2 Globalization, entrepreneurship, and the region[1]

David B. Audretsch, Isabel Grilo and A. Roy Thurik

INTRODUCTION

Perhaps one of the less-understood phenomena accompanying the increased globalization during the first decade of the twenty-first century has been a shift in the comparative advantage of high-wage countries towards knowledge-based economic activity. An important implication of this shift in this comparative advantage is that much of the production and commercialization of economic knowledge is less associated with footloose multinational corporations and more associated with high-tech innovative regional clusters, such as Silicon Valley in California, the Cambridge area in the UK, and the Montpellier area in France. Only two decades ago the conventional wisdom predicted that globalization would render the demise of the region as a meaningful unit of economic analysis. Yet the obsession of policymakers around the globe to 'create the next Silicon Valley' reveals the increased importance of geographic proximity and regional agglomerations as well as of the role of small and medium-sized enterprises (SMEs) and entrepreneurial activity. The purpose of this chapter is to resolve the paradox of globalization by explaining the emergence of entrepreneurship and geographic localization as the two key organizational platforms because of and not in spite of a globalizing economy.

That globalization is one of the defining changes at the turn of the century is clear from a reading of the popular press. Like all grand concepts, a definition for globalization is elusive and elicits criticism. That domestic economies are globalizing is a cliché makes it no less true. In fact, the shift in economic activity from a local or national sphere to an international or global orientation ranks among the most vehement changes shaping the current economic landscape.

The driving force underlying the emerging globalization has been technology. While there are many different aspects to the technological revolution, the advent of the microprocessor combined with its application

in telecommunications has altered the economic meanings of national borders and distance.

The present chapter analyzes the linkages between globalization, entrepreneurship and the role of regions. It is organized as follows. First, the meaning of globalization is dealt with. Second, the regional dimension of the response to globalization is described where downsizing, knowledge spillovers and agglomeration are the essential phenomena. Third, it is shown how these developments have led to the emergence of new entrepreneurial activities. Fourth, more details are given on the effects of the information and communication technology (ICT) revolution on the organization of industry in a globalized economy. Finally, we conclude that policies promoting both knowledge investments as well as entrepreneurship have become prominent for many regions in the most developed countries.

THE MEANING OF GLOBALIZATION

This section deals with what is meant by the death of distance predicted by the advent of the microprocessor revolution, and with the geopolitical consequences of this revolution. Finally, it provides some figures concerning globalization.

The Death of Distance

Observing the speed at virtually no cost with which information can be transmitted across geographic space via the Internet, cell phones, and electronic communication superhighways, *The Economist* proclaimed on its title page of an influential issue (30 September 1995) in the mid-1990s, 'The Death of Distance'. The new communications technologies have triggered a virtual spatial revolution in terms of the geography of production. According to *The Economist*, 'The death of distance as a determinant of the cost of communications will probably be the single most important economic force shaping society in the first half of the next century'. What the telecommunications revolution has done is to reduce the cost of transmitting information across geographic space to virtually zero. At the same time, the microprocessor revolution has made it feasible for nearly everyone to participate in global communications. There are many statistics about the increase of international trade and transactions. Inferences about the degree of and increase in globalization based on international trade statistics miss an important point – it is the quality and not just the quantity of international transactions that have changed. Interaction

among individuals adds a very different quality to the more traditional measures of trade, foreign direct investment (FDI), and capital flows and also has very different implications for the development of economic activities. This additional quality contributed by the transnational interactions of individuals, and not just arm's-length transactions by corporations, exposes people to ideas and experiences that were previously inaccessible.

The Political Dimension of Globalization

Globalization would not have occurred to the degree that it has if the fundamental changes were restricted to the advent of the microprocessor and telecommunications. It took a political revolution in large parts of the world to reap the full benefits from these technological changes. The political counterpart of the technological revolution was the increase in democracy and concomitant stability in areas of the world that had previously been inaccessible. The Cold War combined with internal political instability rendered potential investments in Eastern Europe and much of the developing world risky and impractical. During the period since the Second World War, most trade and economic investment were generally confined to Europe and North America, and later a few of the Asian countries, principally Japan and the Asian Tigers. Trade with countries behind the iron curtain was restricted and in some cases prohibited. Even trade with Japan and other Asian countries was highly regulated and restricted. Similarly, investments in politically unstable countries in South America and the Middle East resulted in episodes of national takeovers and confiscation where foreign investors lost their investments. In other words, the energy and focus devoted to maintain geopolitical balance was freed up to boost geo-economic growth.

The fall of the Berlin Wall in 1989 and subsequent downfall of communism in Eastern Europe and the former Soviet Union was a catalyst for stability and accessibility to parts of the world that had previously been inaccessible. Within just a few years it has become possible not just to trade with, but also to invest in these countries, as well as in many others such as China, Vietnam, India, and Indonesia. For example, India became accessible as a trading and investment partner after opening its economy in the early 1990s. Trade and investment with the developed countries quickly blossomed, reflecting the rapid change in two dimensions. First, India was confronted with sudden changes in trade and investment, not to mention a paradigmatic shift in ways of doing business. Second, to some foreign partners, taking advantage of opportunities in India also meant downward pressure on wages, and even plant closings in the home country. Of a much higher order of magnitude was the effect of China's

new market orientation which has, since the beginning of the current century, brought China into the international arena and made it a major player in the international division of labor.

With the opening of some of these areas to participation in the world economy for the first time in decades, the equilibrium which dominated the economic landscape since the Second World War came to a sudden end. This created the opportunities associated with gaping disequilibria. Consider the large differentials in labor costs: as long as the Berlin Wall stood, and countries such as China and Vietnam remained closed, large discrepancies in wage rates could be maintained without eliciting responses in trade and FDI. The low wage rates in China or parts of the former Soviet Union neither invited foreign companies to build plants nor resulted in large-scale trade with the West based on access to low production costs. Investment by foreign companies was either prohibited by local governments or considered to be too risky by the companies. Similarly, trade and other restrictions limited the capabilities of firms in those countries from being able to produce and trade with Western nations.

The gaping wage differentials existing while the Berlin Wall stood and much of the communist world was cut off from the West were suddenly exposed in the early 1990s. There were not only unprecedented labor cost differentials but also massive and willing populations craving to join the high levels of consumption that had become the norm in Western Europe and North America. For example, in the early part of the 1990s, the daily earnings of labor were estimated to be $90 in the United States and $80 in the European Union (EU). This was a sharp contrast to shortly after the Berlin Wall fell and wages were only some $6 in Poland and the Czech Republic. In Asia, the wage gap was even greater, where the daily earnings were $1.50 in China, $2.50 in India, and $1.25 in Sri Lanka. The potential labor force in countries like China, with some 450 million workers, and India with some 350 million workers, dwarfs the workforce in North America and Europe.[2]

Of course, the productivity of labor is vastly greater in the West, which compensates to a significant degree for such large wage differentials. Nevertheless, given the magnitude of these numbers, both trade and investment have responded to the opportunities made possible by the events of 1989.

Globalization: Some Figures

While the most salient feature of globalization involves interaction and interfaces among individuals across national boundaries, the more

traditional measures of transnational activity reflect an upward trend of global activities. These traditional measures include trade (exports and imports), FDI (inward and outward), international capital flows, and intercountry labor mobility. The overall trend for all of these measures has been strongly positive. The world trade of goods and services increased fivefold between 1985 and 2007 and has more than doubled since 1996 (OECD, 2008 and 2009), while trade in goods experiences even higher growth rates. The trade of services increased by more than three times over this time period. The increases in investment income, direct investment, and portfolio investment (UNCTAD, 2007) are also sizable. But the increase in all of these measures within just over a decade reflects the increasing degree of globalization.

The degree of world trade, measured by exports and imports, has increased over time. World exports increase from $1.3 trillion in 1970 to nearly $5 trillion in 1999 and to $12 trillion in 2006, in real terms (WTO, 2007). While some of this increase in the world export rate is attributable to an increased participation in international trade by countries that had previously been excluded, export rates in the leading industrialized countries have also increased over the past three decades. For example, US exports and imports have increased from 13 percent of GDP in 1985 to more than 21 percent by 1996 and to almost 30 percent in 2007 (OECD, 2007) while the corresponding openness values for the EU are 49, 79, and 123 percent, respectively. The increase in world trade is also not attributable to the influence of just a few industries or sectors, but rather systematic across most parts of the economy. A different manifestation of globalization involves (inward) FDI, which has increased for all world countries from an average of $0.5 trillion in the last decade of the last century to $1.5 trillion in 2006 in real terms. The increase in global FDI has also not been solely the result of a greater participation by countries previously excluded from the world economy. In the EU (inward) FDI as a percentage of gross fixed capital formation increased from an average of 12 percent for the last decade of the last century to 18 percent in 2006. For the US these percentages stayed the same (7 percent), whereas for the UK it nearly doubled from 18 percent to 34 percent. The stock of FDI for all world countries as a percentage of gross domestic product increased from an average of 8 percent in the last decade of the last century to 25 percent in 2006 (UNCTAD, 2007). Transnational private capital flows have also increased in the past two decades. For instance, total net capital flows to developing countries increased from an average of US$120 billion (2006) in the 1995–2000 period to nearly US$200 billion in 2007 (IMF, 2007).

THE REGIONAL RESPONSE

It is generally believed that the United States has been much quicker to absorb the consequences of globalized production than Europe, based upon the different growth rates of the United States when compared to European nations over the last 20 years. Indeed, the European countries have been relatively slow to move from the *managed* to the *entrepreneurial* economy (Audretsch and Thurik, 2001 and 2004). Clearly, the European response varied across countries. Nevertheless, by and large five distinct stages can be discerned of the evolution of the European stance towards the entrepreneurial economy (Audretsch et al., 2002, pp. 4–6). The first stage was denial. During the 1980s and early 1990s, European policymakers looked to Silicon Valley with disbelief. Europe was used to facing a competitive threat from the large well-known multinational American corporations; but not from nameless and unrecognizable start-up firms in exotic industries such as software and biotechnology. Twenty years ago the emerging firms such as Apple Computer and Intel were interesting but irrelevant competitors in the automobile, textile, machinery, and chemical industries – then the obvious engines of European competitiveness.

The second stage, during the mid-1990s, was recognition. Europe recognized that the entrepreneurial economy in Silicon Valley delivered a sustainable long-run performance. But it held to its traditional products while embracing the theory of comparative advantage and channeling resources into traditional moderate technology industries. During this phase Europe's most important economy, Germany, would provide the automobiles, textiles, and machine tools. The entrepreneurial economy of Silicon Valley, Route 128, and the Research Triangle would produce the software and microprocessors. Each continent would specialize according to its comparative advantage and then trade with each other.

The third stage, during the second half of the 1990s, was envy. As Europe's growth stagnated and unemployment soared, the capacity of the American entrepreneurial economy to generate both jobs and higher wages became the object of envy. The United States and Europe adhered to different doctrines: as the entrepreneurial economy diffused across the United States, European policymakers, particularly in large countries such as Germany and France, despaired that European traditions and values were simply inconsistent and incompatible with the entrepreneurial economy. They should have concluded that the concept of comparative advantage had yielded to the different, but better, concept of dynamic competitive advantage.

The fourth stage, during the last years of the twentieth century, was consensus. European policymakers reached a consensus that – in the

terminology of Audretsch and Thurik (2001 and 2004) – the new entrepreneurial economy was superior to the old managed economy and that a commitment had to be forged to creating a new entrepreneurial economy. A broad set of policies were instituted to create a new entrepreneurial economy. European policymakers looked across the Atlantic and realized that if places such as North Carolina, Austin, and Salt Lake City could implement targeted policies to create the entrepreneurial economy, European cities and regions could as well. After all, Europe had a number of advantages and traditions, such as a highly educated and skilled labor force, world-class research institutions and its variety in cultures, and hence innovative approaches to new products and organizations. These phenomena would provide a perfect framework for absorbing the high levels of uncertainty inherent to the entrepreneurial economy (Audretsch and Thurik, 2001).

The fifth stage is attainment. The entrepreneurial economy is finally emerging in Europe. Consider the Green Paper on Entrepreneurship of the European Commission (European Commission, 2003) which aimed to stimulate debate among policymakers, businesses, representative organizations, journalists, and scientific experts on how to shape entrepreneurship policy.[3] More recently, the adoption in 2008 of the Small Business Act for Europe has provided a comprehensive SME policy framework for the EU and its member states in which initiatives to foster an entrepreneurial economy feature prominently (European Commission, 2008). See Audretsch et al. (2002) for further information on the five stages and some country studies on the determinants of entrepreneurship.

Downsizing: An Old Phenomenon

Confronted with lower-cost competition in foreign locations, producers in the high-cost countries have four options apart from doing nothing and losing global market share: (i) reduce wages and other production costs sufficiently to compete with the low-cost foreign producers, (ii) substitute equipment and technology for labor to increase productivity, (iii) shift production out of the high-cost location and into the low-cost location, and (iv) formulate a strategy away from using traditional inputs such as land, labor, and capital and toward knowledge.

Many of the European and American firms that have successfully restructured resorted to alternatives (ii) and (iii). Substituting capital and technology for labor, along with shifting production to lower-cost locations has resulted in waves of corporate downsizing throughout Europe and North America well before the more recent restructuring triggered by the financial crisis of 2008/09. For example, already between 1979 and

1995 more than 43 million jobs were lost in the United States as a result of corporate downsizing.[4] This includes 25 million blue-collar jobs and 18 million white-collar jobs. Similarly, the 500 largest US manufacturing corporations cut nearly five million jobs between 1980 and 1993, or one-quarter of their workforce (Audretsch, 1995). Perhaps most disconcerting, the rate of corporate downsizing has apparently increased over time in the United States, even as the unemployment rate has fallen. During most of the 1980s, about one in 25 workers lost a job. In the 1990s this has risen to one in 20 workers.

Although at its most intense in the late 1980s and early 1990s, this wave of corporate downsizing has continued (Burke and Cooper, 2000).[5] The cries of betrayal and lack of social conscience on the part of the large corporations have died in the twenty-first century because the virtues of the new entrepreneurial economy become clear, but they were ubiquitous in the last century.[6] It is a mistake to blame the corporations for this wave of downsizing that has triggered massive job losses and rising unemployment in so many countries. These corporations are simply trying to survive in an economy of global competitors who have access to lower-cost inputs.

Much of the policy debate responding to the twin forces of the telecommunications revolution and increased globalization has revolved around a trade-off between maintaining higher wages but suffering greater unemployment versus higher levels of employment but at the cost of lower wage rates. There is, however, an alternative. It does not require sacrificing wages to create new jobs, nor does it require fewer jobs to maintain wage levels and the social safety net. This alternative involves shifting economic activity out of the traditional industries where the high-cost countries of Europe and North America have lost the comparative advantage, and into those industries where the comparative advantage is compatible with both high wages and high levels of employment – knowledge-based economic activity (Audretsch and Thurik, 1999). This shift is one of the reasons why entrepreneurship starts playing a vital role and the modern economy is often described as the 'entrepreneurial economy'.

The Knowledge Response

Globalization has rendered the comparative advantage in traditional moderate technology industries incompatible with high wage levels. At the same time, the emerging comparative advantage that is compatible with high wage levels is based on innovative activity. For example, employment has increased by 15 percent in Silicon Valley between 1992 and 1996, even though the mean income is 50 percent greater than in the rest of the country.7

Thus, the regional response to globalization has been the emergence of strategic management policy – not for firms, but for regions. As long as corporations were inextricably linked to their regional location by substantial sunk costs, such as capital investment, the competitiveness of a region was identical to the competitiveness of the corporations located in that region. A quarter-century ago, while the proclamation, 'What is good for General Motors is good for America' may have been controversial, few would have disagreed that 'What is good for General Motors is good for Detroit.' And so it was with US Steel in Pittsburgh and Volkswagen in Wolfsburg. As long as the corporation thrived, so would the region.

As globalization has not only changed the degree to which the traditional economic factors of capital and labor are sunk, but also shifted the comparative advantage in the high-wage countries of North America and Europe toward knowledge-based economic activity, corporations have been forced to shift production to lower-cost locations. This has led to a delinking between the competitiveness of firms and regions. The advent of the strategic management of regions has been a response to the realization that the strategic management of corporations includes a policy option not available to regions – changing the production location.

Knowledge Spillovers

That knowledge spills over is barely disputed. While disputing the importance of knowledge externalities in explaining the geographic concentration of economic activity, Krugman (1991) and others do not question the existence or importance of such knowledge spillovers. In fact, they argue that such knowledge externalities are so important and forceful that there is no compelling reason for a geographic boundary to limit the spatial extent of the spillover. According to this line of thinking, the concern is not that knowledge does not spill over but that it should stop spilling over just because it hits a geographic border, such as a city limit, state line, or national boundary. The claim that geographic location is important to the process linking knowledge spillovers to innovative activity in a world of e-mail, cell phones, fax machines, and cyberspace may seem surprising and even paradoxical. The resolution to the paradox posed by the localization of knowledge spillovers in an era where the telecommunications revolution has drastically reduced the cost of communication lies in a distinction between knowledge and information. Information, such as the price of gold on the New York Stock Exchange, or the value of the yen in London, can be easily codified and has a singular meaning and interpretation. By contrast, knowledge is vague, difficult to codify, and often only serendipitously recognized (Audretsch et al., 2000). While the marginal cost

of transmitting information across geographic space has been rendered invariant to distance by the telecommunications revolution, the marginal cost of transmitting knowledge, and especially tacit knowledge, rises with distance.

Von Hippel (1994) demonstrates that high-context, uncertain knowledge, or what he terms a 'sticky' knowledge, is best transmitted via face-to-face interaction and through frequent and repeated contact. Geographic proximity matters in transmitting knowledge, because as Kenneth Arrow (1962) pointed out nearly half a century ago, such tacit knowledge is inherently non-rival in nature, and knowledge developed for any particular application can easily spill over and have economic value in very different applications. As Glaeser et al. (1992, p. 1126) have observed, 'Intellectual breakthroughs must cross hallways and streets more easily than oceans and continents'.

The importance of local proximity for the transmission of knowledge spillovers has been observed in many different contexts. It has been pointed out that, 'business is a social activity, and you have to be where important work is taking place'.8 See Jacobs (1969), Jaffe (1989), Saxenian (1990), Feldman (1994), Venables (1996), and Audretsch (1998) for some of these contexts.

Not only does Krugman (1991, p. 53) doubt that knowledge spillovers are not geographically constrained, but he also argues that they are impossible to measure because 'knowledge flows are invisible, they leave no paper trail by which they may be measured and tracked'. However, an emerging literature (Jaffe et al., 1993) has overcome data constraints to measure the extent of knowledge spillovers and link them to the geography of innovative activity See also Audretsch and Feldman (1996), Audretsch (1998), Breschi and Lissoni (2001), Bottazi and Perri (2003), and Audretsch and Lehmann (2005).

Empirical evidence suggests that location and proximity clearly matter in exploiting knowledge spillovers. Not only have Jaffe et al. (1993) found that patent citations tend to occur more frequently within the state in which they were patented than outside of that state, but Audretsch and Feldman (1996) found that the propensity of innovative activity to cluster geographically tends to be greater in industries where economic knowledge plays a more important role.9 Prevenzer (1997) and Zucker et al. (1998) show that in biotechnology, which is an industry based almost exclusively on knowledge, the firms tend to cluster together in just a handful of locations. This finding is supported by Audretsch and Stephan (1996), who examine the geographic relationships of scientists working with biotechnology firms. The importance of geographic proximity is clearly shaped by the role played by the scientist. The scientist is more likely to be located in

the same region as the firm when the relationship involves the transfer of knowledge rather than of information. However, when the scientist is providing a service to the company that does not involve knowledge transfer, local proximity becomes much less important.

There is reason to believe that knowledge spillovers are not homogeneous across firms. In the face of a wave of studies identifying vigorous innovative activity emanating from small firms in certain industries, the question is: how are these small, and frequently new, firms able to generate innovative output while undertaking generally negligible amounts of investment into knowledge-generating inputs, such as research and development (R&D)? The answer appears to be through exploiting knowledge created by expenditures on research in universities and on R&D in large corporations. The findings of Acs et al. (1994) suggest that the innovative output of all firms rises along with an increase in the amount of R&D inputs, both in private corporations as well as in university laboratories. However, R&D expenditures made by private companies play a particularly important role in providing knowledge inputs to the innovative activity of large firms, while expenditures on research made by universities serve as an especially key input for generating innovative activity in small enterprises. Apparently, large firms are more adept at exploiting knowledge created in their own laboratories, while their smaller counterparts have a comparative advantage at exploiting spillovers from university laboratories.

Spillovers, Agglomeration, and the Role of Regions

Once a city, region, or state develops a viable cluster of production and innovative activity why should it ever lose the first-mover advantage? One answer, provided by Audretsch and Feldman (1996) is that the relative importance of local proximity and therefore agglomeration effects is shaped by the stage of the industry life cycle. A growing literature suggests that who innovates and how much innovative activity is undertaken is closely linked to the phase of the industry life cycle (Klepper, 1996). Audretsch and Feldman (1996) argue that an additional key aspect to the evolution of innovative activity over the industry life cycle is where that innovative activity takes place. The theory of knowledge spillovers, derived from the knowledge production function, suggests that the propensity for innovative activity to cluster spatially will be the greatest in industries where tacit knowledge plays an important role. As argued above, it is tacit knowledge, as opposed to information that can only be transmitted informally, and typically demands direct, trustful and repeated contact. The role of tacit knowledge in generating innovative activity is presumably the

greatest during the early stages of the industry life cycle, before product standards have been established and a dominant design has emerged. Audretsch and Feldman classify 210 industries into four different stages of the life cycle. The results provided considerable evidence suggesting that the propensity for innovative activity to spatially cluster is shaped by the stage of the industry life cycle. On the one hand, new economic knowledge embodied in skilled workers tends to raise the propensity for innovative activity to spatially cluster throughout all phases of the industry life cycle. On the other hand, certain other sources of new economic knowledge, such as university research, tend to elevate the propensity for innovative activity to cluster during the introduction stage of the life cycle, but not during the growth stage, and then again during the stage of decline.

Perhaps most striking is the finding that greater geographic concentration of production actually leads to more, and not less, dispersion of innovative activity. Apparently, innovative activity is promoted by knowledge spillovers that occur within a distinct geographic region, particularly in the early stages of the industry life cycle, but as the industry evolves toward maturity and decline, innovation may be dispersed by additional increases in concentration of production that have been built up within that same region. The evidence suggests that what may serve as an agglomerating influence in triggering innovative activity to spatially cluster during the introduction and growth stages of the industry life cycle, may later result in a congestion effect, leading to greater dispersion in innovative activity. While the literature on economic geography has traditionally focused on factors such as rents, commuting time, and pollution as constituting congestion and dissipating agglomeration economies (Henderson, 1986), this type of congestion refers to lock-in with respect to new ideas. While there may have been agglomeration economies in automobiles in Detroit in the 1970s and computers in the Northeast Corridor in the 1980s, a type of intellectual lock-in made it difficult for Detroit to shift out of large-car production and for IBM and DEC to shift out of mainframe computers and into mini-computers. Perhaps it was this type of intellectual congestion that led to the emergence of the personal computer in California, about as far away from the geographic agglomeration of the mainframe computer as is feasible on the mainland of the United States. Even when IBM developed its own personal computer, the company located its fledgling PC facility in Boca Raton, Florida, way outside of the mainframe agglomeration, in the Northeast Corridor. Thus, there is at least some evidence suggesting that spatial agglomerations, just as other organizational units of economic activity are vulnerable to technological lock-in, with the result being in certain circumstances that new ideas need new space.

THE KNOWLEDGE PRODUCTION FUNCTION AND THE EMERGENCE OF ENTREPRENEURSHIP

That SMEs would emerge as becoming more important seems to be contrary to many of the conventional theories of innovation. The starting point for most theories of innovation is the firm. In such theories the firms are exogenous and their performance in generating technological change is endogenous (Arrow, 1962). For example, in the most prevalent model found in the literature of technological change, the model of the knowledge production function, formalized by Zvi Griliches (1979), firms exist exogenously and then engage in the pursuit of new economic knowledge as an input into the process of generating innovative activity. The most decisive input in the knowledge production function is new economic knowledge. Knowledge as an input in a production function is inherently different from the more traditional inputs of labor, capital, and land. While the economic value of the traditional inputs is relatively certain, knowledge is intrinsically uncertain and its potential value is asymmetric across economic agents.10 The most important, although not the only source of new knowledge is considered to be R&D. Other key factors generating new economic knowledge include a high degree of human capital, a skilled labor force, and a high presence of scientists and engineers.

There is considerable empirical evidence supporting the model of the knowledge production function. This empirical link between knowledge inputs and innovative output apparently becomes stronger as the unit of observation becomes increasingly aggregated. For example, at the unit of observation of countries, the relationship between R&D and patents is very strong. The most innovative countries, such as the United States, Japan, and Germany, also tend to undertake high investments in R&D. By contrast, little patent activity is associated with developing countries, which have very low R&D expenditures. Similarly, the link between R&D and innovative output, measured in terms of either patents or new product innovations is also very strong when the unit of observation is the industry. The most innovative industries, such as computers, instruments, and pharmaceuticals also tend to be the most R&D intensive. Audretsch (1995) finds a simple correlation coefficient of 0.74 between R&D inputs and innovative output at the level of four-digit standard industrial classification (SIC) industries. However, when the knowledge production function is tested for the unit of observation of the firm, the link between knowledge inputs and innovative output becomes weakly positive in some studies and even non-existent or negative in others. The model of the knowledge production function becomes particularly weak when small firms are included in the sample. This is not surprising, since formal R&D

is concentrated among the largest corporations, but a series of studies (Acs and Audretsch, 1988) have clearly documented that small firms account for a disproportional share of new product innovations given their low R&D expenditures.

The breakdown of the knowledge production function at the level of the firm raises the question, where do innovative firms with little or no R&D get the knowledge inputs? This question becomes particularly relevant for firms that, because small and new, undertake small absolute amounts of R&D themselves, yet contribute considerable innovative activity in newly emerging industries such as biotechnology and computer software (Audretsch, 1995). One answer that has emerged in the economics literature is from other, third-party firms or research institutions, such as universities: economic knowledge may spill over from the firm conducting the R&D or the research laboratory of a university.

The Emergence of Entrepreneurship

Why should knowledge spill over from the source of origin? At least two major channels or mechanisms for knowledge spillovers have been identified in the literature. Both of these spillover mechanisms revolve around the issue of appropriability of new knowledge. First, Cohen and Levinthal (1989) suggest that existing firms develop the capacity to adapt new technology and ideas developed in other firms and are therefore able to appropriate some of the returns accruing to investments in new knowledge made externally.

Second, Audretsch (1995) proposes shifting the unit of observation away from exogenously assumed firms to individuals, such as scientists, engineers, or other knowledge workers – agents with endowments of new economic knowledge. When the lens is shifted away from the firm to the individual as the relevant unit of observation, the appropriability issue remains, but the question becomes: how can economic agents with a given endowment of new knowledge best appropriate the returns from that knowledge? If the scientist or engineer can pursue the new idea within the organizational structure of the firm developing the knowledge and appropriate roughly the expected value of that knowledge, he (or she) has no reason to leave the firm. On the other hand, if he places a greater value on his ideas than do the decision-making bureaucracy of the incumbent firm, he may choose to start a new firm to appropriate the value of his knowledge. In the metaphor provided by Albert O. Hirschman (1970), if voice proves to be ineffective within incumbent organizations, and loyalty is sufficiently weak, a knowledge worker may resort to exit the firm or university where the knowledge was created in order to form a new company.

In this spillover channel the knowledge production function is actually reversed. The knowledge is exogenous and embodied in a worker. The firm is created endogenously in the worker's effort to appropriate the value of *his/her* knowledge through innovative activity.

What emerges from the new evolutionary theories and empirical evidence on innovation as a competitive strategy deployed by SMEs is that markets are in motion, with many new firms entering the industry and many existing firms exiting. But is this motion horizontal, in that the bulk of firms exiting comprise firms that had entered relatively recently, or vertical, in that a significant share of the exiting firms had been established incumbents that were displaced by younger firms? In trying to shed some light on this question, Audretsch (1995) proposes two different models of the evolutionary process of industries over time. Some industries can be best characterized by the model of the conical revolving door, where new businesses are started, but there is also a high propensity to subsequently exit from the market. Other industries may be better characterized by the metaphor of the forest, where incumbent establishments are displaced by new entrants. Which view is more applicable apparently depends on three major factors – the technological conditions, scale economies, and demand (ibid., p. 171).

When SMEs deploy a strategy of innovation, they typically start at a very small scale of output. They are motivated by the desire to appropriate the expected value of new economic knowledge. But, depending upon the extent of scale economies in the industry, the firm may not be able to remain viable indefinitely at its start-up size. Rather, if scale economies are anything other than negligible, the new firm is likely to have to grow to survive. The temporary survival of new firms is presumably supported through the deployment of a strategy of compensating factor differentials that enable the firm to discover whether or not it has a viable product (Audretsch et al., 2001).

The empirical evidence has found that the post-entry growth of firms that survive tends to be spurred by the extent to which there is a gap between the minimum efficient scale (MES) level of output and the size of the firm. However, the likelihood of any particular new firm surviving tends to decrease as this gap increases. Such new SMEs deploying a strategy of innovation to attain competitiveness are apparently engaged in the selection process. Only those SMEs offering a viable product that can be produced efficiently will grow and ultimately approach or attain the MES level of output. The remainder will stagnate, and depending upon the severity of the other selection mechanism – the extent of scale economies – may ultimately be forced to exit out of the industry. Thus, in highly innovative industries, there is a continuing process of entry of new

SMEs into industries and not necessarily the permanence of individual SMEs over the long run. Although the skewed size distribution of firms persists with remarkable stability over long periods of time, a constant set of SMEs does not appear to be responsible for this skewed distribution. Rather, by serving as agents of change, SMEs provide an essential source of new ideas and experimentation that otherwise would remain untapped in the economy.

ENTREPRENEURSHIP IN THE GLOBALIZED ECONOMY

Above we explained how globalization has ushered in an increased role for the entrepreneurial organization as well as an increased importance of geographic location. The emergence of entrepreneurship is due to the shift towards knowledge-intensive industries where SMEs play an increasing role in the modern knowledge production function as a conduit of knowledge spillovers and the evolution of industries as learning mechanism serving as agents of change. This suggests that through the process of taking knowledge created in an incumbent organization that might otherwise have remained unused and dormant, and using that knowledge to launch a new enterprise, entrepreneurship serves as an important mechanism for the spillover of knowledge.11

In addition, changes in technology may have shifted the competitive advantage away from larger-scale organizations to smaller-scale organizations. In particular, the advent of the ICT revolution directly favored SMEs and entrepreneurship (Nooteboom, 1999 and 2000).

Any economic regime switch based upon a radical new technology is accompanied by the arrival of numerous small firms. There are two reasons. First, since a new technology creates new markets by definition, it destroys incumbent market positions and the entry barriers typical for the older technology and its market. Hence, entry is made easy. Second, in the early stages of new markets, price elasticity is low because of the novelty of the product. The small firm of the typical entrant has no disadvantage because there is no competitive pressure to fight the battle of scale economies.

ICT and the Competitive Advantage of Small Firms

The specific nature of ICT-driven regime switch leads to two more reasons why the competitive advantages of large firms decreases. First, ICT tools and the practically free access to the Internet created a worldwide

platform for relations between firms irrespective of their size. Small firms in particular need these relationships to compensate for their narrow set of competencies. The second has to do with the scale effects in transaction costs (Nooteboom, 1993) when firms engage in deals, try to do so, or want to monitor them. Transaction costs are higher for small firms when compared to large firms. This has to do with the fixed costs involved with setting up information systems for search, evaluation, control and enforcement. These fixed costs consist of necessary hardware, software and mastering their use. The arrival of the ICT tools which are generally cheap, small and easy to use together with the practically free access to the Internet has significantly reduced the fixed cost part in the transaction costs of any deal.

In the newer knowledge-intensive economy there is more need for the exploration side of doing business as well as the skills and knowledge side. A well-known conflict in the strategic renewal of firms is whether to engage in product or process innovation. This difficult choice between the exploration and the exploitation emphasis is made easier because, as we explained above, Western firms hardly have a competitive advantage when it comes to exploiting scale economies by fine tuning the production process. This fine tuning is a process of extreme focus, eliminating every redundant part in the production process using division of labor and mechanized tasks and the smooth interplay of the labor and machines involved. Once an optimum given a certain product is reached, little prevents the forces of the globalized world from moving this optimum to wherever labor costs are lowest. Exploration is an entirely different activity requiring openness, flexibility and experimentation instead of focus and elimination. It thrives in environments where variety and cooperation can be made useful to break the knowledge filter. These are typically 'industrial district'-like and 'open source'-oriented environments with many small firms and much turbulence.

Another aspect is the removal of one of the major scale effects in the exploitation stage of the product life cycle: easy to use and cheap ICT tools in part destroy the fruits of large scale. Scale effects in distribution are threatened by the above-mentioned drop in the fixed part of the transaction costs. Lastly, there is the reputation effect which indeed protects many Western businesses, for instance in the fashion or lifestyle industries. Another cause of the decreased importance of the exploitation stage of the product life cycle is the increased wealth of the global consumer, who can afford to behave whimsically and individualistically so that the exploitation period of any given product decreases when compared to the exploration stage. Finally, the discrimination between the exploitation and exploration sides of doing business decreases. This is the world of

prototypes, beta versions, simulations, and so on. This merger between the exploitation and exploration stages is necessary because of demand pressures but also made possible by the introduction of numerical controlled machines, that is, robots (Acs et al., 1991). Computer-aided design facilitates vertical cooperation and the speed with which products can be brought to the market.

The fine tuning of the production process involves skills and knowledge as well as physical capital. In the knowledge-intensive economy the emphasis is on skills and knowledge rather than on physical capital since globalization together with the whimsical and individualistic consumer makes investments in inflexible physical capital less desirable. Rejuvenation of labor by training or replacement and improvement of knowledge by joining loose networks of businesses or cooperation with research institutes is easier than rebuilding factories and plants. By and large, the shape of factories in the service industry differs from that in manufacturing where investments in physical capital are closely connected to a specific product. In the services, physical capital takes the shape of buildings and offices which can be used for different and changing portfolios of skills and knowledge. This is one of the reasons why Western countries have not lost their competitive advantage in the service industries. The higher orientation towards skills and knowledge creates more room for SMEs in many industries.

The Declining Role of 'Leakage'

Traditionally, 'leakage' is the most important impediment for businesses to cooperate. Leakage is the unwanted spillover of knowledge or competencies which is detrimental to the specific capabilities of a firm. A firm's competitive position can be negatively effected by leakage if the knowledge or competencies spill over beyond the boundaries of a specific cooperative effort and its partners towards potential competitors. Of course, a solution is the contracting and maintenance of exclusivity. This again has several disadvantages. First, many modern forms of cooperation have ill-defined goals and means by definition, since they aim for novelty. Second, the transaction costs involved in setting up, monitoring, and enforcing exclusivity contracts can be high because of their complexity and uncertainty. Lastly, exclusivity contracts limit the spontaneity of the process of learning which is essential in the process of joint learning. 'Leakage' is less of a problem in the globalized economy with its fast-changing consumer tastes and its fast-changing technological opportunities. First, these fast changes limit the time for competitors to absorb the potential fruits of a third-party cooperative effort. By the time it understands, imitates,

implements, and commercializes the original cooperative efforts already work on further developments and improvements. Second, as described above, more and more competitive advantage is the potential to combine processes of exploitation and exploration. This combination is a way of rejuvenation which is deeply engrained in a firm's organizational culture and cannot be easily imitated. In short, an essential part of the competitive advantage of modern firms is their ability to bring about change in products and technology and less to understand the virtues of existing products and technologies. Protection of what already exists as well as 'leakage' of its deeper characteristics has become less important. This protection was more difficult for SMEs.

So, there are many avenues by which the ICT revolution stimulated the competitive advantages of SMEs and generated new emphasis on the role of entrepreneurship. These avenues go beyond the effects of globalization which urged modern economies to shift towards knowledge-intensive activities. The increased emphasis on SMEs and entrepreneurship leads to a shift in policy focus towards their individual promotion as well as their collective support on the 'industrial district' level.

CONCLUSIONS

Globalization is shifting the comparative advantage in the OECD countries away from being based on traditional inputs of production, such as land, labor, and capital, toward knowledge. This chapter has focused on two important implications, both of which emanate from the shift in comparative advantage revolving around knowledge-based economic activity. The first implication involves the organizational context for the commercialization of that knowledge and the second implication involves the spatial or geographic context.

As what has been commonly characterized as the 'Swedish Paradox' and the 'European Paradox' suggests, investments in knowledge alone may not suffice to generate innovative activity and ultimately economic growth and employment. Rather, there are both theoretical and empirical reasons for challenging the assumption that investments in knowledge automatically lead to innovation and economic growth. The existence of the knowledge filter impedes the automatic spillover of knowledge. Entrepreneurial activity, in the organizational context of a new firm, can play a key role in generating economic growth by providing a conduit for the spillover of knowledge from the organization where it is created to a new organization where it is actually commercialized and transformed into innovative activity. Thus, entrepreneurship emerges as an important

organizational form when the comparative advantage is based on knowledge, because it provides the link between the creation of that knowledge and its transformation into innovative activity.

A large literature has provided compelling evidence that knowledge spillovers tend to be localized within close geographic proximity to the source of that knowledge. In other words: entrepreneurial activity accordingly tends to spatially cluster within close geographic proximity to the knowledge source. This suggests that one of the apparent paradoxes of globalization is the (re-)emergence of regions as a source of knowledge and entrepreneurial activity that is localized and requires a presence in that region both to access the knowledge as well as to commercialize it. Thus, policies that promote both knowledge investments as well as entrepreneurship have become prominent for many regions in the most developed countries. While much of the recent attention has been devoted to the financial and economic crises, there is little reason to think that, as long as the trends towards globalized economic activity increases, the importance played by entrepreneurship within a regional context will diminish.

NOTES

1. The preparation of this document benefited from visits of Isabel Grilo to IDS in Bloomington and the Max Planck Institute in Jena. It has been written in cooperation with the research program SCALES, carried out by EIM and financed by the Dutch Ministry of Economic Affairs. Haibo Zhou provided research assistance.
2. The data are adopted from Jensen (1993).
3. It analyses a range of policy options and asks, within the proposed context for entrepreneurship policy, a number of questions suggesting different options on how to reach progress.
4. 'The Downsizing of America', *New York Times*, 3 March 1996, p. 1.
5. The disadvantages of downsizing have also been documented. See Dougherty and Bowman (1995).
6. As the German newspaper, *Die Zeit* (2 February, 1996, p.1) pointed out in a front page article, 'When Profits Lead to Ruin – More Profits and More Unemployment: Where is the Social Responsibility of the Firms?', the German public has responded to the recent waves of corporate downsizing with accusations that corporate Germany is no longer fulfilling its share of the social contract.
7. 'The Valley of Money's Delights', *The Economist*, 29 March 1997, special section, p. 1.
8. 'The Best Cities for Knowledge Workers', *Fortune*, 15 November 1993, p. 44.
9. Economic knowledge is here proxied by R&D activity.
10. Arrow (1962) pointed out that this is one of the reasons for inherent market failure. See also Audretsch et al. (2000).
11. The partly endogenous character of entrepreneurial activity is best shown in Acs et al. (2009) where the knowledge spillover theory of entrepreneurship is presented.

REFERENCES

Acs, Z.J. and D.B. Audretsch (1988), 'Innovation in large and small firms: an empirical analysis', *American Economic Review*, **78** (4), 678–90.

Acs, Z.J., D.B. Audretsch and B. Carlsson (1991), 'Flexible technology and firm size', *Small Business Economics*, **3** (4), 307–19.

Acs, Z.J., D.B. Audretsch and M.P. Feldman (1994), 'R&D spillovers and recipient firm size', *Review of Economics and Statistics*, **76** (2), 336–40.

Acs, Z.J., P. Braunerhjelm, D.B. Audretsch and B. Carlsson (2009), 'The knowledge spillover theory of entrepreneurship', *Small Business Economics*, **32** (1), 15–30.

Arrow, Kenneth (1962), 'Economic welfare and the allocation of resources for invention', in Richard Nelson (ed.), *The Rate and Direction of Inventive Activity*, Princeton, NJ: Princeton University Press, pp. 609–25.

Audretsch, David B. (1995), *Innovation and Industry Evolution*, Cambridge, MA: MIT Press.

Audretsch, D.B. (1998), 'Agglomeration and the location of innovative activity', *Oxford Review of Economic Policy*, **14** (2), 18–29.

Audretsch, D.B. and M.P. Feldman (1996), 'R&D spillovers and the geography of innovation and production', *American Economic Review*, **86** (4), 253–73.

Audretsch, D.B., P. Houweling and A.R. Thurik (2000), 'Firm survival in the Netherlands', *Review of Industrial Organization*, **16** (1), 1–11.

Audretsch, D.B. and E.E. Lehmann (2005), 'Does the knowledge spillover theory hold for regions?', *Research Policy*, **34** (8), 1191–202.

Audretsch, D.B. and P. Stephan (1996), 'Company-scientist locational links: the case of biotechnology', *American Economic Review*, **86** (4), 641–52.

Audretsch, David B. and A. Roy Thurik (1999), *Innovation, Industry Evolution and Employment*, Cambridge: Cambridge University Press.

Audretsch, D.B. and A.R. Thurik (2001), 'What is new about the new economy: sources of growth in the managed and entrepreneurial economies', *Industrial and Corporate Change*, **10** (1): 267–315.

Audretsch, D.B. and A.R. Thurik (2004), 'A model of the entrepreneurial economy', *International Journal of Entrepreneurship Education*, **2** (2), 143–66.

Audretsch, David. B., A. Roy Thurik, Ingrid Verheul and Alexander R.M. Wennekers (2002), *Entrepreneurship: Determinants and Policies in the New Economy*, Boston, MA and Dordrecht: Kluwer Academic Publishers.

Audretsch, D.B., G. van Leeuwen, B.J. Menkveld and A.R. Thurik (2001), 'Market dynamics in the Netherlands: competition policy and the response of small firms', *International Journal of Industrial Organisation*, **19** (5), 795–821.

Bottazzi, L. and G. Peri (2003), 'Innovation and spillovers in regions: evidence from European patent data', *European Economic Review*, **47** (4), 687–710.

Breschi, S. and F. Lissoni (2001), 'Knowledge spillovers and local innovation systems: a critical survey', *Industrial and Corporate Change*, **10** (4), 975–1005.

Burke, Ronald J. and Cary L. Cooper (2000), *The Organisation in Crisis: Downsizing, Restructuring and Privatisation*, Oxford: Blackwell.

Cohen, W. and D. Levinthal (1989), 'Innovation and learning: the two faces of R&D', *Economic Journal*, **99** (3), 569–96.

Dougherty, D.J. and E.H. Bowman (1995),'The effects of organizational downsizing on product innovation', *California Management Review*, **37** (4), 28–44.

European Commission (2003), *Green Paper: Entrepreneurship in Europe*, available at: http://ec.europa.eu/enterprise/entrepreneurship/green_paper/index.htm (accessed December 2009).

European Commission (2008), '"Think small first", a "Small Business Act" for European Brussels', available at: http://ec.europa.eu/enterprise/policies/sme/small-business-act/index_en.htm (accessed December 2009).

Feldman, Maryann (1994), *The Geography of Innovation*, Boston, MA: Kluwer.

Glaeser, E., H. Kallal, J. Scheinkman and A. Shleifer (1992), 'Growth of cities', *Journal of Political Economy*, **100**, 1126–52.
Griliches, Z. (1979), 'Issues in assessing the contribution of R&D to productivity growth', *Bell Journal of Economics*, **10**, 92–116.
Henderson, V. (1986), 'Efficiency of resource usage and city size', *Journal of Urban Economics*, **19** (1), 47–70.
Hirschman, Albert O. (1970), *Exit, Voice, and Loyalty*, Cambridge, MA: Harvard University Press.
IMF (2007), 'World Economic Outlook: Globalization and Inequality', WEO Reports, International Monetary Fund, available at: http://www.imf.org/external/pubs/ft/weo/2007/02/index.htm (accessed December 2009).
Jacobs, Jane (1969), *The Economy of Cities*, New York: Random House.
Jaffe, A. (1989), 'Real effects of academic research', *American Economic Review*, **79**, 957–70.
Jaffe, A., M. Trajtenberg and R. Henderson (1993), 'Geographic localization of knowledge spillovers as evidenced by patent citations', *Quarterly Journal of Economics*, **63**, 577–98.
Jensen, M.C. (1993), 'The modern industrial revolution, exit, and the failure of internal control systems', *Journal of Finance*, **48**, 831–80.
Klepper, S. (1996), 'Entry, exit, growth, and innovation over the product life cycle', *American Economic Review*, **86** (4), 562–83.
Krugman, Paul (1991), *Geography and Trade*, Cambridge, MA: MIT Press.
Nooteboom, B. (1993), 'Firm size effects on transaction costs', *Small Business Economics*, **5** (4), 283–95.
Nooteboom, Bart (1999), *Interfirm Alliances: Analysis and Design*, London: Routledge.
Nooteboom, Bart (2000), *Learning and Innovation in Organizations and Economies*, Oxford: Oxford University Press.
OECD (2007), *OECD Economic Outlook No. 81*, Paris: Organisation for Economic Co-operation and Development.
OECD (2008), *Main Economic Indicators*, Paris: Organisation for Economic Co-operation and Development.
OECD (2009), *OECD Economic Outlook No. 85,* Paris: Organisation for Economic Co-operation and Development.
Prevenzer, M. (1997), 'The dynamics of industrial clustering in biotechnology', *Small Business Economics*, **9** (3), 255–71.
Saxenian, A. (1990), 'Regional networks and the resurgence of Silicon Valley', *California Management Review*, **33**, 89–111.
UNCTAD (2007), *World Investment Report 2007, Transnational Corporations, Extractive Industries and Development*, New York and Geneva: United Nations Conference on Trade and Development, available at: http://www.unctad.org/wir (accessed December 2009).
Venables, A.J. (1996), 'Localization of industry and trade performance', *Oxford Review of Economic Policy*, **12** (3), 52–60.
Von Hippel, E. (1994), 'Sticky information and the locus of problem solving: implications for innovation', *Management Science*, **40**, 429–39.
WTO (2007), 'World Trade 2006, Prospects for 2007: Risks Lie Ahead Following Stronger Trade in 2006', WTO Press/472, World Trade Organization, available at: http://www.wto.org/english/news_e/pres07_e/pr472_e.htm#chart1 (accessed December 2009).
Zucker, L., M. Darby and J. Armstrong (1998), 'Geographically localized knowledge: spillovers or markets?' *Economic Inquiry*, **36** (1), 65–86.