

Umberto **Berardi**

Moving to Sustainable  
Buildings:  
**Paths to Adopt  
Green Innovations in  
Developed Countries**



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*This book is dedicated to all the construction  
stakeholders that daily help our future  
by creating sustainable buildings.*





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## Foreword

This book is an important contribution to the growing field of sustainable building. The First Conference on Sustainable Construction, organised in 1993 by the International Council for Research and Innovation in Building and Construction (CIB), set the broad issue of sustainability in building on the international research agenda. Scholars from various disciplines joined the conference in Tampa, Florida, which was hosted by the Center of Construction and Environment of the University of Florida, and chaired by Professor Charles Kibert. Sustainable architecture and urban planning, handling of construction and demolition waste, management of building projects, and systems of sustainable innovation were all addressed. The conference concluded with the announcement of an intention to further investigate these topics. Since then, many scholars have focussed on sustainability in building, and today, twenty years later, a number of noteworthy research projects and publications are produced in the expanding field of sustainable building innovation. Scholars have not stopped investigating the theme, and even in times when public attention decreased, researchers continued to develop projects in order to improve knowledge regarding and provide insights into this important issue.

In this field of sustainability and building, Umberto Berardi continues to make significant contributions. This book is one of his major works, and I expect many new contributions of his will follow in the future years. Umberto Berardi is a knowledgeable and front-running researcher in the area of sustainable building innovation. He is aware of the multidisciplinary nature of this field and shares his knowledge on the assessment, rating and improvement of buildings' sustainable qualities, the innovation processes that drive changes in the building industry toward more sustainability, the complex struggle of stakeholders in the project-driven and fragmented building industry, and the organisational methods and theories that can be used to understand and improve eco-innovative building. Umberto Berardi is



very knowledgeable; he knows things others do not know and shares it with his readers in this open access book. In more than one way, this is a gift to his readers.

Bart Bossink  
Professor of Technology and Innovation  
VU University Amsterdam, the Netherlands

# Preface

Among international actions for sustainability, makers of programmes and policies are assigning more and more attention to buildings. Many national and local activities encourage sustainable buildings worldwide. At the same time, R&D continually offers new green products, facilitating a transition to sustainability within the building sector. Although sustainable buildings show higher value premium and their number has increased even during the recent international crisis, a transition to a sustainable building sector is far from being reached worldwide.

In spite of many efforts, building practices do not seem to have undergone any significant change. This raises the question of how green innovations are dealt with in construction. The aim of this book is to create an understanding of how sustainable building can be incentivised and of how green innovations may be better managed in the building sector.

This book is based on recent field research of the author. It explores various aspects of transitions of the construction sector to sustainable building through the adoption of green innovations. The research methods range from theoretical discussions about the concept of sustainable building to interviews about preferences of building stakeholders and field studies about the organisation of processes for the adoption of green innovations in sustainable buildings.

The book does not pretend to be exhaustive in the theme of sustainable buildings. However, it aims to contribute to showing how green innovations may be successfully managed in order to help the diffusion of sustainable buildings. This perspective considers both the product-centred focus on green innovations and green buildings, and the process-centred focus on building in a sustainable way. Thereby, the book emphasises the importance of a clear definition of the terms *sustainable building* and *green innovation*, and at the same time, it gives attention to the building process.

The main contribution of this book to the promotion of sustainable buildings consists of a discussion about available definitions and interpretations of the concept of sustainability in the building sector (Chapter 2). This allows an

exploring of the differences between *efficient*, *green* and other names used to identify sustainable buildings. Then, the book reviews sustainability assessment methods in the building sector (Chapter 3).

This review is followed by the analysis of the green innovations that have been adopted in a large sample of sustainable buildings in the US (Chapter 4). This first part of the book (Chapters 1 to 4) aims to explore the concepts of *green innovations* and *sustainable buildings* to clarify the sustainability transition that the second part of the book examines.

The contribution of the second part of this book to the topic of building in a sustainable way consists of few analyses about difficulties encountered by the actors of the building sector. This investigation aims to look at drivers and barriers for the diffusion of green innovations in sustainable buildings. In particular, after a general introduction to the adoption of (green) innovations in the building sector (Chapter 5), the book describes the power, motivation and influence of construction stakeholders over the adoption of green innovation in buildings (Chapter 6). Then, the book describes which changes to the interactions between firms can favour a shift of the construction sector to sustainable buildings (Chapter 7). Policies for sustainable building are reviewed and discussed in order to understand which influence every level of government can have in the transition to sustainable buildings (Chapter 8). The concluding chapter reviews the main topics discussed in the book.

The starting point of this book is the importance of the building sector to sustainable development. This requires sustainable buildings and, in general, a transition to sustainability of the construction sector. However, a literature review of definitions of *sustainable building* shows that this terminology needs clarification, as it is often used in a confusing manner. By examining the evolution of the concept of sustainable development in the last years, this book investigates what *sustainability* means in the construction sector. Many constraints hinder a simple definition of what an (environmentally) sustainable building is. In particular, the dependence of the concept on time, scale, domain and social constraints is investigated and discussed. Sustainable assessment systems are then considered, because they represent considerable drivers for sustainable building. Different systems are described and compared in this book to understand which factors are (or have to be) considered for a sustainable building. Later, this book analyses the sustainability assessments of a large sample of American buildings (490 buildings). This presents data about green innovations in buildings that, currently, aim to be defined as sustainable.

The book shows that energy performance is considered the most important criterion in sustainability rating systems and is the least achieved criterion in sustainability assessment results. This means that great barriers are still encountered in the adoption of energy-efficient innovations. In contrast, other