CONTENTS

CHAPTER ONE

Introduction and Chapter Outline

NATIONAL AND REGIONAL experiences of rapid growth that lack easy explanations are often casually ascribed to divine intervention. Over two dozen national and regional experiences of rapid growth lacking explanation have been dubbed "miracles." These so-called miracles are unexpected and outside the scope of the conventional market-centric economic paradigm. This book brings several such purported miracles back to earth. It offers an explanation in terms of a production-centric paradigm anchored by fundamental principles of production and business organization. The capability triad is the primary organizing concept.[1] The claim is that we can learn about how capitalist economies function and malfunction from examining cases of rapid growth. The lesson is that there is no divine intervention, just a man-made conjunction of capabilities.

The Capability Triad Thesis: The Argument in Brief

In 1939 the US Army Air Corps had an inventory of 2,500 airplanes. On May 16, 1940, with the fall of France imminent, President Franklin Delano Roosevelt addressed Congress asking for appropriations to increase production, including a request for 50,000 planes within three years.[2] Eighteen months later, the newly designated US Army Air Force still had

1. I coined the term "capability triad" in a report to the Northern Ireland Economic Council (Best 2000).

2. Franklin Roosevelt, "Message to Congress on Appropriation for National Defense," www.presidency.ucsb.edu/ws/?pid=15954.

only 3,304 combat aircraft (Tate 1998). Within four years aircraft production overall totaled 100,000 planes. The American production "miracle" was not limited to aircraft. Between 1935–39 and 1944, US munitions production increased 140 times versus 7 times in Germany, and national output nearly doubled. Over the same period, the nation's labor supply available for production declined by the nearly 12 million men and women, who were absorbed into the armed forces.

What makes the experience interesting is that it involved the crafting and enactment of a development policy that successfully transformed the nation's industrial structure and doubled output in half a decade. New industries were built and others reorganized according to more advanced principles of production and organization. It was a period of unprecedented government investment in research and development (R&D), but an R&D that interfaced with production engineering in companies to develop new productive structures and scale new production processes. The diffusion of innovation processes inside and outside enterprises combined to drive the rapid growth of the American economy.

Conventional economic policymaking was suspended during World War II. Prices were frozen, and macromonetary policies were subordinated to policies geared to the development and diffusion of production capabilities in the nation's business enterprises. Special-purpose "mobilization" agencies were constructed to design and operationalize productive structures to achieve the production goals outlined in the president's vision of an "Arsenal of Democracy."

The policy focus on production capabilities and business organization takes us into uncharted territory with respect to the mainstream economics of policymaking. For example, the World War II policy focus was on the transformation of the nation's production system and the creation of a new set of productive structures to meet the president's output targets. Organizational change and technological innovation were the only means of increasing productivity at a time when increasing numbers of workers were being transferred into the armed forces.

A development policy strategy and a governance structure were designed to organize entrepreneurial activity into a force driving national growth and economic transformation. Here the government was the organizer, and business was strategically reorganized to drive the transformation of production. What were the implications for economic theory, education, and policymaking? They take us beyond the standard paradigm to an emergent political economy framework in which production, enterprise, and governance are systemically interconnected.

The standard paradigm is theoretically rigorous, but its failure to account for the drivers, processes, and enablers of transformative experiences illustrates the limits of the a priori principles to address complex interactive processes in real-world economies.[3] The role of historical experiences as a tool for theory construction and paradigm development signals a methodological divide between the standard equilibrium and the alternative systemic approach to economics and economic inquiry.

This book advances a production-centric economics paradigm that is constructed from an examination of real-world transformative experiences applying systemic observation rather than a priori reasoning to discover economic principles. The historical chapters serve as real-world laboratories for investigating patterns of change and characterizing deep structural principles of production and organization.

The historical case studies do not start from a blank page. They build on earlier work in which I characterized examinations of successful transitions in industrial leadership and economic transformative experiences in terms of a capability triad:

> Rapid growth involves coordinated organizational changes in each of three domains: the business model, production capabilities, and skill formation. The three domains are not separable and additive components of growth, but mutually interdependent sub-systems of a single developmental process. No one of the three elements of the Capability Triad can contribute to growth independently of mutual adjustment processes involving all three elements. (Best 2000, 56)

Figure 1.1 visualizes this interconnectedness.[4] This book applies and extends the thesis with new case studies and a chronologically organized supportive account of the major theoretical contributors to an emergent

3. The standard policy framework assumes a fixed production system. Business organization enters the story, but as an alternative mode of coordination to the market. Competition, regulatory, industrial, and macro/finance policies are all framed by a market-centric concept of the economy in which the economic baseline is an optimal allocation of resources. Government is conceptualized as a substitute optimizer, not an economic organizer, and economic governance is narrowly interpreted.

4. In *The New Competitive Advantage* (2001, 10) I wrote: "Interconnectedness complicates analysis and exposition. The method of analysis deployed in this book is to examine enterprise and regional capabilities from three conceptual viewpoints. We look at them consecutively from a viewpoint that highlights the production system, from a second viewpoint that focuses on business organization, and a third viewpoint that targets skill formation processes. The challenge is to develop conceptual viewpoints that capture both the defining features of each domain and the interconnections that shape and reshape them. Triple vision may be an aid!"

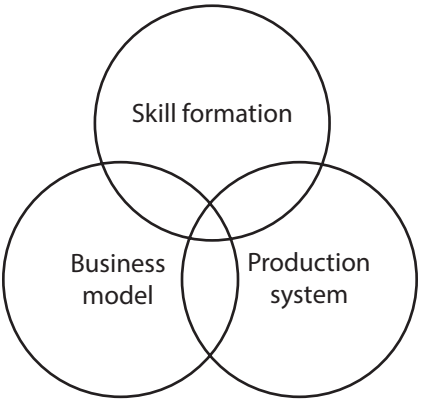

FIGURE 1.1. Capability triad.

economics in which production and business capability development are the critical dimensions of variation and integral to transformative policy frameworks.

The interconnectedness theme has important implications. Policies that address production capability, enterprise growth, and skill formation separately and in isolation will not be successful. As noted, a requirement for transformative policies is that they be seamlessly blended into the detailed mechanics of organizational change within private firms, as investigation of the alleged economic miracles shows. The instruments are not subsidies and taxes to nudge and tweak business behavior but the provision of capability development services by infrastructural agencies outside the firms. Key, too, is the incorporation of business leaders, scientists, and technology experts in the structure of economic governance and their conversion to the desirability of the transformative objectives. When firms, regions, and nations become stuck in low-productivity capability triads, the government may be the only institution that can coordinate and orchestrate holistic organizational change cutting across the three domains.

Furthermore, although enterprise development and economic governance are bound together, they are indirectly mediated by infrastructural institutions in successful transformative experiences. The policymaking spectrum extends to linking developmental infrastructures in ways that advance change within and across mutually adjusting enterprises. The term "economic governance" calls attention to ways in which financial, science and technology, and educational infrastructures can be strategically unified to foster enterprise innovation and cluster dynamic processes at both regional and national levels.

The term "economic governance" is paradigm-specific. From a market-centric perspective it is about regulating transactions not covered by detailed contracts or problems in rule enforcement.[5] In the wake of the financial, fiscal, and economic crises that began in 2008, the EU defines economic governance in terms of "coordination and surveillance of both fiscal and macroeconomic policies and the setting-up of a framework for the management of financial crises."[6] In the production-centric paradigm, economic governance is understood in terms of infrastructural institutions and organizations that galvanize capability triad innovation dynamics.

The policymaking goals go beyond standard macroeconomic stabilization targets to, for example, organize and link developmental infrastructures and processes of change to reduce regional imbalances; transition from declining to new industrial sectors; establish entirely new sectors, as in the United States during World War II; or create and grow the entrepreneurial engines and the cluster dynamic processes required to drive the transition to a post–fossil fuel economy.

The capability triad is a better way to understand how crises can be overcome and robust growth achieved. It is a way to understand how real people react (or do not react) to crises and challenges.[7] Quantitative economic analysis starts with a fixed model (or representation) of the economy as it is today and was in the past. It feeds in anticipated changes in the domestic and international policy environments and examines the impacts of such changes where the structure of the economy is often treated as effectively frozen in time.

It is possible, but not likely, that the transformative experiences described in this book can be interpreted by the economist's standard quantitative models, but despite an abundance of research, not much progress has been made. The alternative production-centric economics paradigm goes some distance toward conceptualizing the otherwise missing production side of the economy, toward capturing the interdependencies of

5. The Nobel Prize for economic sciences in 2009 was divided between Elinor Ostrom, "for her analysis of economic governance, especially the commons," and Oliver Williamson, "for his analysis of economic governance, especially the boundaries of the firm" ("Nobel Prizes and Laureates," www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2009/index.html).

6. "Fact Sheets on the European Union: Economic Governance," www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuId=FTU_4.1.4.html.

7. Richard Bookstaber (2017) gets inside the concept of reflexivity to understand how real people react, or do not, to crises and challenges in a critique of standard economic theory that, in contrast, turns real people into production "inputs" and "rational economic man" to construct a paradigm in which crises are eliminated by assumption.

production capabilities, business organization, and economic governance in real-world economies and thereby toward explaining the success stories and addressing the challenge of designing and executing transformative policy frameworks. These are the claims that the book seeks to substantiate.

The paradigmatic differences go beyond a difference in the axioms to the relationship between models and complexity. The methodological approach that unites all the theorists I associate with the alternative paradigm is the priority given to observation, including case studies and empirical research, as a means of making sense of the complex relationships, institutional structures, and innovation processes of a capitalist economy. Each of the historical experiences examined in the chapters that follow is treated as a real-world laboratory for investigating and characterizing relationships, processes, and institutional forms by which principles and generalizations can be drawn for crafting policy frameworks. Each experience tells us more and subjects previous findings to review.

This research methodology creates a dilemma in terms of presentation. Which comes first, real-world case studies or the conceptual framework used in their interpretation? As noted, systemic observations influence the design of the economics framework, just as observations are chosen, interpreted, compared, and reinterpreted through it.[8] Real-world investigative research and the development of theoretical concepts combine to derive general principles and craft terms by which we observe and make sense of the complexities of capitalist economies. With this methodological caveat in mind, two real-world transformative experiences are chronicled in chapters 2 and 3 before turning to an account of the major contributors to the alternative production-centric theoretical framework in chapter 4. Chapters 5, 6, 7, and 8 apply the capability triad to the postwar economic development experiences of Germany, the United Kingdom, Ireland, Japan, and China; chapter 9 examines changes in the strategic external context for US policymaking with the success of Japan and China's export-led growth strategies. In each case, cross-country comparisons of productive structures and economic systems are used to elucidate economic governance dimensions of the production-centric paradigm.

We now turn to a brief synopsis of the chapters that follow to map the journey by which the real-world analyses and conceptual frame evolve symbiotically together. The goal is to inform policy deliberations at regional

8. Paradigm competition is the battleground for scientific advance (Kuhn 1962).

and national levels with an economics that accounts for the fundamental principles of production and business organization that underlie competitive advantage in the global marketplace.

America's Arsenal of Democracy

In chapter 2 the strategic transformation of the American production system during World War II is examined. President Franklin Delano Roosevelt's vision was to use economic power to build an Arsenal of Democracy that would help the Allies to win the war. The wartime experience serves as an extraordinary but rarely examined laboratory that permits research into the economics and governance of production.

Economic histories that focus mainly on the Federal Reserve Bank and the Treasury obscure the agencies, programs, and policies by which the nation's industrial performance advanced by orders of magnitude. Both fiscal and monetary policies were involved, but they were subservient to the transformation of the nation's productive structures.

Two agencies, among others, pioneered new methods of economic policymaking. The War Production Board (WPB) focused on the measurement, coordination, and transformation of production. Simon Kuznets, chief economist at the WPB, was the author of the Victory Program, by which economic and military strategies were coordinated. The Office of Scientific Research and Development (OSRD), at the center of science and technology policymaking, was led by Vannevar Bush, the institutional architect behind the creation of America's organizational capability to design, develop, and produce advanced-technology weapons systems. These two agencies, in effect, combined to enact a national economic development strategy to integrate mass production with technological innovation. Kuznets was awarded the third Nobel Prize in economics; Bush's *Science: The Endless Frontier* was the foundation stone for what became America's postwar science and technology infrastructure. Together, these two agencies undertook complementary policies that transformed the industrial innovation system and empowered the wartime and postwar growth of the American economy.

Implementation was led by production and business leaders immersed in the process engineering practices for applying the synchronization principle of mass-production, innovative programs to introduce participatory management practices in the workplace, and the economic governance innovations of the multidivisional enterprise. It is within this

organizationally interconnected structure that a major shift in production performance was achieved and new permanent industrial planning relationships linking government, business, and universities were institutionalized.[9]

Greater Boston: A Manufactory of Sectors

Chapter 3 turns to postwar Greater Boston as a real-world laboratory to characterize the origins and complementarity of the productive infrastructures that define the region's industrial innovation system. Business enterprises in Massachusetts do not and never have concentrated on mass production. Nor have they been recognized for process engineering of high-volume assembly production processes. The region has few Fortune 500 companies, yet it leads the nation in R&D, and it has both created and lost more industrial sectors than anywhere in the world. The Massachusetts high-tech economy has the characteristics of an industrial experimental laboratory in which business enterprises, individually and collectively, are organized to pursue strategic advantage based on global leadership in early-stage technology development and rapid new business growth.[10]

The critical input for making these claims is a historical data set of economic information for real companies that includes for each its date of founding, location, employment, and products. Official data are of little help for two reasons. First, the companies are anonymous and ahistorical, and second, the classification categories lack the granularity required to capture changes in enterprise differentiation and patterns of specialization. Critical to the latter are product data screened by an engineering-based taxonomy without which the activities performed by small- and medium-sized companies in a region remain hidden.

The research included the construction of a longitudinal company and product database organized around a finely grained, technology-informed taxonomy. It offers an alternative to the market-centric paradigm that

9. The massive increase in federal R&D funding during World War II laid the institutional foundations of the science and technology infrastructure that enabled the emergence and postwar application of the principle of systems integration in the form of America's regional innovation systems.

10. Our research method is like that used in the empirical studies of revealed comparative advantage first proposed and conducted by Bela Balassa (1965). In these studies underlying comparative advantage is interpreted by the examination of traded product statistics. Instead we use measures of companies and products filtered by a finely granulated technology taxonomy to reveal underlying technological capabilities that impart competitive advantage to firms in the region.

holds technology and product definition constant and allows prices and quantities to adjust. The alternative accounts for the opposite. Firms compete by establishing a distinctive capability to develop new products and improve performance.[11]

The proposition guiding the research is that regionally distinctive production and technology capabilities are collectively and cumulatively advanced over time. Although intangible, these capabilities are embedded in the industrial processes and deep craft skills of a region and manifest in specialized groups of companies and the products they design and develop. They constitute a regional resource legacy that can be leveraged by today's companies. We seek to discover legacy technological capabilities and technical expertise that, although intangible, impart locational advantage by screening with an engineering-differentiating taxonomy.

Firms do not develop and conduct business in isolation. The population of enterprises is embedded in a regional industrial ecosystem that facilitates constant reshuffling of the region's expertise, technology capabilities, and financial resources and enables not only a single company but groups of companies to grow fast. The concept of a regional industrial ecosystem suggests an analogy to Darwin's small area in which a "manufactory of species" is active, here applied to the emergence, co-adaptation, and growth of diverse sectors. A common pattern of rapid new sector development is outlined.

The capability of Greater Boston's industrial ecosystem to foster the emergence and rapid growth of new sectors is characterized in terms of developmental infrastructures. One example is the region's place within the national science and technology infrastructure, described by Henry Etzkowitz (2002) as a triple helix linking federally funded basic research, research-intensive universities, and technologically driven enterprises. A second example is a combined private and government financial ecosystem that supported and co-evolved with the rapid growth of new high-tech firms. A third is the region's legacy of tool-, instrument-, and equipment-making small firms that have co-evolved with the production capabilities of downstream firms to pursue product-led competitive strategies. A fourth is a skill formation system funded and organized at different levels of government but collectively operating as an informal strategic industrial policy.

11. The exclusive price and output adjustment assumptions of both formal models and blackboard economics become irrelevant if no two firms supply the same product and if we assume that all firms do not have the same product development and technology management capabilities.

The Massachusetts business system has itself been transformed by an interactive dynamic localization and globalization process. When the minicomputer companies were being built in Massachusetts, the prevailing business model was one of vertical integration and integral product architecture. The opportunities for globalization shifted the pressures in favor of an open-system business model that advanced the Greater Boston's distinctive capabilities in early-stage technology development, complex product systems, and new sector creation.

Globalization meant that large investments in high tech could generate returns by leveraging technology platforms with offshore production, marketing, and sales facilities. In many cases, much of the enterprise growth in employment is out of state and offshore, and much but not all is outsourced. Nevertheless, the crown jewels of a company, its technology platform, design, and development engineering expertise as well as its early-stage manufacturing capability, remained rooted in Massachusetts. This was not simply for control or governance purposes, important as they are, but because of the region's unique industrial ecosystem, which is a nontradable resource leveraged by locally based technology-developing business enterprises. As we will see in chapter 7, the Industrial Development Authority of Ireland seized the opportunity to drive a development policy framework based on attracting such enterprises to establish production platforms in Ireland for export to Europe. It was a mutually beneficial strategy linking two regions within a single production system.

The Capability Triad: The Theoretical Legacy

Chapter 4 takes a conceptual turn, shifting attention from historical experiences to an extensive but largely ignored legacy of theoretical contributions to an economics of rapid growth and innovation dynamics. Although the dominant economics paradigm is supported by a huge base of research and knowledge, it cannot provide a consistent account of rapid growth experiences. If such accounts had fit easily within the standard framework, they would have been readily available and lessons for policymaking would have been drawn. Divine intervention would be less frequently cited to explain doubling of output in half a decade and an ability to transition to new sectors as others decline.

The strength of the mainstream is the core theory of exchange in the marketplace; the weakness is that it does not account for either productive structures or economic governance. If the goal is to understand productivity, competitiveness, transformation, and growth, it is better to start

with a theory of production and work from there to understand exchange relations, but the standard paradigm does the opposite and, in the process, characterizes the sphere of production in terms of exchange relations.

Adam Smith is the starting point of both the standard market-centric and the alternative production-centric paradigms. Yet Smith's vision of economic progress was not restricted by the assumptions of constant returns to scale, unchanging technology, and universal markets of today's standard paradigm. Either diminishing or constant returns to scale have persisted as the standard model of production. Many technically creative justifications of and accommodations to the assumption of diminishing returns have been proposed, but the denial of increasing returns persisting at the core of the market-centric paradigm collides with evidence from the real world. Although both the standard and the alternative perspectives began with Adam Smith, they diverged with David Ricardo. Ricardo introduced diminishing returns to production to construct a logical theory of comparative advantage and became the exemplar of how to build a simple, timeless, closed, and elegant theoretical model of the production side of the economy.

The difficulty of incorporating increasing returns into formal models has been known since Ricardo despite the shifting of its source from land to capital to management. But all such efforts tend to collapse dynamics into a single proxy variable such as management talent, although in fact the sources of increasing returns are multiple and complex.

Charles Babbage is the pioneer of the alternative paradigm in which innovation and technological change are at center stage. Published in 1832, Babbage's *On the Economy of Machinery and Manufactures* was a conscious attempt to provide an alternative to the views of David Ricardo, the standard bearer of the political economy of his times. Babbage went beyond Smith's rhetorical pin factory to explore the interiors of the most technologically innovative enterprises of his day. The knowledge Babbage gained from systemic observation of the real world, like that of his fellow natural philosophers, laid the foundations for an emergent political economy characterized in terms of fundamental principles of production and business organization.[12]

12. Babbage's pursuit of principles of change was an application of the systemic observation approach to scientific progress being advanced by his fellow natural philosophers at Cambridge University. The pursuit of systemic-observational principles of change united the emerging sciences of evolutionary biology, geology, and astronomy. In the case of political economy, scientific investigation started with observation of production in workshops

Whereas the classic texts of the standard paradigm construct logical models by hard thinking in advance of addressing real-world complexity, Babbage approached complexity by systemic observation to characterize fundamental principles of change. His observation-based perspective continues to thrive in most scientific disciplines but is unfortunately rare in economics, particularly in the study of production, business organization, and technology.

Joseph Schumpeter paid tribute to Babbage's book more than a century after its publication as follows:

> This work which was widely used (also by Marx), is a remarkable performance by a remarkable man. Babbage . . . was an economist of note. His chief merit was that he combined a command of simple but sound economic theory with a thorough first-hand knowledge of industrial technology and of the business procedure relevant thereto. This almost unique combination of acquirements enabled him to provide not only a large quantity of well-known facts but also, unlike other writers who did the same thing, interpretations. He excelled, amongst other things, in conceptualization, his definitions of a machine and his conception of invention are deservedly famous. (Schumpeter 1954, 541, cited in Hyman 1982, 121)

Babbage replaced Ricardo's law of diminishing returns with innovation-driven increasing returns to scale. Alfred Marshall's *Principles of Economics*, first published in 1890, extended Babbage's ideas into an emergent theory of industrial organization.[13] In a celebrated passage, Marshall described economies arising from an increase in the scale of production as falling into "two classes—those dependent on the general development of the industry, and those dependent upon the individual houses of business engaged in it and the efficiency of their management; that is into *external* and *internal* economies" (1920 [1890]: 266, repeated on 314; Marshall's emphasis). He wrote that external economies "result from the growth of correlated branches of industry which mutually assist one another" (1920 [1890]: 317). With the inclusion of organization and interfirm dynamics as variables, Marshall's "law of increasing returns" introduces a growth

and factories in which engineering practices were most innovative and change was most dramatic.

13. In Marshall's words, "The *law of increasing return* may be worded thus:—An increase of labour and capital leads generally to improved organization, which increases the efficiency of the work of capital" (1920 [1890]: 318, Marshall's emphasis).

dynamic of cumulative increasing returns later advanced by Allyn Young and Gunnar Myrdal.

Edith Penrose's *Theory of the Growth of the Firm*, published in 1959, characterizes internal economies of expansion in terms of an iterative technology capability and a market opportunity learning dynamic that drive the innovation process. Although Penrose identifies the source of value and knowledge creation within a firm, the capability development paradigm she pioneered anchors and complements the interconnectedness of engineering-focused production principles and a manufacturing systems framework as sketched by Babbage. Similarly, Penrose's concept of a technology base and her entrepreneur-driven knowledge creation dynamic are enriched by Babbage's focus on production principles.

George Richardson's theory of interfirm specialization and differentiation dynamics extends Penrose's internal capability development process to networked groups of mutually adjusting firms. Real-world examples of open-system focus-and-network, business models that have proven innovative and globally competitive, include those of Greater Boston, the "Third Italy," and Germany's *Mittelstand* (all discussed later). No longer is product and technological innovation the preserve of enterprises operating within oligopolistic market structures.

Jane Jacobs's *Economy of Cities* was published in 1969. But it was not until her work was referred to by Robert Lucas in his paper on "endogenous growth theory" titled "On the Mechanics of Economic Development" that it came to be acknowledged within the economics profession. Lucas argued that this "remarkable" book was "mainly and convincingly concerned . . . with the external effects of human capital" (1988, 37). For Lucas, human capital has two special features: first, unlike physical capital, it does not suffer from decreasing returns, and, second, a higher level of human capital in an economy raises the level of productivity of everybody in that economy, not just the productivity of those whose human capital is higher.

Jacobs has a different agenda. She asks the questions: Why do cities grow? Why have today's major cities undergone a period of explosive growth? Why do some cities continue to grow over a long period, while others go into decline? She examines cities historically, giving special attention to cases of rapid growth to discover patterns of complex interactions in their most pronounced forms. She sees cities as the engines of economic advancement, providing markets, jobs, capital, and technology for themselves, the regions around them, and other cities as well.

Rather than celebrating economic efficiency, Jacobs celebrates a city's growth dynamics as expressed in the rate of addition of new goods and

services. Sustained city growth is simultaneously a process of increasing differentiation of skills and an experimental process of new product development and sector evolution. In her words: "Existing divisions of labor multiply into more divisions of labor by grace of intervening added activities that yield up more sums of work to be divided" (Jacobs 1969, 58). The "intervening added activities" are described in terms of new "work" combined with multiple trials and errors linking the old to the new divisions of labor. The increasing differentiation in skills increases the opportunities for innovation and for sustained city growth.

Jacobs offers rich language such as "symbiotic nests of suppliers and their markets" (Jacobs 1984, 76) and "lateral interrelationships" to characterize Darwinian-type mutual adjustment processes. But whereas both Jacobs and Penrose extend the fundamental principle of the division of labor into ongoing differentiation processes, Penrose's capability development axioms substantiate a theory of entrepreneurial firm activity that drives the innovation process.

Jacobs is to the city what Penrose is to the firm and Babbage is to production in the emergent alternative paradigm. Each of the three theorists provides a unique and powerful conceptual framework that casts light on an otherwise hidden domain of economic life ignored at great cost in the standard paradigm. Together they expose interactive links that underlie innovation dynamics, technological change, and growth processes.

However, an economics of production, business organization, and skill formation is not sufficient to explain rapid growth experiences. The historical accounts of such experiences emphasize the strategic role of economic governance in galvanizing change within and across firms to reorganize according to world-class production and organizational principles. The governance role involves crafting a strategic policy framework that links development objectives, organizational means, and implementation measures. The capability triad is a heuristic device that unifies and integrates the interactive connections "discovered" by the theorists outlined in chapter 4. It assists policymakers to craft and coordinate infrastructures to meet the challenges of economic transformation.

Germany's Social Market Economy

Most commentary on the divergence in economic performance between the successful center and the periphery countries of the EU has been conducted in terms of market competitiveness: labor market flexibility, government regulation, and the efficiency of state versus private ownership

of public utilities. Here the term "competitiveness" connotes a model of the economy in which a downward adjustment in costs and prices causes a nation's productive enterprises to become more competitive, its trade balance to improve, and its economy to grow.

In chapter 5 as well as in the following two chapters, the divergence in economic performance in three different EU states is explored in terms of business system capabilities and institutions of economic governance. The central finding is that in the core northern economies an entirely different production system has evolved from the peripheral, mainly southern, economies of Europe. The difference is revealed by the existence of a plethora of globally competitive, technologically advanced, mid-sized firms in Germany, Austria, Denmark, Finland, the Netherlands, and Sweden in contrast to a paucity in the peripheral economies.

Germany is the most successful large economy in Europe. The German business system does not fit either conventional theoretical models[14] or the historical experience of other industrialized countries. Known as the *Mittelstand*, a population of small and medium-sized, largely family-owned business enterprises, constitutes a business model that predates German unification in the nineteenth century and has persisted through the political revolutions of the twentieth century up to the present. Today more than three million small and mid-sized enterprises—that is, companies with fewer than 500 employees and annual sales of less than €50 million—together employ over 70 percent of German workers and generate roughly half of the country's gross domestic product (GDP) (Frenkel and Fendel 1999).[15]

The numbers of small- and medium-sized enterprises (SMEs), however, are not the issue; it is what they do. Specifically, it is the prevalence of enterprises with production capabilities geared not only toward a distinctive and well-engineered product but toward new product development, technology management, and continuous innovation. These are the organizational capabilities that enable enterprises to engage in Schumpeterian competition, to pursue strategies aimed at superior product, process,

14. Models such as that produced by the neoclassical theory of the optimizing firm and the assumption that all firms have immediate access to the same technologies and production functions.

15. Frenkel and Fendel (1999) classify firms as follows: micro enterprises (up to 9 EEs), small enterprises (10–99), medium enterprises (100–499), and large enterprises (500 or more EEs). They report that one in 500 was large in Germany and one in 140 in the United States and that the contribution of medium-sized enterprises to turnover was 24.4 percent in Germany and only 13.9 percent in the United States in 1992.

technology, and/or organization. They are the organizational requirements of entrepreneurial firms that enable them to create value, increase productivity, and support high-paying jobs and upon which enterprise and regional and national competitive advantage depend.

The case study of Germany draws upon and resonates with the characterization described in chapter 3 of the productive structures that constitute the regional industrial ecosystem of Greater Boston. In both economies we find localized networked business systems in which firms focus on core capabilities and form partnerships for complementary capabilities. But the adjustment dynamics among firms that make up the *Mittelstand* are not characterized by high rates of enterprise population churn, as in Greater Boston.

There are differences, too, with respect to economic governance functions. In the German economy, the regional government's stewardship role is pronounced, widespread, and linked to the federal government's production-centric model of macro/financial policymaking. From the structural competitiveness perspective, success in economic development results from combining the right production perspective with policymakers who refrain from destabilizing the macro economy. Erratic macro/financial policymaking undermines the preconditions for the successful development of the production system. At the same time, the notion that development is generated as a direct result of macro/financial policy cleverness is wishful thinking.[16]

The concept of economic governance calls attention to three levels of economic stewardship: those within the enterprise and within both regional and national government. The unified triadic competitiveness structure of the German economy is not unique in the EU. It distinguishes the articulated capability triads of the much smaller social market economies of the Nordic countries from the fragmented capability triads of the peripheral economies of the EU and the United Kingdom.

The German economic governance model has three distinctive and mutually reinforcing characteristics missing in the United Kingdom. First, the balance between central and regional economic governments is organized to capture the benefits of operational decentralization combined with national-level strategic policymaking for economic performance. The

16. Awareness of the limits of neoliberal macro and fiscal stabilization policies as development policy in the IMF was announced by IMF economists in a series of articles in the mid-2010s (Ostry, Loungani, and Furceri 2016, 38–41).

central government legislates the standard development infrastructure, both intangible and material, by which regional governments can craft localized economic policy. The German nation's science and technology infrastructure, along with its vocational education system, corporate governance laws, and its financial institutions, provides inputs into regional strategic policymaking. Regional governments have the power to convene and thereby build the interrelationships among enterprises, agencies, and agents required to have the crew on board to manage both the flight and the landing safely.

Second, Germany built a dual educational system to create a skilled labor force and provide technical expertise on the scale necessary to transform the nation into an industrial power by the late nineteenth century. The history of Germany's vocational training had its origins in the guild system, whereby craftsmen organized the process of qualifying to become a journeyman and progressing to a master. It evolved through a series vocational training acts from 1869 up to the present time.[17]

Third, the German model of macro/financial policymaking is production-centric. Macroeconomic stabilization policymaking is subservient to the establishment of the capability development measures needed to advance production performance. Erratic macro/financial policymaking undermines the preconditions for successful development in all regions. As noted, the notion that development of production capabilities is generated as a direct result of macro/financial policy guile is absurd.

Capability Triad Failure: The United Kingdom

In chapter 6 we apply the capability triad concept to the industrial experience of the United Kingdom. Although it was the first country to undergo an industrial revolution, it was not successful in maintaining its leadership. Economic historians tell us that by the mid-nineteenth century US manufacturing productivity in terms of labor hours was nearly twice that of the United Kingdom, and by the turn of the century Germany was the leader in the emerging electrical and chemical industries, the leading sectors of the second industrial revolution. The United Kingdom has never overcome a substantial productivity gap in manufacturing.

17. "Vocational Training 'Made in Germany': Germany's Dual System of Vocational Education and Training," www.gtai.de/GTAI/Content/EN/Invest/_SharedDocs/Downloads/GTAI/BLG/blg—most-wanted—dual-vocational-training-in-germany-pdf.pdf?v=4.

Could it have been different? The capability triad takes us inside the production system to examine mutual adjustment processes linking production capabilities, business organization, and economic governance. The decline of British industry is traced to capability triad fragmentation at a time in which other nations were pursuing development frameworks fostered by articulated support infrastructures.

The starting point is production. Three branches of the UK car industry are examined: the traditional road-car companies, the Formula 1 race-car cluster, and the production units of foreign-owned enterprises. The first could have led a transformation in UK industry to meet international performance standards but failed to do so and collapsed in the 1970s. The failure over decades to acknowledge, reorganize, and transition to productive structures based on fundamental principles of interchangeability, flow, and system integration is the single reason for the historic low performance standards and low productivity of much of British industry.

The second and third sectors are also interesting but for different reasons. They are globally competitive but do not have a macro-scale impact on business development and operate independently of the national industrial ecosystem. The scale of the racing car cluster known as Motor Sports Valley is too small to have a macroeconomic impact. With respect to high-volume affiliates of foreign multinational enterprises, the production facilities are extensions of their home-base capability triads. Unlike production facilities, capability triads and economic governance systems cannot be imported or exported.

The car industry looms large in UK industrial history owing to the potentially positive impact of performance capability on the nation's component supply base and machine tool sectors (tooling, instruments, and equipment making). Both subsectors are important because of the contribution of a technically skilled supply base to a rapid ramp-up of growth opportunities and that of a precision engineering machine tool industry to the new product development and technology management capabilities of all final goods producers. In these roles the specialist component and machine tool sectors perform an infrastructural role to enable a nation's business system to engage in product-led competition. The failure of UK car companies to organize according to the principles of interchangeability and flow had the opposite effect on the nation's component and machine tool sectors, which had little reason to meet the ever more demanding precision engineering performance standards of their functionally equivalent sectors in the United States and Germany.

A nation's skill formation system is equally integral to building and maintaining the nation's structural competitive advantage. A highly skilled labor force is a productive resource to the nation's business enterprises. It enables product-led competition, innovation, and the rapid growth of emergent sectors. Examples of German and US historical experiences are described in which government policymakers have constructed educational institutions and undertaken timely and strategic investments in sync with the quality and quantity of skills demanded by innovative, repositioning, and growing enterprises and complete sectors.

The experiences of rapid growth highlight the critical importance of strategic frameworks that recognize the mutual interdependencies of production capabilities, business system performance, and skill formation institutions. The historic failure of the United Kingdom to address its skill formation shortcomings, combined with industrial decline, consigned a growing proportion of workers to structural unemployment or underemployment in the 1980s and 1990s and more recently to the gig economy, recently described as a growing "precariat."

The deep structural sources of innovation and productivity are hidden from view by the theory and measures of technological progress and by the "factor" productivity of the standard paradigm that has informed British economic policymaking. In fact, governments in the United Kingdom have undertaken more industrial strategies than anywhere else in the world, but they have all failed to address the interdependencies that link production, business, and governance to unified intangible infrastructures. The final section of chapter 6 backs the claim with examples of policymaking that, by commission or omission, either failed to arrest industrial decline or failed to identify opportunities to do so.

Ireland: A Divided Economy

Ireland, with a much smaller economy than that of the United Kingdom, provides a historical experience that permits a comparative examination of development policy frameworks. Following a failed period of economic protectionism betweem 1932 and 1960, the Industrial Development Authority, established in 1949 by the Irish government, designed and implemented an industrial strategy that attracted many of America's leading information technology and life science companies to make Ireland an export platform to service the European marketplace. These multinational enterprises (MNEs) established branch plants organized around world-class manufacturing practices for volume manufacturing.

The Irish government combined a set of enabling tax and financial incentives with the creation of educational and transportation infrastructural investments to implement the strategy.[18] The foreign enterprises proved to be engines of growth that propelled employment growth from under 1.4 million in the 1980s to over 2.0 million in the early 2000s. This was and remains an extraordinary success story in which the nation was transformed from one of the poorest to one of the richest in Europe.

However, no one foresaw the post-2007 unfolding of events. In record time a property bubble burst, a vast construction industry collapsed, and the nation's banks, which had acquired massive international debts, were suddenly insolvent and their obligations transferred to Irish taxpayers. The Irish Stock Exchange general index, which reached a peak of 10,000 points in April 2007, fell to 1,987 points in February 2009. There was an abrupt return of the centuries-old tragedy of Ireland: mass outmigration.

In chapter 7 we examine Ireland from a perspective of dynamic capabilities to better understand both the country's success and its subsequent economic crash. The lessons learned from the successful growth experiences in the earlier chapters are distilled to examine the Irish boom. The journey takes us inside the organizational dynamics of enterprises and development policy frameworks on both sides of the border between Ireland and Northern Ireland, which remains part of the United Kingdom.

We start with a striking and perhaps distinctive feature of Ireland's economy exposed by the Great Recession. Ireland is a nation of two economies that internally mirrors the EU split between core and periphery economies. Although the core economies have been relatively resilient, the peripheral economies have suffered. The foreign-owned high-tech economy of Ireland has been largely unaffected, while the indigenous business and production system has suffered a decline in activity similar to that experienced by peripheral economies of Europe.

The business and production systems of both the indigenous and foreign elements of the economy are examined. A study of border counties of Ireland and Northern Ireland reveals isolated entrepreneurial firms but virtually no interfirm cluster dynamic processes and enabling infrastructures that foster the enterprise and regional production capability development upon which competitive advantage depends.

18. It should be noted that the availability of generous EU development assistance, in terms of Structural Funds, greatly facilitated the later stages of the "real" Celtic Tiger advance. Yet, in the words of John Bradley, "It is sobering to reflect that the cost of the bank bail-out of recent years greatly exceeded the totality of Structural Funds received over the period 1989–2013" (Bradley 2013).

Clusters are important in part because emergent cluster processes offer governments a range of instruments for shaping entrepreneurial activity within business systems without risking the creation of a co-dependent business culture, which has become an unfortunate feature of industrial policy and business organization on both sides of the Irish border. An examination of Ireland's clusters of foreign high-tech branch plants reveals the same absence of entrepreneurial firm and cluster-dynamic processes critical to domestic entrepreneurial firm emergence, growth, and proliferation. The capability difference between foreign and the indigenous business units is that, with few exceptions, only the branch plants of MNEs operate world-class production facilities.

However, production capabilities alone do not make an entrepreneurial firm. Both the foreign and indigenous sides of Ireland's business system lack new product development and technology management capabilities. This finding transcends the division in Ireland's national development policy framework between foreign and indigenous business and production systems.

New Production Systems: Japan and China

The last quarter of the twentieth century witnessed a fundamental change in the global context with the emergence, first, of the rapid-growth Japanese economy followed by the four "tiger" economies of South Korea, Taiwan, Hong Kong, and Singapore and, second, of the Chinese export-driven rapid-growth economy. Both rapid-growth experiences are examined in chapter 8 from a production-centric perspective. Japan's success came from building a production system that established new performance standards in cost, quality, and time. The new system is organized around the principle of multiproduct flow and a continuous improvement model of work organization. The new business organization supported a competitive advantage in new product development, technology management, and incremental innovation capabilities. Strikingly, the new production capabilities enabled Japanese enterprises to use America's advanced-technology innovation capability in pursuit of product-led competition. American mass producers were organizationally ill equipped to convert the nation's advanced science and technology infrastructure to commercial applications.

China, in contrast, constructed a policy framework that included attracting foreign direct investment (FDI) in the form of global production networks organized by foreign-headquartered enterprises. The strategy

fostered the offshoring of manufacturing by US multinational enterprises. The offshore production facilities of US corporations located in China replaced the onshore manufacturing of the same companies.

A measure of the magnitude of the transition is the increase in the percentage of China's foreign trade (exports plus imports) to GDP from 10 percent in 1978 to 67 percent in 2006. The pace of transformation in economic activity across a nation of nearly 1.4 billion people remains virtually incomprehensible. Its impact on economic activity in the rest of the world can no longer be ignored.

America's Fragmenting Capability Triad

Chapter 9 examines the postwar evolution of the US economy starting with the consequences of the establishment of America's Arsenal of Democracy. The nation's production system was permanently transformed by the creation of an industrial planning system and a national science and technology infrastructure. The interrelationships linking the nation's production and business systems and institutions of economic governance were permanently altered.

President Eisenhower's "Farewell Address to the Nation" famously warned of the unwarranted powers of a military-industrial complex that threatened democratic institutions. At least in the case of Greater Washington's economy, Eisenhower's warning has been borne out. It is a regional economy based on the postwar establishment of a government-contract business culture dominated by about a half-dozen permanent prime contractors (Ceruzzi 2008).

America's postwar policymakers have not responded to the challenge to the nation's manufacturing base of the emergence of Japan, the four "tigers," and China. The manufacturing employment share of the US economy has declined steadily, from nearly 25 percent in 1970 to 9 percent in 2011. Although America's leadership in science and technology and in regional innovation systems such as those of Silicon Valley and Greater Boston remains, the threats to manufacturing capabilities put America's industrial future at risk.

What can a busy person who invests time in reading these chapters learn? Economic growth, development, and good job creation are shown not to depend on divine intervention. The cases explored are not miraculous episodes of unusual economic beneficence. Nor are they the result of especially deft manipulation of macrofinancial policies instruments. Instead they can be understood in terms of an analytical framework with a

sharp focus on three core elements—production system, business organization, and governance—and their interconnections. Interconnectedness is pivotal for understanding how strategic policy frameworks impact economic performance and how building on them is essential for successful policy. The lesson of this book is to highlight the importance of thinking in terms of the capability triad.

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