

# Entrepreneurship and Innovation in Second Tier Regions



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Cheltenham, UK • Northampton, MA, USA

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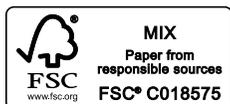
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Published by  
Edward Elgar Publishing Limited  
The Lypiatts  
15 Lansdown Road  
Cheltenham  
Glos GL50 2JA  
UK

Edward Elgar Publishing, Inc.  
William Pratt House  
9 Dewey Court  
Northampton  
Massachusetts 01060  
USA

A catalogue record for this book  
is available from the British Library

Library of Congress Control Number: 2011930991



ISBN 978 1 84720 359 5

Typeset by Servis Filmsetting Ltd, Stockport, Cheshire  
Printed and bound by MPG Books Group, UK

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# Acknowledgements

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This book is about two of my favourite questions in economic geography: why do certain regions develop entrepreneurial and innovative economies, and how can policymakers support knowledge-based economic development? In order to answer these questions, one needs to develop an in-depth understanding about a region's peculiar strengths and weaknesses. Through this study of three second tier high-tech regions in the United States, I had the opportunity to gain such an understanding. I do not know whether the answers I give in this book shed the right light on the questions and whether they are sufficiently developed to help policymakers understand the complex dynamics of regional economic development. However, I continue to be fascinated by the ability of certain regions in the world to capture entrepreneurial and innovative dynamics.

I grew up near Stuttgart, Germany, and I spent many summers working for small and medium-sized firms that were part of Baden-Württemberg's industrial districts. I became intrigued by the region's economic development and during a seminar at the University of Konstanz as an undergraduate I developed a keen interest in understanding the drivers of economically successful regions like this. I continued my studies as a Masters and Ph.D. student in the US, and as a graduate research assistant at Portland State University's Institute of Metropolitan Studies I had the good fortune to work on several applied research projects about Portland's economy. Through this work, I gained insights into regional economic development which culminated in a dissertation about the evolution of the high-tech economy in the Portland region. While working at Virginia Polytechnic Institute and State University (Virginia Tech), I had the opportunity to expand this research and examine two more regions (Boise, Idaho, and Kansas City, which straddles the Kansas-Missouri state border). Through these comparisons I was able to reflect on each region's growth. I am now working as a Professor of Economic Geography at the University of Bern in Switzerland and I continue to study regional development issues in the US. Writing this book has given me the opportunity to develop some preliminary answers to my initial questions and discover additional questions that I look forward to exploring in the future.

Researching and writing this book would not have been possible without the help of many colleagues and friends. My advisers at Portland State University deserve many thanks: Professors Carl Abbott, Sy Adler, Robert Daasch, Robert Liebman, Ethan Seltzer, and the late Craig Wollner supported me during the dissertation. I also had the privilege of working with economist Joe Cortright on a variety of research projects about Portland's regional economy. During my time at Virginia Tech, colleagues such as Paul Knox and Robert E. Lang shared with me invaluable insights about metropolitan growth patterns in the US. My graduate research assistants at Virginia Tech provided much needed research support: David Bieri, Shana Johnson, Seth Peery, and Roger Zalneraitis – you rock! A special thank you goes to David Bieri, who was instrumental in developing the quantitative analysis presented in Chapter 3. I also owe thanks to Stuart Armstrong who visualized the spin-off activities presented in Chapters 4 and 5. Other friends and colleagues offered valuable comments, including Ron Boschma, Jennifer Clark, Maryann Feldman, Ed Feser, Darrene Hackler, Ned Hill, Chris Hoene, Britta Klagge, Nicola Lowe, Ann Markusen, Sheila Martin, Philip McCann, Max-Peter Menzel, John Provo, and Greg Schrock. I would also like to thank Bruce Katz, Jennifer Vey, and Howard Wial at the Brookings Institution. They allowed me to develop the Kansas City case study and the comparative study of all three regions for two publications with the Brookings Metropolitan Policy Program (Mayer, 2006, 2009a). Special thanks to Hilary Russell who edited the book and to Alan Sturmer, who as Executive Editor at Edward Elgar Publishing supported this book project. I would also like to thank the numerous experts who took the time to meet with me and share their knowledge and experiences about their firms, industries, and regions.

**Heike Mayer**  
March 2010  
Bern, Switzerland



# 1. Introduction

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‘Starting a cluster involves, first, building the economic fundamentals for an industry or technology, and second, finding the spark of entrepreneurship to get going.’

Bresnahan, Gambardella, and Saxenian (2001: 842)

‘In a world of dramatically improved communications systems and increasingly internationally mobile corporations, it is puzzling why certain places are able to grow relatively rapidly as well as sustain their attractiveness to both capital and labor. Movement is, of course, costly and disruptive to both. Harvey’s (1982) work on capital’s need for “spatial fix” and Storper and Walker’s (1989) work on labor and reproduction suggest generic reasons why hypermobility cannot completely obliterate production ensembles in space. But neither account explains why certain places manage to generate, attract, and anchor productive activity while others do not. Why, in other words, do some cities achieve “second tier” status and successfully challenge primate cities while others do not?’

Markusen, Lee, and DiGiovanna (1999: 21)

For much of the twentieth century, the rise and subsequent success of Silicon Valley as the world’s leading high-technology centre has captured the attention of researchers and policymakers. Indeed the region’s prowess is obvious: Silicon Valley boasts the highest concentration of high-tech workers of any metropolitan area in the US and captures the largest share of risk capital invested in new business ventures. Silicon Valley evolved as a network-based industrial system that allowed its regional economy to adjust to economic downturns. As a result, numerous Silicon Valley-based entrepreneurs create revolutionary technologies, and the region’s industries continuously evolve and reinvent themselves. Yet, high-tech development has spread beyond Silicon Valley, and other regions are emerging as vibrant, innovative and entrepreneurial high-technology locations. These regions represent second tier high-tech regions. While they often lack a nearby world-class research university – which is often thought necessary for high-tech development by policymakers and academics alike – or large amounts of venture capital, they do host large firms that take on the role of ‘surrogate universities’. In this function, they attract and develop highly specialized and skilled *talent*, they create and commercialize cutting-edge *innovations*, and they function as incubators for *spin-off* firms. Second tier high-tech regions develop unique specializations and competitive advantages.

This book illustrates how three metropolitan areas in the US – Portland, Oregon; Kansas City, Kansas-Missouri; and Boise, Idaho – have emerged as second tier high-tech regions without the presence of a major research university. These three regions have significant concentrations of high-tech industry activity. Relative to their size and location, they are highly innovative and entrepreneurial. In each region, large firms that functioned as ‘surrogate universities’ built critical corporate assets that led to the development of unique industry specializations. Intel, for example, opened its first branch manufacturing facility in Portland in 1976 and has since then expanded it into a state-of-the-art manufacturing process development facility for semiconductor production. Consequently most of Intel’s innovations are ‘made in Oregon’. During the 1990s, the majority of Intel’s patents were assigned to Oregon-based inventors. Hewlett-Packard relocated its printer division to Boise in 1973. Its trademark product, the laser printer, was developed in Idaho, not in Silicon Valley. Kansas City is a highly specialized life sciences centre that hosts a cluster of contract research organizations and firms in the animal health industry which, combined, capture major parts of the world’s leading animal health market. The three regions stand out because in addition to building these corporate assets, state and local policymakers are developing unique policies to link universities with industry, facilitate entrepreneurship, and support the commercialization of knowledge.

Portland, Boise, and Kansas City are different in several ways from such large, well-known high-technology centres as Silicon Valley and Boston. Smaller and somewhat less specialized in high-tech industries, their businesses do not attract large amounts of venture capital and spend less on research and development. Each second tier region is uniquely specialized in a subset of high-tech industries. Portland is known for its concentration in high-tech manufacturing, particularly test and measurement equipment, semiconductors, and computers. Boise specializes in computer peripherals and semiconductors, and Kansas City specializes in pharmaceutical manufacturing and development, contract research and animal health sciences. Table 1.1 compares the three case study regions with two prominent high-tech centres, Silicon Valley and Boston’s Route 128. While all three second tier high-tech regions are significantly smaller in terms of high-tech employment, they do specialize in high-tech as indicated by the location quotient measure. Relative to their size and extent to which they have a high-tech employment base, they do show positive measures in terms of entrepreneurship. In addition, Portland and Boise are about as inventive as Boston, measured by patenting activity (Table 1.1).

What is responsible for the success of these second tier high-tech regions? Case studies reveal a model of high-tech regional development

Table 1.1 Comparison of high-tech regions

High-tech activity indicator	Portland	Boise	Kansas City	San Francisco-San Jose (combined)	Boston
<b>High-tech industry</b>					
High-tech employment, 2005	58 646	18 969	49 918	375 413	218 392
Number of high-tech firms, 2005	5614	1335	4850	23 003	14 357
High-tech location quotient, 2005 <sup>1</sup>	1.35	1.76	1.14	3.27	1.96
<b>Entrepreneurship</b>					
Total number of high-tech firm births, 1998–2000	24	23	71	622	297
Venture capital deals per 1000 people, 2000–5	6.2	1.0	2.2	58.1	35.5
<b>Innovation and research</b>					
Total industry R&D funding, 2000–5 (millions of dollars)	\$2087	\$506	\$662	\$44 862	\$26 422
Total university R&D funding, 2000–5 (millions of dollars)	\$123	\$42	\$163	\$10 480	\$7930
Patents per 1000 people, 1990–99	260	24	40	2126	223

*Notes:* 1. The high-tech location quotient, a measure of the extent to which a metropolitan area is specialized in high-tech industries, is the ratio of the percentage of a metropolitan area's employment that is in high-tech industries to the percentage of nationwide employment in those industries. A location quotient above 1.00 indicates some degree of high-tech specialization, and the higher the location quotient the greater the metropolitan area's high-tech specialization. I define high-tech industries as those that Daniel Hecker of the Bureau of Labor Statistics classified as 'Level I' high-tech industries, that have the highest percentages of their nationwide employment in such technology-oriented occupations as engineers, technicians, life and physical scientists, engineering and natural science managers. In general these industries group broadly into biotechnology, information technology, high-tech manufacturing, high-tech services, and research and development (R&D) (see Hecker, 2005).

*Source:* Author's analysis of data from County Business Patterns, US Census, Small Business Administration, National Science Foundation, and US Patent and Trademark Office.

that is fundamentally different from Silicon Valley. By serving as ‘surrogate universities’, their firms were able to develop leadership and market dominance in their respective industries. Their research and development efforts sometimes spilled over to the region through spin-off activities by former employees, fostering a supportive environment in which a network of spin-offs, competitors, suppliers and support firms flourished. Public policy efforts respond to this successful development and are mostly focused on linking existing higher education assets to industry. The second tier regions reviewed in this book literally bootstrapped their high-tech economies. Their successful emergence illustrates that the presence of a university is neither necessary nor sufficient for regional development. The analysis highlights the importance of businesses – particularly large and dominant industry players – in regional economic growth.

## CONCEPTS AND PREMISES

The book explores four premises regarding the emergence of second tier high-tech regions. The first premise advances the idea that the Silicon Valley model may represent the exception and not the norm, especially when we consider the role of the university in high-tech development. Silicon Valley may represent one mode of development, but it is not clear whether this mode can be generalized to other regions. Efforts to imitate this model have mostly failed and are testament to the Valley’s uniqueness. The Silicon Valley model highlights the role of the major research university as an engine of growth, spawning a theory of sorts that such a university is necessary to grow a high-tech economy. Contrary to this common assumption, the literature on the evolution of high-tech regions is characterized by a lively debate regarding a university’s role in catalysing economic growth. The debate can be structured into three models that explain high-tech growth. The first model is characterized by successful high-tech development in regions where such a university is present. Regions like California’s Silicon Valley or Boston’s Route 128 represent this model. The second model describes regions that host research institutions, such as a world-class university that is extremely active in research and development, but have failed to leverage these institutions for high-tech economic development. These regions suggest that the presence of a research university is not sufficient for high-tech industry to thrive. The third model focuses on regions that do not have a major research university, but have successfully developed a high-tech industry base. This book focuses on this model and provides an alternative explanation of high-tech regional development. From this debate, the notion emerges that a

research university is not necessary to spur high-tech industries and that the lessons Silicon Valley appears to provide us may be misleading.

The second premise highlights the role of firms as ‘surrogate universities’. Regions that lack a major higher education infrastructure but have managed to grow a vibrant high-tech economy have leveraged the presence of large and dominant high-tech firms. It is firms and not universities that drive the growth of second tier high-tech regions. These firms have catalysed entrepreneurial spin-off processes that resulted in the formation of dynamic cluster economies. Clusters can be defined as regional groupings of similar and related firms that display strong and dynamic inter-firm relationships, an entrepreneurial environment, or a set of specific location factors that support the cluster’s growth (Martin and Sunley, 2003; Porter, 2000a). Second tier high-tech regions grow and evolve primarily through spin-off processes, so we can also call them spin-off regions. A spin-off region is characterized by dynamic new firm formation, which in turn leads to cluster development. Spin-off regions grow a specialized set of industries through entrepreneurial activities. It is through these spin-off processes that skills, capabilities, and capacities are transferred and converted by entrepreneurial individuals who carry routines and institutions learned in their prior jobs.

Conceptualizing second tier high-tech regions as spin-off regions allows us to consider the question of how specialized regional economies evolve in the first place. Considering this question puts us in the middle of a debate that is characterized by two competing explanations. On the one hand, scholars argue that industry clusters grow because of agglomeration economies. In this view, agglomeration economies represent advantages that occur to the firm due to the location in an urban environment (urbanization economies) or in a cluster (localization economies). Linking clusters to entrepreneurship, Porter argues that ‘new business ideas will tend to bubble up within clusters because of the concentration of firms, ideas, skills, technology, and needs there. Once an idea is perceived, the barriers to entry and growth are lower at cluster locations’ (Porter, 2000b: 269). This perspective assumes that agglomeration economies give rise to entrepreneurial activities and implies that a certain level of economic activity has to be present for a cluster to emerge. The concept is rather imprecise, especially regarding the dynamic aspects of cluster formation and growth, as it is unclear how agglomeration economies evolve in the first place and what factors spur their emergence (Lorenzen, 2005; Martin and Sunley, 2003). Yet this perspective represents the dominant view about high-tech regional development. Common explanations about Silicon Valley’s growth focus on the importance of the network-based regional industrial system that gives rise to entrepreneurial activities. Trying to explain the

emergence of clusters from the perspective of agglomeration economies is limiting not only because of the lack of precision but also because the perspective does not incorporate an explanation of why regions that do not possess these dynamic agglomeration economies in the first place do (or do not) develop clusters. The second tier high-tech regions discussed in this book are a case in point, as their economies evolved despite the lack of agglomeration economies. A competing explanation highlights the role of spin-off processes in the creation of agglomeration economies (Klepper, 2001b, 2008). In this view, firms are the source of entrepreneurship because they function as incubators, and their employees exploit knowledge and experiences they gained there and carry these insights over to their subsequent ventures. This results in new industries or clusters, with the characteristics of these firms influencing the extent and nature of entrepreneurial evolution.

The third premise links back to the previous discussion and focuses on the role of firm building and entrepreneurship in regional economic development. It posits that second tier high-tech regions emerged because firms that acted as 'surrogate universities' influenced regional growth. Firm building activities such as linkages with other firms inside and outside the region, connections to markets, the type and nature of products and services the firms produce, the nature of production, corporate policies and culture, human and capital assets, innovation models, and corporate changes in general, shape the ways in which firms influence the regions in which they operate. Firm building is a dynamic process because corporate strategies change in response to market opportunities, demand, and competition (Berger, 2005). The regions examined in this book leveraged the presence of large firms that took the lead in their respective markets – Tektronix, Intel, Hewlett-Packard, Micron Technology, and Marion Laboratories – and these lead firms have undergone major restructuring processes in response to changes in national and global markets. Entrepreneurial activities helped spur growth in the second tier high-tech regions and these activities were influenced by the nature and evolution of the lead firms.

The fourth premise leads to a discussion about policy implications. Even though second tier high-tech regions managed to grow without the presence of a major research university, they have developed policies that link existing higher education institutions and research institutions with industries. While I am arguing that research universities are neither necessary nor sufficient for the emergence of a high-tech region, I am also arguing that universities have become more important over time in these regions and they have become important partners with local industry. The three regions discussed in this book have developed interesting models for linking universities with industry.

## METHODOLOGY

This study examines the emergence of second tier high-tech regions in the US. Emerging high-tech regions are sometimes referred to as ‘second tier cities’. Markusen et al. analysed second tier cities and defined them as ‘spatially distinct areas of economic activity where a specialized set of trade-oriented industries takes root and flourishes, establishing employment and population growth trajectories that are the envy of many other places’ (1999: 3). These second tier cities represent fast-growing medium-sized metropolitan areas, and their emergence is seen as a consequence of industrial restructuring and economic transformation. Markusen et al. (1999), however, define second tier cities based on population rather than the nature and extent of their high-tech economies. As a result, they discuss Silicon Valley alongside Colorado Springs. This approach fails to recognize that there are substantive differences between emerging second tier high-tech regions like Portland, Boise, and Kansas City and pioneering high-tech regions like Silicon Valley. Second tier high-tech regions, as defined in this book, specialize in certain sub-sectors of the high-tech economy and take advantage of the presence of lead high-tech firms. Collectively, these emerging high-tech regions have performed better than regions that represent so-called high-tech centres in recent years. They were able to recover more quickly from the bursting of the dot.com bubble in 2001 and they have shown stronger growth rates between 1998 and 2005 than the regions that are typically considered as pioneers. Understanding the dynamics of growth in second tier high-tech regions is important because these regions may offer more realistic scenarios for how to grow and transform a regional economy than Silicon Valley or Boston.

This book explores several fundamental questions about second tier high-tech regions. First, I ask which regions in the US have emerged as second tier high-tech regions, and to what extent they differ from their more prominent counterparts like California’s Silicon Valley, Boston’s Route 128, or North Carolina’s Research Triangle Park? I answer this question in Chapter 3 through an in-depth analysis of economic data regarding employment, talent, innovation, and entrepreneurship for all metropolitan areas in the US. Second, I ask how did these second tier high-tech regions emerge and in what ways have they been able to develop knowledge-based economies even though they lack important prerequisites such as a major research university and large amounts of venture capital? The answer to this question is explored through in-depth case studies of three US metropolitan regions, Portland, Boise, and Kansas City. Within the case studies, I examine the ways in which firms function as ‘surrogate universities’ and how processes of firm building and

entrepreneurship contribute to regional development. The last set of questions focuses on public policy: what kind of policies did the regions' economic developers and planners develop to support the growth of their knowledge-based industries?

The research involved two related inquiries: a broad quantitative overview of high-tech development in all metropolitan areas in the US and in-depth case studies of three second tier high-tech regions. The quantitative perspective involved an assessment of high-tech growth in the US and specifically an analysis of high-tech economic activity in the metropolitan statistical areas (MSAs). The procedure used an employment-based definition of high-tech industries and followed Hecker's approach (Hecker, 2005). In developing the typology, we used a wide range of data that reflect the economic performance of the MSAs and their associated degrees of industrial specialization, as well as input-based characteristics such as quality of the labour force, R&D funding, and employment concentration. To examine the ways in which metropolitan areas differ in their high-tech development, we employed a principal component and model-based cluster analysis to create typologies of high-tech regions. (For a detailed discussion of the methodology, including the 20 individual variables used for the cluster analysis, see Appendix.) The data can broadly be grouped into four thematic categories: economic performance, talent, innovation, and entrepreneurship. The analysis yielded a typology of high-tech regions that describes five distinct types:

1. High-tech centres
2. High-tech challenger regions
3. High-tech hidden gem regions
4. Old economy regions in transition
5. Regions with no significant high-tech activity

High-tech challenger regions and high-tech hidden gem regions represent second tier high-tech regions. They differ in terms of their development dynamics, not only from each other but also from high-tech centres, old economy regions in transition, and regions with no significant high-tech activity.

In a second step, three metropolitan areas representing emerging high-tech regions were selected for in-depth case studies. Unlike regions that are in advantageous positions because of hosting military facilities, major research universities, federal research laboratories, proximity to large metropolitan areas, or because they can build on old economy industries, these cases represent regions that 'bootstrapped' their high-tech economies. Regions that bootstrap their high-tech economies manage to

foster such knowledge-based industries in the absence of large amounts of venture capital or the presence of world-class universities. By using the word 'bootstrap' I imply that their economies manage to thrive economically without help from the outside, or to put it simply, they manage to pull themselves up by their own bootstraps. I chose to examine Portland (Oregon), Boise (Idaho), and Kansas City (Kansas-Missouri). Portland and Kansas City represent high-tech challenger regions, while Boise belongs to the hidden gem region category.

For the case studies, I decided to focus on three emerging high-tech regions that bootstrapped by leveraging corporate assets or other types of anchor institutions. These regions were chosen because they have above average high-tech employment concentration as measured by the location quotient (Boise with a location quotient of 1.76, Portland with 1.35, and Kansas City with 1.14) and because they represent different sizes (ranging from about 500 000 to 2 million residents). More importantly, they were able to grow a significant concentration of high-tech firms without factors often considered critical in the growth of a technology region: a world-class research university and large amounts of venture capital. In addition, each region can be considered a peripherally located area that has been overshadowed by other more prominent cities. For example, Seattle has always trumped Portland and Boise in the Pacific Northwest as a location for important business activities, and Kansas City always stood in the shadow of St Louis, Missouri, even though both were considered important urban centres in the heartland. How did these regions compensate for these missing ingredients? How did they overcome their location disadvantages and develop high-tech economies?

The case study research was informed by key informant interviews, secondary sources such as academic studies, newspaper articles, and corporate reports. In total, 104 semi-structured interviews were held with key experts in the three regions (see Appendix 1). In addition, I conducted online surveys of high-tech firms in Portland and Boise that included questions about the entrepreneur(s), the spin-off, and regional development factors. The surveys were conducted between July and December 2007 and followed a snowball sampling technique. The Kansas City case study did not include a survey. Here the motivation for inquiry was on differences and similarities between regions specializing in high-tech manufacturing (Portland and Boise) and regions specializing in life sciences (Kansas City). The chapter on Kansas City highlights how the second tier development model applies to the pharmaceutical and biotechnology industry.

Throughout, the study was guided by Markusen's approach to 'studying regions by studying firms' (Markusen, 1994: 477). The broad areas of inquiry included the notions of firm building, entrepreneurial firm

formation, and the formation of a regional innovation milieu or networked economy. I conceptualized the lead firms as ‘surrogate universities’ that develop talent, engage in innovation and knowledge creation, and function as incubators of spin-offs. To assess their impact on the region’s entrepreneurial economy, I used a corporate genealogy approach, in which entrepreneurial firms and their parents are of interest (Cooper, 1971; Klepper, 2001a, 2001b, 2008; Neck, Meyer, Cohen, and Corbett, 2004).

## SYNOPSIS OF CHAPTERS

This book intends to stimulate scholars of regional development and economic developers to think about alternative models of high-tech regional growth. Policymakers and planning practitioners will find the book instructive because it provides a viable and – most of all – feasible alternative to the Silicon Valley model. The study also contributes to questions about regional economic evolution and the emergence of industrial clusters. The book highlights the role of firm building and entrepreneurship in the evolution of regional economies. More specifically, the research highlights the evolution of regions that are traditionally not regarded as pioneers in high-tech development and therefore have not received much scholarly attention.

Chapter 2 offers insights into an evolutionary theory of the emergence of high-tech regions. These insights encompass the deconstruction of several myths that resulted from the overemphasis on Silicon Valley as the model for high-tech development. I outline three alternative models of high-tech development and qualify the role of universities as neither necessary nor sufficient for high-tech growth. In a second step, I outline a theory of cluster emergence that rests on the role of firm building and entrepreneurship. Through the lens of firm building I am able to conceptualize the role of firms as ‘surrogate universities’.

Chapter 3 presents a quantitative analysis of the metropolitan geography of high-tech development. The analysis does not simply rank metropolitan areas by the number of high-tech jobs, a method that would favour large urban places and historically established high-tech centres (Chapple, Markusen, Schrock, Yamamoto, and Yu, 2004; Cortright and Mayer, 2004). Instead I employ a substantively different approach that focuses on the degree to which different metropolitan areas share similar innovation, human capital, and entrepreneurship dynamics. This approach yields a typology of high-tech regions that distinguishes established high-tech centres from second tier regions, which can be further distinguished into challenger regions and hidden gem regions. In addition, the analysis

identifies old economy regions in transition and regions with no significant high-tech activity.

Chapters 4, 5, and 6 present case studies of emerging second tier high-tech regions. Each provides a detailed historical account of the evolution of a specific second tier high-tech region. Chapter 4 discusses the case of Portland, Oregon. This region, also known as the Silicon Forest, hosts a variety of high-tech firms that specialize in manufacturing semiconductors and test and measurement instruments. These include companies with a world-class reputation, including Intel and Tektronix. Intel, one of the most prominent computer chip makers, employs about 15 000 workers in the Portland region, and the company's Oregon facilities host Intel's most important R&D functions. The presence of Intel has attracted a variety of competitors, and the region produces about 10 per cent of the world's semiconductors. Tektronix is internationally known for its high quality oscilloscopes. Intel and Tektronix played the role of incubators for many well-known high-tech start-ups such as Sequent Computer Systems (now IBM), Mentor Graphics, Triquint Semiconductors, and InFocus Systems, among others. In this chapter I argue that Intel and Tektronix attracted a talented workforce, functioned as incubators for start-up companies, and engaged in research that spilled over to the region. In addition, Portland was able to develop an innovation milieu in which new companies – both homegrown and from the outside – flourish. I also discuss the ways in which Oregon's universities are building unique partnerships among themselves and with industry to address critical issues of innovation and knowledge creation. The Oregon Nanoscience and Microtechnologies Institute (ONAMI) could serve as a model for how other regions could leverage synergies from various higher education institutions.

Chapter 5 discusses the case of Boise, Idaho, another fast-growing metropolitan region in the Pacific Northwest. Like Portland, Boise benefited from the expansion of California-based companies such as Hewlett-Packard (HP). It also is home to a successful home-grown semiconductor manufacturing company, Micron Technology. Micron employs about 10 000 workers in Boise, of which an estimated 1 300 are involved with R&D. Boise is also an important location for Hewlett-Packard. Even though HP's employment in Boise has declined, the remaining jobs are more concentrated in R&D. Both Micron and HP serve the region as 'surrogate universities', as the local higher education infrastructure is not as developed and has only improved slightly in recent years. Even though Boise has seen its economy transform into a knowledge-based regional economy, local and state policymakers are reluctant to embrace this new type of economy. Regional economic development policies are fragmented and underfinanced and efforts are often stifled by politics.

Chapter 6 discusses the case of Kansas City, a region in the heartland of the US that has managed to grow a vibrant life sciences economy. I argue that Kansas City shows underdeveloped capacity on a variety of indicators, such as top-tier research universities, patent registrations, and venture capital investments that could support an innovative economy. These deficiencies would lead a pessimist to assume that the region faces a daunting challenge in trying to establish a vibrant life sciences or high-tech industry cluster. However, I argue against that pessimism and show that Kansas City's economy possesses an array of assets that sets the city apart from its competitors. For example, Kansas City has been home to locally grown firms (especially the pharmaceutical company Marion Laboratories) that have functioned as anchors and entrepreneurial seedbeds for a budding life sciences economy. Marion Laboratories' impact on the Kansas City economy has been similar to that of Tektronix and Intel on the Portland region. The firm contributed to the creation of a talented labour pool (employees who were especially familiar with drug development and marketing) and entrepreneurship in the form of new locally based spin-off companies. In addition, major investments have been made in life sciences research over the past five years, with the Stowers Institute for Medical Research being the linchpin in this endeavour. Stowers' \$2 billion endowment is the largest endowment for a medical research organization in the US and holds much promise for the Kansas City life sciences economy. I discuss how policymakers, business representatives, and higher education officials are facing their biggest challenge: to keep the economic benefits of commercialization of innovation in Kansas City and to grow entrepreneurial companies.

Finally, in Chapter 7, I review the implications of the growth of second tier high-tech regions and their significance. I discuss the opportunities and challenges these regions face and highlight their limitations in comparison to established high-tech centres. I also discuss policy implications for practitioners interested in fostering innovative and entrepreneurial high-tech economies.

## NOTE

1. Flexibly specialized businesses can be defined as 'small, innovative firms, embedded within a regionally cooperative system of industrial governance which enables them to adapt and flourish despite globalizing tendencies' (A. R. Markusen, et al., 1999, p. 22). Other authors, particularly in the field of economic geography, have written about the concept and used it to explain the rise of specialized regional economies (Amin, 1994; Piore and Sabel, 1984; A. J. Scott, 2004; Storper and Christopherson, 1987).