-Publication Data
A CIP record for this book is available from the British Library
ISBN 978-1-78630-804-7

Foreword

An economic model on its last legs, suffocated by a pollution that is difficult to curb. This is the starting point of Marie-France Vernier's reflection in her book *Eco-design and Ecological Transition*. This economic model, capitalism, is based on the realization of a process of accumulation in which the investment, combining material capital and labor force, must give rise to a production of a greater value, a source of profit at the time of its market valuation. This accumulation process deploys a linear economy in which natural resources are considered almost unlimited and the emphasis is on the production of value during the production process and its market realization. In the same way, once the profit is made by the act of selling, the future of the goods leaves the field of interest of the economic actors. In other words, in the "extract-produce-consume-discard" sequence, the two extremities have been little considered for a long time. The theorists of this economic model nevertheless sensed the untenable lightness of such a sequence, emphasizing for some the insufficiency of natural resources to provide for the needs of a growing population (Malthus), or the rupture between human and nature through industrialization (Marx), or the costs induced by too much pollution (Pigou), etc. But these presentiments did not emerge from the carefree enthusiasm provoked by the new technologies and by the improvement of well-being following the diffusion of all kinds of goods that flooded the countries at the heart of the first industrial revolutions.

In this sequence, the "production" and "consumption" steps have guided the strategies of the actors of production and consumption, often with the ambition of increasing their

scope and intensity. They have been at the center of thinkers' reflections through, for example, highlighting the sources of the increase in labor productivity, and also of the consequences of exploiting labor power, or of the limits of the relationship between consumption and well-being. But the shortcomings that have been highlighted, especially concerning economic and social inequalities, concretized by the regular social protests, have not been the first instigator of the current collective reflection on the necessity of an adaptation or a change of economic model.

The origin of the current questioning of the economic model results more from the division provoked by the two ends of the sequence, "extract" and "discard", and its consequences on the heart that constitute production and consumption. The awareness of the non-renewable and therefore finite nature of a certain number of resources essential to the production process sounded at first like a faraway threat, until it became an annual countdown moving ever closer to the "day of overshoot" (July 28 in 2022, according to the calculations of the Global Footprint Network), from which humanity would draw irreversibly on the "non-renewable" resources of the Earth. At the same time, the release into the atmosphere of the residues of production based on fossil fuels accentuates a climate change that creates uncertainties. Alongside this, the accumulation of material waste, long hidden from the eyes of the Western world in the "pollution havens" created by globalization, is suddenly resurfacing, for example in a seventh continent, a "plastic vortex", estimated at 1.6 million km² and located in the northeast Pacific Ocean.

The neglect of these two sequences, "extracting" and "discarding", creates costs that weigh on the core of the economic model, "produce" and "consume". Paradoxically, they are the driving force behind the change or the

necessary “transition” of the economic model. Marie-France Vernier deals with this transition by starting from the heart – production – and analyzes with finesse the positive discussion of modifying the production process and the design of goods and services, a modification that could be a vector of economic and social renewal. How to take into account the environmental question in production? If the first strategies of companies, guided by environmental regulations, were to try to reduce the environmental impacts at the “end of the chain”, eco-design, or even taking into account of the environmental impact at each stage of the production process of a good, quickly appeared as a solution for everything to change – without anything actually changing.

Indeed, Marie-France Vernier expresses it very well, eco-design has imposed itself in a minimalist version, “technocentric”, in a belief that technology could replace the other forms of destroyed or missing capital, notably natural capital, the fable of the drone replacing the bee in its work of pollination. Despite the availability of rigorous tools, such as life cycle assessments (LCAs), the reduction of the environmental impact is sometimes too restricted to one stage of the production process, or even leads to higher costs at other stages. It is also mainly this type of eco-design that is associated with the circular economy. This can be defined as an economic system, which is based on a set of practices designed to better manage the “extract” and “throw away” sequences by reducing the resources used and introducing reduce, reuse and recycling loops in the production and consumption processes. The potential for change associated with (technocentric) eco-design, despite the technological, organizational and commercial innovations to which it gives rise, thus remains low.

A “more sustainable conception”, which would integrate not only environmental but also social dimensions into the analysis, implying a rethinking of the relationship between human, the object and the environment, would be more promising. It would imply large-scale, systemic transformations, which would not only seek to limit the negative externalities of the linear economy, as we have defined it, but above all to rethink the ways of “meeting the needs of current generations without jeopardizing the ability of future generations to meet their own needs”.

Marie-France Vernier outlines a few avenues, such as a more collective (open) conception and management of resources in the form of the “commons”. As a sort of third way between public and private property, the commons corresponds to the definition of forms of collective use and management of resources by communities of actors with the aim of preventing server and perpetuating these resources. These avenues will certainly be a source of reflection and perhaps of creativity for the readers of Marie-France Vernier’s work.

Blandine LAPERCHE
Professor of Economics
Université du Littoral-Côte-d’Opale
Chair of the Innovation Research Network

Introduction

The ability of companies to lead a transition to a more sustainable and environmentally friendly economy is an increasingly important issue for our society. The launch of the Green Pact for Europe by the European Commission in 2019 is symptomatic: the announced objective is a climate-neutral Europe with, in particular, the end of greenhouse gas emissions, a growth based on a “clean and circular” economy and actions to fight against biodiversity loss. In France, the 2015 law on the energy transition for green growth mentions the terms transition and sufficiency.

Although there is a lot of talk about companies’ commitments to sustainable development and green or ecological products, production, consumption and pollution are still increasing. In Europe, for example, the total volume of waste increased by 14% between 2004 and 2018 according to Eurostat data (2022)¹, while over the same period the European population increased by 2.9%. Similarly, according to “The Global E-waste Monitor” report, published in partnership with the United Nations Institute for Training and Research (UNITAR), e-waste is expected to increase from 53.6 million tons in 2019 to 74 million tons in 2030, an expected increase of 38%! According to the same report, the collection and recycling rate is only 17.4% to date.

The ecological transition is still far off or in its infancy. It requires companies to adapt their strategies. At the heart of our economic model, they are in close contact with several players: consumers, distributors, suppliers, and also local authorities and training centers. They are at the center of the exchange of goods and services on which we depend every day.

Eco-design can be a response by allowing the company to offer products or services with a lower environmental impact. It thus contributes to the ecological transition. This book proposes an analysis and a perspective implementation from a reflection at the heart of the products and services of our everyday lives. We begin by defining the central terms of the debate: economic model, ecological transition and eco-design.

Elements of definition

The current economic model

We use the term economic model to designate the dominant mode of organization in our societies in Europe and in a large part of the American and Asian continents. It has several characteristics. It is based on market relations in the areas of production and consumption. Individuals buy or sell goods or services for food, leisure or health. This consumption is based on a system of production in which capital, labor and natural resources are transformed into products on the basis of a capitalist system. The private ownership of the means of production gives great power to the owners of capital, who decide on the major orientations of companies. The search for, or at least the maintenance of, profitability is a determining element of these strategic choices (Beaud [2010](#); Bardelli [2016](#)).

With the first industrial revolution, this mode of production allowed for decisive progress in the areas of health, food and housing, as well as for increasingly visible pollutions in the environmental field (Beaud [2010](#)). This mode of production irrevocably pollutes and damages the environment. It consumes large quantities of renewable and non-renewable natural resources. The former is endangered by pollution and the latter is lost once used.

This economic model is also characterized by a globalization of the exchange of goods, capital and services. It means an “interdependence of the elements (societies, nations, firms, cultures) that constitute a complex system” (Bocquet [2018](#), p. 18). Companies are thus dependent on their suppliers for raw materials and semi-finished products. At the same time, they generate pollution that is dispersed to the four corners of the planet. As early as the 1970s, the environmental alarm was sounded with the publication of the Meadows report at the Stockholm conference. As Olivier Godart (2015, p. 64) writes:

There is the discovery of the feedback effects of man’s ability to alter, transform, develop his biophysical environment well beyond the model of adaptation to a given environment.

The social consequences of the current economic model should not be forgotten (from the putting to work of the most fragile in the factories and the development of wage-earning with the first industrial revolution to the new forms of flexibility of work today); nevertheless, this work is centered on the environmental stakes.

The necessary ecological transition

The term ecological transition reveals the growing dissatisfaction of our society with the disastrous environmental and social consequences for the planet, its fauna and flora and also for society itself. It is a “dual awareness of the finiteness of the resources on which global economic growth is based and of the environmental footprint resulting from our energy consumption” (Monnoyer-Smith [2017](#), p. 5).

Transition involves economic and social changes. It thus designates a process leading to a new model. It requires a

mutation, according to De Perthuis ([2014](#)), in order to reconcile the current economic model with “the great cycles of natural regulation that allow the reproduction of resources”. According to ADEME, “the ecological transition implies major changes in production systems and lifestyles, as well as the consideration of economic and social impacts, and more broadly, multiple conditions of feasibility” (Vidalenc et al. [2022](#), p. 9).

The transition is not only ecological, but also social, as it means a change from an unsustainable production and consumption model to a socio-economic model with an impact on the environment that is “acceptable” or sustainable in the long run (Stamm [2015](#)). The environment is then considered as a common good to be preserved for the well-being of all. Transition then consists of renewing ways of consuming, producing, working and living together (Serveille et al. [2017](#)). Some authors are more radical: it must lead “to a more sober system, and, as a result, likely to be more sustainable, equitable and stable” (Bourg and Papaux [2015](#), p. 1007).

The transition would be unavoidable as soon as society no longer has the resources to live as it has for several centuries. The transition can be undergone or chosen. If it is undergone, society is obliged to adapt to the scarcity of resources, climate change, the loss of biodiversity, etc. These changes create tensions, as individuals are unequal in their access to natural resources such as water or soil, or in the consequences of natural disasters (Bourg and Papaux [2015](#)). Chosen, society forges its destiny: with major changes in modes of production and consumption, and thus challenging established systemic relationships, with the ultimate goal of enabling future generations to meet their needs. States, through public policies, are beginning to guide actors in this direction. Some consumers are opting for products with less environmental impact, or for bulk

purchases in order to drastically reduce their waste. Companies, sometimes under public pressure and sometimes voluntarily with strategies of corporate social responsibility (CSR), are modifying their production to limit their environmental impact. In other words, individuals, in their consumption decisions or within a company, adopt an ethical approach and support the ecological transition. It is ethical because it reflects “the search for a good life, with and for others, in just institutions” (Ricoeur [1990](#), p. 202).

Eco-design: an answer?

Eco-design enables innovation by integrating the environmental impact as early as possible in the design process. It takes place during the design phase, from the emergence of the idea to the detailed definition of the final product or service. This pre-production phase can be a source of innovation and contribute to the ecological transition.

In the economic literature, innovation is most often seen as a source of economic progress and growth. It is also at the heart of the question of our society’s capacity to change its economic model, because individuals can introduce changes with environmental and social consequences. Innovation consists of introducing a new or significantly improved product, marketing or organizational mode to the market. Since the work of Joseph Schumpeter in 1934, innovation has traditionally been considered the central factor in the development of business competitiveness and economic growth.

In the early 1960s, authors focused on environmental innovations. These are socio-technical solutions that preserve resources, reduce environmental degradation and/or recover the value of substances already used in economic activity (De Jesus and Mendonça [2018](#)).

Habitually, the literature on eco-innovation distinguishes three main types of motivations: they can be regulatory, voluntary or market-driven (Horbach et al. [2012](#); Rexhäuser and Rammer [2014](#)).

In addition to the technological aspects, which are very present in the literature, environmental innovations can have organizational, social or institutional dimensions (Rennings [2000](#); OECD [2009](#)). They are based, for example, on new uses, such as the functional economy.

In the literature, eco-design is associated with the circular economy (Vence and Pereira [2019](#); Garrido and Prada [2021](#)) as a step before the circular economy to define environmental issues or as a component of the circular economy itself (Ghisetti and Montresor [2020](#)). The functional economy and frugal innovations also contribute to the reduction of ecological impact.

Purpose and structure of the book

The purpose of this book is to understand how eco-design can propose solutions to the environmental limitations of our economic model and thus contribute to the ecological transition. We ask ourselves in particular how the environmental and social changes allowed by the eco-design method are or are not sufficient to modify the current economic system.

This book is part of an evolutionary and systemic perspective. Eco-design is a method that appeared in the 1960s, which has evolved considerably in a historical context in which environmental issues have become increasingly important, and even restrictive, for companies under pressure from public policies and their customers. These multiple demands lead to irreversible changes (Nelson and Winter [1982](#)): eco-design is thus a term

increasingly used by companies to demonstrate their environmental approach. It thus fuels a process of environmental and social innovation that can contribute to the ecological transition.

From a systemic perspective, we will study the conditions explaining the diffusion of eco-design and its consequences in firms. We are thus interested in the system as an environment in which firms evolve and which impacts their strategies (Coppin [2002](#)). Our analysis focuses on the actors of the socio-technical system, the relationships they maintain and the rules that determine the dynamics of this system (Geels [2004](#); Hekkert et al. [2007](#)). We can then understand the consequences for companies in terms of practices and economic results.

This book consists of four chapters. The first chapter deals with the limits of the contemporary economic model. The first section presents the foundations of the economic system, namely the industrial revolution and the capitalist process. We will see that observers quickly began to focus on the environmental consequences of transformations in the field of production. The market economy develops with capitalism. The production and the mass consumption become the engine of the economic activity on a big part of the territories in the world and thus the source of a pollution. In the second section, we will analyze the consequences of this pollution by distinguishing between solid waste and pollutant emissions. We will present some figures, and then the main public policies to fight pollution, including the most recent laws in favor of the circular economy. Indeed, the State is a major actor in the ecological transition to encourage and also force companies to change their production methods. The third section will raise the question of the sustainability of our economic model. We will return to the distinction between strong and weak sustainability. The indicator of the

ecological footprint will allow us to show how our economic model goes beyond the limits of the planet.

In the second chapter, we analyze eco-design as a source of environmental innovation and therefore an essential step in the ecological transition. In the first section, we present the precursors of eco-design, then the two visions of eco-design: on the one hand, technocentric eco-design, in which it is the improvements made possible by the technique that lead to the reduction of environmental impacts; on the other hand, sustainable design, in which the environmental and social dimensions are associated. In the second section, we will analyze technocentric eco-design more precisely, the most widely used method. Finally, in the third section, we will see how eco-design contributes to environmental innovations such as the circular economy, the functional economy and frugal innovation.

The third chapter proposes evaluating the contribution of eco-design approaches to the ecological transition. We will analyze eco-design practices in a systemic approach, in order to evaluate to what extent we can consider that there are factors favorable to the ecological transition and what type of eco-design is encouraged. We will study the characteristics of the socio-technical systems in which eco-design approaches have been developed. Thus, we will distinguish the activities of the actors (companies, states, training centers, users), the relationships they develop and the institutions that guide their strategies. We will conclude by studying the financial results and communication strategies. Indeed, eco-design approaches seem to be validated by the market: they respond to normative institutions, which support market values in socio-technical systems. As for communication strategies, they encourage eco-design approaches, most often based on life cycle analyses.

The objective of the last chapter is to analyze how eco-design can be a sustainable response to the environmental degradation resulting from the economic model and thus contribute significantly to the ecological transition. In the first section, we will note the limits of technocentric eco-design. It does not make it possible to escape from the dominant socio-technical regime. In addition, the search for eco-efficiency and the rebound effect prevent us from getting out of the ecological crisis. The second section is an analysis of the circular economy as an opportunity for new economic models, to which technocentric eco-design contributes. Nevertheless, it remains a partial solution, well identified by the principles of thermodynamics. In the third section, we will see what avenues can be envisaged in a sustainable design approach. The search for new uses with re-examined relations between the individual and the environment and frugal innovation are approaches that transform our relationship with objects. In the last section, we will study the offered perspectives by the processes of open innovations, allowing a greater participation of the actors and also the contributions of the notion of governance linked to the concept of common good. We will thus question the capacity of actors to negotiate, and even to establish new rules in order to create the conditions for strong sustainability.

Note

1 See: <https://ec.europa.eu/>.