Innovation and entrepreneurship

A Growth Model for Europe Beyond the Crisis

Daria Tataj

Preface by Manuel Castells

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Praise for Innovation and Entrepreneurship

Fascinating to see that the early learnings of the European Institute of Innovation and Technology (EIT) now hit the public in a book that is the most comprehensive and understandable description of the role of (networked) entrepreneurship in the Knowledge Triangle. Following the author, I sincerely hope that in Education, in Business firms and in Research Institutes, Innovation in Europe returns to its entrepreneurial roots in search of new prosperity.

Professor Martin Schuurmans
Founding Chairman of the European Institute of Innovation and Technology, former Vice President of Philips

In an increasingly research and technology rich world, Daria Tataj explores the growing importance of 'technology push' - in place of demand pull - in driving innovation and growth. She identifies the critical role of the entrepreneur as the integrator of the innovation process from idea to funding to market. Based on extensive research, this book will help shape policy and thinking for a new model of innovation-driven economic growth.

Professor Dame Julia King
Vice Chancellor, Aston University, Birmingham

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To
Darek, Misia
Tosia and Helena

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Preface

Understanding Innovation in the Real Economy – At Last!

by
Manuel
Castells

Innovation and entrepreneurship are the key sources of productivity, competitiveness, and economic growth in the knowledge economy. Thus, in recent years there has been a flurry of theory and research on the processes conducive to enhancing the generation of innovation and entrepreneurship, two distinct but intertwined components of economic growth in our time. Yet, most of the current literature is either based on formal neo-classical theory, with little connection to the real world, or on empirical observation limited to a particular context, thus making it difficult to replicate the findings for companies, regions, or nations in search of a new path of development. However, we may be able to better design innovation policies and entrepreneurship strategies by reflecting on a major experience undertaken by the European Commission in 2008: the European Institute of Innovation and Technology (EIT). This is not a new academic institution, although it is an organization of sorts, built on a pan-European network of companies, universities, and government agencies.

The significance of the EIT is that it proposes a new model of innovation, entrepreneurship, and economic growth, and that it has supported the proposition with a multi-billion euro, multi-year program that is transforming the European landscape of innovation. This is a real life experiment that is testing some of the most audacious ideas about the theory and practice of innovation.

This book aims to elucidate the key factors accounting for a synergistic relationship between universities, businesses, and entrepreneurs in the innovation process. It relies on an extensive review of the literature on innovation and entrepreneurship, constructs an analytical framework, and proceeds with an empirical analysis of the experience of the knowledge and innovation communities created by the EIT. It considers the implications of this experience for a new model of growth for Europe and beyond, as the developed world still struggles to leave behind the consequences of the financial crisis of 2008. The analysis

presented here pays careful attention to the specificity of each economic and institutional context, so that the global innovation model is only an analytical reference that needs to be adapted to each country and to each domain of activity where the innovation process takes place.

The book is timely and highly relevant because, as the author points out, the West has suffered a major financial crisis since 2008, with dire consequences on growth and employment in many countries, including most of Europe and the United States, in spite of recent upward trends in job creation in the US. Austerity policies and responsible fiscal policy are only some of the components of the strategy to overcome the crisis. But restarting the growth engine is the only sustainable policy in the long term. Under the stricter conditions of private lending and public spending, the only possibility for recovering the path of economic growth in a sustainable form is a substantial increase in productivity and competitiveness in the business sector as a result of superior innovation and entrepreneurship. Innovation and entrepreneurship are the drivers of the economic recovery. However, where are the sources of innovation and entrepreneurship in the current context of a shaky world economy? This is where this book provides empirically grounded answers with theoretical meaning and policy relevance.

Looking at the recent international experience, particularly in the United States, the author proposes the notion of networks of innovation. In a fully networked world, based on relentless flows of information and management supported by telecommunicated computer networks, innovation is no longer the result of an individual firm or of a sole innovator, but a networked process between the producers of knowledge, the entrepreneurs that transform ideas into business projects, and the institutional environment that may be conducive to the surge of innovation or, instead, to the limitation of its potential because of lack of entrepreneurship or excessive bureaucracy. Networks are the operating system of the economy in

the age of digital communication and information processing. But networks are specific and organized around certain goals, and when innovation is the goal, the networks of collaboration must be geared toward this purpose. This is what the author shows, using a variety of examples in the international experience, with particular emphasis on the United States, birthplace of the new, innovative economy associated with the information technology revolution and the rise of new forms of entrepreneurship. The author has conducted interviews and has observed entrepreneurial processes in Silicon Valley, Michigan, and other seedbeds of innovation in the United States. And this is apparent in the fine grain analysis through which she explains the formation and dynamics of the networks of innovation that are at the source of dynamism in today's economy. She has been able to integrate these insights in the analytical scheme on which she bases her research.

The book draws on extensive observations from the author's experience as a founding executive committee member of the European Institute of Innovation and Technology, and particularly from the actual performance of the first three Knowledge and Innovation Communities (KICs) launched by the EIT under the auspices of the European Commission. Because of her leading role at the EIT, the author has had access to highly relevant data from these KICs. These data are used to conduct research on the experience and to draw lessons of general analytical value. This book is not an evaluation of the EIT's performance, nor a defense of the EIT's activity. Rather, the study of the EIT experience is a testing ground for the hypotheses on the generation of innovation and entrepreneurship that the author formulates on the basis of the literature review and on the observation and interviews she conducted in the United States and in Europe on different models of innovation.

The "Knowledge and Innovation Communities" are networks of universities, research centers, business firms, and small and medium

enterprises co-located in a given metropolitan area, then networked with other co-localized networks in several metropolitan areas in Europe, managed by a governing agency that is largely self-reliant in terms of its own budget, though initially supported by the European Union. It is an original model of innovation that results from ideas that emerged in the international practice and that have been articulated in a coherent manner for the first time in this pathbreaking book by Dr. Tataj.

The key model proposed in the book is what Dr. Tataj calls "the knowledge triangle." It refers to the synergy resulting from the interaction between education, research, and innovation. It is in the interaction between knowledge produced in research, educational resources that allow both research and the implementation of its findings, and the application of this knowledge to the creation of wealth in the business world, that a synergistic relationship emerges, leading to growth in productivity and competitiveness: a new growth model that results from supply factors, rather than from stimuli from demand, be it public spending or consumer demand. Yet, perhaps the most original approach in Dr. Tataj's contribution is her emphasis on entrepreneurship as the vector that operates the transition from knowledge and education to business performance and economic growth. This is because the historical record of innovation in all contexts shows that the uses of new knowledge to create business projects most often comes from the action of entrepreneurs who have the ability to understand the opportunity of a potentially successful project, and who have the drive to risk their investment and their livelihood in the creation of new enterprises and new lines of innovation in process and in product.

The missing link in the process of innovation, as Dr. Tataj explains, is the entrepreneur that brings together all of the components of the innovation process and creates a business firm out of his/her project. In this process he/she requires access to venture capital under its different

forms (including business angels): without capital that accepts the risk of investing in innovation, there is little chance that new knowledge results in innovative business. The experience of high technology industries and advanced business services in the last three decades shows that venture capital is an essential factor to induce entrepreneurship, the source of innovation in the new, global economy.

However, the diversity of institutional contexts matters, as innovation results from different models, as the author shows by contrasting the experiences of Silicon Valley, Finland, and a number of European innovation systems. The relative weight of government, educational institutions, and venture capitalists varies in each context, but in all cases, the knowledge triangle is present and the role of entrepreneurship is essential. This attention to institutional variation of the innovation process is one of the great strengths of this book, which can be read with benefit in many different countries without having to comply with the ethnocentric biases of some studies of innovation.

Furthermore, the author analyzes the processes and institutions of innovation governance, and shows that governance is a key factor in guiding innovation toward successful business practices and socially useful innovation. The analysis of the complex interplay between the structural components of innovation and the institutional and individual actors who intervene in the process is a truly original contribution of this study, and one that will be most helpful to business executives, academic researchers, and policymakers learning the theoretical and practical lessons of innovation from this book. This is a fundamental, innovative book on innovation that will reshape the way we think about innovation and may yield the most needed policy lessons for a new model of growth in the aftermath of the economic crisis.

Manuel Castells

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Introduction

Is There Growth After the Crisis?

This book is about innovation and entrepreneurship, and how nations and regions can embrace innovation-driven entrepreneurship to integrate and exploit its knowledge, technology, human capital, and industrial base, and thus boost economic growth and job creation.

A global financial crisis, triggered by the bankruptcy of Lehman Brothers in 2008, has had a detrimental effect on the European economy. In 2009 alone it shrunk by 4.3% (Eurostat). After two years of anemic growth, it shrunk again in 2012. Over the four years of struggle, the financial crisis forced lending institutions to severely tighten credit for companies and households. Without financial backing, businesses reduced investment, cut salaries, and laid off workers in many countries, which led to social unrest and political instability (Thompson 2012; Engelen 2011).

As a result of these measures, consumption sharply fell, along with domestic demand, which accounts for about three quarters of GDP growth in the European economy. Governments came to the rescue, bailing out banks with public money and stimulating demand with public spending in infrastructure and social subsidies. Given the already high level of indebtedness of most governments, sovereign debt rose substantially, and financial markets elevated the risk premium and interest rates of sovereign debt to unsustainable levels.(1) The European Commission, supported by the IMF, intervened to rescue countries in exchange for imposing strict policies of economic austerity. These measures helped deal with short-term solvency issues. But what is needed in the mid-term is a new model to help Europe return to a path of growth beyond the crisis.

In Europe, productivity growth and exports are the lighthouses guiding the way toward new prosperity in the darkness of the economic crisis. Indeed, one of the main causes of the crisis in the Euro zone was the artificial integration of economies with vast differences in productivity,

(1) There are some exceptions to this trend, most notably Poland. The country has had positive GDP growth throughout the crisis peaking at 4.5% in 2011 (Eurostat). The reasons why Poland has been coping well with the crisis are multifold and synergistic. They surely include the inflow of structural funds from the European Union, as well as a relatively high level of entrepreneurial activity, and a young, well-educated work force.

culture, and institutions, without a fiscal union and without a regulated, integrated banking system. While the crisis induced the EU to set up the foundations of a common banking system and a common fiscal policy, under the aegis of Germany, the question remained of how to steer all economies toward higher productivity and higher competitiveness.

Economic theory and recent historical experience show that productivity growth is largely a function of innovation and entrepreneurship: innovation because it creates wealth out of the synergy generated by combining production factors in the production process (growth of multi-factor productivity in traditional econometric terms); entrepreneurship because once innovation is generated, there is a need for economic actors to finance and to bring new products and processes into the market, often assuming a high risk for their investment in expectation of high returns.

However, knowing that innovation and entrepreneurship are the sources of productivity and competitiveness does not solve the problem. The next question is how innovation and entrepreneurship are generated in our current global networked, knowledge-driven economy, and in the specific context of European economies. One question immediately leads to other queries: What environments are conducive to innovation? What accelerates this process? Why do certain collaborative partnerships or ventures fail to create value when innovating, while others succeed? Why do certain spots attract resources—knowledge, talent, and capital—while other regions are deserted despite efforts to revitalize clusters through public investment in research infrastructure, education, venture capital industry, and subsidizing R&D activities of local industry?

The answers may lie in the theory and practice of innovation in the knowledge-driven economy. In order to propose such a theory, to understand how value is created in a networked environment, this

book examines a number of settings in which innovation takes place. The scrutiny of these settings allows one to understand how, where, and when knowledge is produced, disseminated, and translated. It inspects structures, dynamics, architecture, and management practices of various types of innovation networks comprising institutional actors from research, education, and industry and focuses on understanding emerging business models as mechanisms of value creation.

Scrutinizing a number of environments in mature and emerging markets, innovation appears as an ever-present, self-perpetuating system of information exchange and knowledge sharing. In the information age, formal education and its institutions exist in parallel with a myriad of ad hoc emergent learning environments where people learn by "hanging out, messing around, and geeking out" on the Web. Innovating becomes a collective distributed open learning process and this is an essence of the capacity to innovate in a world constantly in flux.

The main idea of the conceptual framework proposed in this book includes four components critical to the operational success of innovation networks: research, education, innovation itself, and entrepreneurship—all of these in relation to business strategy and policy-making. The outcome of this analysis is locked in a simple model for investigating collaborative partnerships and the way these partnership networks are capable of creating value in economic and social terms.

The author has based the whole analytical premise of this undertaking on an assumption that in order to enable collective capacity to develop new products and processes and to bring them to markets and to society in a timely fashion, it is necessary to understand networked environments that are conducive to innovation. In this context, the author has defined innovation as a social process of knowledge

production and dissemination, during which human creativity leads to translation of knowledge into shared and enriched capacities.

Effectiveness of collaborative partnerships is largely a function of both innovation and entrepreneurship in university-industry collaboration: innovation because it creates wealth out of the synergy generated by recombining knowledge; entrepreneurship because once innovation is generated, there is a need to manage and finance the process of bringing new products and processes into the market. Evidence shows that bridging the gap between innovation and markets can be done through a diverse set of entrepreneurial entities starting with small innovative firms and ending with large multinationals, through not-for-profit organizations as well as public institutions including universities, and through single individuals: creative, self-employed professionals and micro-multinational entrepreneurs.

Subsequently, I contend that there are three components: research, education, and innovation, which form the Knowledge Triangle, conceptualized initially as a network of institutions engaged in knowledge production and dissemination representing either industry or academia.

I recognize, however, that production and diffusion of innovation occur within institutional settings, such as research institutes, universities, and industry, but they also take place beyond the institutional boundaries of academia and business. Evidence shows that knowledge production, dissemination, and translation also occur in the public sector as well as in the non-government sector. They are driven by individual or collective users (user-driven innovation) as well as by the society-at-large (social innovation, cultural innovation).

If so, innovation happens in more settings than initially assumed, and in fact there is no hierarchy between these settings, although

innovation process participants tend to believe there is, for example in the case of academics disregarding industrial applied research and industry innovators discrediting academic research on account of its inapplicability. What is observed in the Knowledge Triangle is a shift from transaction cultures driven by exchanges and the logic of "zero-sum game" to collaborative, relational, trust-based organizational cultures typical of open innovation environments.

I derived the next critical issue from the following question: Is there any specificity of different kinds of flows in such a network as the Knowledge Triangle? The proposition put forward is that there are flows of a specific kind of knowledge, a specific sort of people, and a specific type of capital. It is the flow of codified knowledge, which takes place across and within innovation settings, institutions, and actors in an innovation network. What makes it different from other similar flows is that it is shared in an open innovation environment.

While codified knowledge is transmitted with tangible carriers, often through formal partnership arrangements and intellectual property regimes, the non-codified knowledge is carried by individual people and is disseminated solely upon their decision to share it or not to share it, which is a derivative of a shift from transaction to collaborative culture. For innovation to take place, these flows of talent are critical since they carry unique capability to frame the codified knowledge, connect different pieces of it, reframe it in a changing context, and give it a new meaning.

These continuous flows of talent enable a translation culture, that is a culture of constant learning. The ever-present, self-perpetuating system of knowledge sharing becomes one of the key ingredients of innovation in a world of relentless change. In this context, the Knowledge Triangle is a specific form of an innovation network comprising research, education, and innovation itself. These activities form part of interlinked

social processes occurring within diverse institutional settings, which create national or transnational innovation systems, in a myriad of ad hoc, emergent learning environments.

The question then arises: What keeps this particular type of a transnational, trans-institutional, trans-sector, and trans-disciplinary innovation network together? It has been shown that there are a wide variety of models for structuring formal contractual collaboration, linkages, and alliances. But there is evidence that a number of innovation networks tend to cease to exist or operate once public funding is withdrawn since there is not enough of a structural model for the network to generate value to participants.

The answer may lie in emerging new types of organizations, such as those presented in this book.

The analysis moves toward distilling value creation mechanisms epitomized by various business models in a new paradigm of a network enterprise, defined as a unit, with or without legal structure, time-limited, and organized in order to accomplish a particular goal, for which diverse actors allocate resources and create a project, which is a business plan or social innovation.

The search for a constituent that holds together the Knowledge Triangle leads to entrepreneurship being the integrative component, the glue of the Knowledge Triangle. It is proven that entrepreneurship is critical for integrating networks in diverse settings where the components of the innovation process take place, and that entrepreneurship acts as a catalyst for value creation not only by integrating the network but also by creating synergies between the three remaining components.

Therefore, what was initially presented as the Knowledge Triangle is re-conceptualized as a multidimensional network, in which three

components of the process—research, education, and innovation—happen simultaneously in a synergistic interaction in a variety of settings. This marks a conceptual shift diverting from thinking of innovation as bilateral or multilateral forms of collaboration between actors in academia and industry with a varying degree of government involvement.

The new paradigm conceptualizes the innovation process of knowledge production, dissemination, and translation (commercialization or application) within a non-hierarchical, dynamic, open environment where different kinds of knowledge flows take place carried by entrepreneurial talent and by entrepreneurial capital. The Knowledge Triangle becomes a multidimensional dynamic and emerging construct "in-the-making." And as a result of the analysis, the components of the Knowledge Triangle are characterized by a shift: from intellectual property-based research to open innovation; from university education to learning environments with a strong peer-to-peer learning component; from innovation within industry to innovation in different kinds of social, creative, and process networks.

These environments conducive to innovation are interlinked and codependent in a context of the global network of innovation networks, which imposes its logic, dynamics, and structures on management practices and business models. What has long been observed is that knowledge, talent, and capital flow freely across the borders and that these resources are accumulated in certain metropolitan areas. The process of industry clustering dates back to the early stages of the industrial revolution.

However, the emergent business models of global and local network enterprises change modalities of value creation. Certain regions or cities emerge as mega nodes and gain access to the global pool of resources: they become magnets attracting excellent knowledge,

entrepreneurial people, and smart capital. What is observed in certain cases more prone to success is a shift in the Knowledge Triangle from transaction cultures driven by exchanges and the logic of "zero-sum game" to collaborative, relational, trust-based organizational cultures typical of open innovation environments. Still, there is no answer as to why certain collaborative partnerships fail to generate innovation and entrepreneurship in this networked global environment.

This is the intellectual landscape of this book, leading ultimately to a redefinition of the policy debate on the sources of new growth in Europe and beyond. These issues will be tackled in three sequential analytical operations: the theory of innovation; the practice of entrepreneurship in the knowledge-driven economy, in a comparative perspective; and the reflection of an innovative policy experience in which this author has taken a leadership role: the European Institute of Innovation and Technology, established in 2008 by the European Commission, precisely to create a new model of innovation by bringing together leading companies, research universities, and entrepreneurs, in local networks of innovation connected in pan-European networks under the organizational arrangement of Knowledge and Innovation Communities.

The theoretical references, the observation of international experiences of innovation, particularly in the United States, informed the design and practice of the EIT. And the experience of the EIT, as lived and documented by this author, may inspire a broader reflection on the conditions under which knowledge, innovation, and entrepreneurship may rekindle the European economy, thus reversing the process of decline that, under the current conditions of merciless competition in a global economy populated by new economic actors, could transform the Old Continent into a historic museum of its glorious past—for others to visit and enjoy.

The argument presented here is constructed in a sequence of analytical steps that inform the chapters of the book as follows:

Introduction subchapter "Innovation Blowback" presents the evidence for how innovation and entrepreneurship are induced in a number of environments. It entices the discussion of the essence of innovation and entrepreneurship as driving forces of economic growth and societal development. The starting point for this deliberation is the situation at the beginning of the twenty-first century when two trends collided. Knowledge spillovers allowed companies originating in emerging markets to challenge Western incumbents. Crises in Europe and shrinking domestic markets undermined their position and eroded profits. In this situation, understanding where innovation comes from and how to exploit it rises to the top of the agenda of business leaders and policy makers in Europe. To face this challenge, I offer examples of learning, coming from both the emerging markets and emerging industries.

Chapter "Innovation Networks" is divided into three parts. The first, "Structure, Modalities, and Drivers," focuses on the analysis of different types of innovation networks. The analysis distills a number of features, drivers, and mechanisms that make innovation networks evolve. The process of evolution of network nodes leads to an explanation of why certain nodes change, attracting the flows of knowledge, talent, and capital. Accumulation of these resources changes the status of a node in the global architecture of innovation networks. It appears as an innovation hotspot. Structure, local and global architecture, dynamics of flows between the nodes and the peripheries uncover the underlying drivers and catalysts of accelerating the velocity of flows and wealth generation and accumulation.

The second part of the chapter "Innovation Networks" is entitled "Toward New Business Models." It aims to explain how value is created

in innovation networks through different types of business models—business models being a proxy for value creation models. It presents the conceptual framework of a network enterprise to understand the specificity of an organizational unit in a network economy. The emerging business models in the global innovation network draw upon this new paradigm of a network enterprise in order to understand and interpret such phenomena as social networks and open innovation, as well as process networks and creation networks. The concept of a network enterprise is used to explain how and why certain types of networks create value, while others fail to do so.

The third part of the chapter entitled "Meaning and Power in the Global Innovation Network" depicts the fundamental contradiction between the mechanisms for knowledge and wealth accumulation that are dominant in the network society. The dynamics of flows across innovation networks induce a new geography of social, economic, and technological inequality and draft a map of exclusion from the global mega nodes that attract the most competitive resources. The role of this subchapter is to prepare ground for a reflection on what governments should do to prevent brain drain, capital outflow, and knowledge waste.

The next chapter, "A Growth Model for Knowledge-Based Economies," introduces a new conceptual model of networked innovation: the Knowledge Triangle. The model depicts a particular type of innovation network, which includes three components: research, education, and innovation. The scrutiny of the Knowledge Triangle takes the analysis starting with the "cluster model" of innovation milieus and proposes a new paradigm of a global network of clusters, which is defined in a dynamic, overlapping distributed model as a network of innovation networks. The observations of the nature of collaborative relationships between business and academia in the innovation process point to the changing paradigm of institutions involved. It is demonstrated that research–education–innovation enter into dynamic exchanges through

three types of flows: flows of knowledge, flows of talent, and flows of capital, which generate new capacity to innovate and ultimately create value, defined in different ways by the institutional and individual agents of the process.

The next chapter is entitled "Knowledge and Innovation Communities." It discusses the experimental application of the Knowledge Triangle model on three novel organizations called Knowledge and Innovation Communities, established by the European Institute of Innovation and Technology in 2010 as legally and financially structured collaborative partnerships between industry and academia.

The chapter encompasses three case studies of these pioneering organizations: Climate-KIC, KIC InnoEnergy, and EIT ICT Labs, which are to bring a qualitative change to operational innovation processes in the areas of climate mitigation and adaptation, sustainable energy, and future information and communication society, respectively. It compares the three KICs' legal setup and governance, their specific network architecture, and three emerging business models. It analyzes how each of the KICs introduces entrepreneurship into the integration of the components of the Knowledge Triangle, to accelerate the velocity of flows in the network and ultimately generate value in its economic and social dimensions.

The last chapter, "Innovation Policies Beyond the Crisis," highlights the role of entrepreneurship as the missing link in the knowledge-driven economies of Europe. It fine-tunes the model introducing entrepreneurship as a missing link in the Knowledge Triangle and implies a multidimensional shift. I discuss entrepreneurship in the context of policy making. Policy can substantially increase probability of success of university-industry collaborative partnership and support or hinder a strategic shift toward a new kind of academic institution, open innovation, and creation of high growth business ventures supported

by venture capital. The chapter illustrates this with the observation of the practices induced by the EIT in the context of European innovation policy. The limitations of the EIT experience are discussed, and a set of policy recommendations is proposed.

The argument put forward in this book suggests that at the core of the renewal of the European economy there is a need for a structural and cultural transformation and the crisis is an opportunity to accomplish such a transformation. The creative destruction prompted by the "invisible hand" phases out obsolete and inefficient models of business practice. The emerging model of value creation rises from the dynamics of the flows of knowledge, talent, and capital in the global innovation network.

In the end, it is a question of identity: Will the young generation of Europeans choose to be entrepreneurs rather than employees? And if so, will they be able to innovate?