Prologue

Cycles, crises and innovation are the major economic forces that shape capitalist economies. These forces need to be harnessed for the daunting task of shifting the juggernaut of industrial and economic development away from the technological and organizational systems that have created an ecologically unsustainable world. Innovation for transforming the world's industrial system into an ecologically sustainable society is the clarion call in this book. Creative destruction is required on a massive scale to open the market space for eco-innovation (ecologically-based innovations).

This narrative reveals how innovation is created, implemented and diffused through the globally dominant capitalist economic system. Based on these revelations, the second half of the book covers the public and private innovation strategies that form a transformational path towards sustainable development. Predicting the sustainable economic society that eventuates from this paradigm shift is not the purpose of this book. That will become apparent soon enough if (and as) the shift occurs. What this book aims to achieve is a framework for this paradigm shift. Whether the final destination is capitalist or some alternative is irrelevant to this discussion. The world community needs to plot a course towards sustainable development with many variations within it.

By revealing the nature of innovation and how it operates to support unsustainable economic development, the framework for a strategic shift becomes evident. Thus, this is an economics book in the sense of providing an economic foundation to the innovation process and what is needed for paradigm shift. The book, however, covers much more than economics, since understanding the multidimensional nature of innovation also requires knowledge of the 'disciplines' in innovation management, entrepreneurship and creativity. The literature in these disciplines is engaged to build innovation frameworks. The ecologically-based sustainable development literature in this book provides the rationale for paradigm shift. Thus, readers from all these disciplines hopefully will find scholarly relevance and insightful views. Practitioners in business and strategic management can profit from understanding the signals in society for business opportunities in eco-innovation. Politicians and policy makers in the public sphere who need to plan infrastructure and advance innovation policy towards sustainable development can find frameworks to guide their deliberations.

The book begins with the history of economic thought on innovation and its relation to ecological sustainability. This provides the political economy outlook on the elements of the frameworks contained within this book. The economic forces of cycles and crises that underpin this book have been the focus of attention of Western philosophers and political economists since the encapsulation of innovation in the *New Atlantis* fable by Francis Bacon in 1623 (published 1626). Central to this story are two giant figures of the twentieth century in the field of political economy: Michał Kalecki and Joseph Schumpeter. Kalecki is recognized as developing the same 'effective demand' approach to economics (initially in Polish and French) that John Maynard Keynes developed under 'Keynesianism' in the English-speaking world, but unlike Keynes, Kalecki had a clear non-neoclassical epistemology. Schumpeter is known for recognizing the creative destruction aspect to innovation. Both Kalecki and Schumpeter identify cycles, crises and innovation as the three dynamic forces plotting the path of economic development. Kalecki with his class-based Marxian economics roots and Schumpeter with his agency-based Austrian economics roots seem strange bedfellows. Nevertheless, the starting point for both is to view innovation as being the implementation of new ideas that address specific problems and/or identifiable opportunities that occur on the basis of the economic boom and bust of cycles. Where Schumpeter is known for opening up the evolutionary approach to innovation and economic development, it is Kalecki's 'adaptation mechanism' through investment in innovation which forms the central contribution of this book.

From the standpoint of the mid-twentieth century, Schumpeter and Kalecki understood that the manufacturing industry played the leading role of investment in the innovation process, but also recognized that such investment would eventually wane, retarding capitalist development. The other great economist of the twentieth century, John Maynard Keynes, concentrated on the impacts of this investment on cycles through effective demand – a macroeconomic perspective that heavily underlies the whole economic analysis in this book. Cycles and crises, which have been always part of industrial society, were effectively addressed by these economists in their own accounts of economic development.

From the standpoint of the early twenty-first century, the depiction of cycles, crises and innovation needs to be revisited and reconstructed in the context of massive developments that had not been identified by Schumpeter, Keynes or Kalecki. These developments include: the rise of the high-tech service economy on the back of the information and communication technology revolution; the intensification of globalization as a commercial reality; the increasing rate of destruction of Earth's ecosystems through economic growth in both developed and developing economies; and deep over-accumulation and financial instability that lead to economic recession with accompanying unemployment and regional inequalities.

Mainstream orthodox (or neoclassical) economics has expanded exponentially if we measure the growth in the number of their journals and the amount of articles, chapter readings and books published. However despite its proliferation, in the context of the three dynamic forces to be investigated in this book, neoclassical economics is limited by its narrow focus and shallow depth of analysis. The very specific set of neoclassical economic tools available allows examination of the three major economic forces only with a microscopic lens and a static vision of the economic process. The process is one that is viewed as a closed system. Within this orthodox thinking, cycles are due to external factors or the market being dysfunctional due to non-optimal regulatory actions. Crises in these circumstances are short-term market adjustments towards a fresh equilibrium. Innovation (called 'technical progress') is crucially left unexplained or simply added in as an incentive appendage to drive disequilibrium into a price-allocative optimal outcome. This analysis provides some appreciation of the allocation power of markets in the innovation process, but does not provide any understanding of market power – and consequent political power – that ensues within capitalism and the dynamic fluctuating path of economic development that flows from such power.

Beginning with Bacon's *New Atlantis* as the beacon, while navigating through the history of economic thought on science, innovation and technology, this book observes innovation from the Kaleckian dynamics of cycles and crises. The limitations of neoclassical economics, noted above, lead this study into a political economy approach that focuses on the centrality of power and the generation of patterns which show both correspondence and contradictions in the way that market processes relate to the real world. This alternative approach has a critical realist perspective, examining the real social world as it negotiates an open system of social structures and agents. This is its behavioural stance.

The elements of the approach in this book cover the gamut of innovation from individual small entrepreneurs to publicly funded science research, and then on to large-scale corporate entrepreneurship. With this understanding developed in the first half of the book, the second half, from Chapter 6 on, specifies an innovation policy approach that enables capitalist economies to chart an alternative course that can specifically address crises, notably the ecological crisis.

The Kaleckian behavioural and accumulation perspectives, in terms of entrepreneurial investment, are the basis of profits, reproduction and productivity growth that enable the economic system to improve living standards (however defined). What underlies this investment process is the Schumpeterian innovation perspective that sees clustering of basic or radical innovations as the wellspring for the upturn in the trough of a business cycle.

Then, the Kaleckian adaptation mechanism enables this clustering to become investment bunching, which is the innovation impulse for a cyclical expansion. The shift to incremental innovation and consequent limitations of reproduction create the conditions that are susceptible to cyclical contraction. Then, there is the inevitability of crisis that waits for a trigger to cause the downturn. This is the dynamic macroeconomic setting within which the innovation narrative is told in this book.

There are many excellent books on various aspects of innovation – some examine the creative and scientific knowledge base for innovation; many explicate the legal and management aspects of the innovation process within organizations for competitive advantage; fresh efforts have been made to set out the national, regional and industrial (sectoral) innovation systems that provide the policy environment for innovation to prosper; still others provide deep historical studies of technological progress through innovation. This book does not attempt to cover any of these aspects, although the works of these authors have significantly influenced the analysis in this book. Closer to the analysis in this book is the research literature on the theory of innovation arising from paradigm shifts and technological revolutions, as well as the related evolutionary modelling of innovation with endogenous economic growth. However, none of this literature explicitly takes a critical realist focus on the power of innovation. This book examines how this power is exhibited in the course of cycles and crises that always beset economies – at least since the innovation out of the first Industrial Revolution – and how the rise of capital, through investment, enshrines innovation in profit and power. This is the discourse with which the following pages engage.