

Knowledge Economies

Innovation, organization and location

Wilfred Dolfsma

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This book makes a strong and coherent contribution to the discussion of the knowledge economy and of innovation, offering a range of theoretical insights from different disciplinary perspectives. The role of knowledge, knowledge development, and knowledge diffusion is discussed not only at the micro level of individuals and firms, but also at the level of groups of firms and sectors, as well as at the level of the economy at large.

Dolfsma analyses knowledge development and diffusion as a thoroughly social process, depending on communicative structures to support cooperation. The author combines insights from economics and management with perspectives from sociology (network theory), anthropology (gift exchange), social psychology, science studies and information theory (scientometrics), using empirical analyses to demonstrate where knowledge impacts the dynamics of an economy.

This book will be of great interest to students and researchers engaged with the economics of innovation and knowledge as well as policy makers interested in knowledge development and transfer.

Wilfred Dolfsma, economist and philosopher, holds a PhD in economics and is currently employed at the University of Groningen School of Economics and Business as professor of innovation. In addition, he is corresponding editor of the *Review of Social Economy*.

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Wilfred Dolfsma

To Marnix and Jorinde who, together, know that knowledge is about facts, interpretation, and social context.

Preface

Developing new knowledge is necessarily a cooperative effort. That is one of the main themes of this book. It applies reflectively as well, and, as I hope that new knowledge is offered in this book, it is inevitable that it is very much the result of joint efforts. I have been in the very fortunate position, in the past years in which this book has come to fruition, to have worked with people who have helped me better understand the role of knowledge in the economy and in economic and social theory. There are widening circles of people that I would like to identify as contributing to my work, I just hope that I have been able to contribute as much to each of them as they have to me. In light of Mauss' (1954 [2000]) insight that there is a need for people in a given community not just to give, but also to receive, and finally to reciprocate, I can only express deep gratitude to the people who have given whom I will mention momentarily.

Some people I owe deep gratitude to can readily be identified through work that is included here. In combining knowledge and insights when working on a project it is possible that novel insights and knowledge may develop. I am sure that this has happened in the projects on which this book draws, at least for me personally. Consequently, it pleases me to thank Rick Aalbers, Rene van der Eijk, Albert Jolink, Otto Koppius, Loet Leydesdorff, Gerben van der Panne, Pat Welch for their inspiring, provoking and fruitful cooperation.

Others have read and discussed individual pieces critically and constructively. I would like to thank Mark Blaug, John Davis, Sheila Dow, Hinnerk Gnutzmann, Jeroen Hinloopen, Ferdinand Jaspers, Peter Leeson, Killian McCarthy, Robert McMaster, Bert Mosselmans, Arie Rip, Franz Schaper, Rudi Verburg, Ulrich Witt, and Fia Wunderink. While these contributions constitute the kind of intellectual gifts without which academia would grind to a shrieking halt, contributions such as they have made I cherish. Reflecting on my personal intellectual trajectory on the role of knowledge in the economy and in economics, I should go back to the times when I was graduating from economics and philosophy over 15 years ago. Since then Jack Vromen, John Groenewegen, Alfred Kleinknecht, Luc Soete, and perhaps also George Waardenburg and Gernot Grabher provided stimulus. Certainly Arjo Klammer did. My institutional odyssey reflects this too; from Erasmus University (economics of culture), University of Twente (philosophy of science and technology), University of Bonn (economic geography), Delft University of

Technology (economics of innovation), RSM Erasmus University (business school), to UNU-MERIT, and the Utrecht School of Economics. I have learned from colleagues and friends in each place.

Participants in seminars at the Max Planck Institute, Jena, at a 2004 ECIS seminar at Eindhoven University, at a 2006 CIRCLE, Lund University workshop, at UNU-MERIT at Aberdeen University School of Business, at the 2005 EAEPE Conference, at the 2004 Sunbelt Conference, at the 2004 ISS Conference, at the 2005 EGOS Conference, at the 1996 and 2006 AFEE meetings and the 2005 World Summit on the Information Society should all be thanked and I do so eagerly.

All of this came to a head during a sabbatical I spent at the Netherlands Institute for Advanced Studies in the Social Sciences in the Humanities and the Social Sciences (NIAS) in the academic year of 2005/2006, at that wonderful location in the Wassenaar dunes. Perhaps the changes in the way NIAS worked and how it facilitated its visiting scholars during that year – seen as revolutionary by its staff – have brought out the angle on the theme of this book: cooperation is necessary for new knowledge to develop and diffuse. Cooperation between individuals from a different disciplinary background was certainly stimulated to the best possible extent. Seminars organized, five minute talks, wonderful lunches and a great library service guaranteed that. Cooperation with more likeminded people, with whom one has an extended cooperation, however, requires that they may not only be enticed to come over to Wassenaar, but also that they can sometimes be called. It is with great relief that I learned soon after I arrived at NIAS that landlines would be installed in each office! While this, of course, is a joke, some element of each joke is always to be taken seriously. In thanking everybody who has made my stay at NIAS such a wonderful experience, I would still like to single out Jos Hooghuis, Wouter Hugenholtz, Rita Buis, Eline van der Ploeg, and dean Wim Blockmans.

Publishers and journals are important, albeit sometimes anonymous players in the academic scene. Some of the material presented in this book was published before, in articles in the *Journal of Economic Issues* (2006, AFEE), the *Journal of Economic and Social Geography* (2003, Blackwell), *Research Policy* (2005, 2006, Elsevier) and the *Review of Social Economy* (2001, Routledge). I acknowledge the efforts that publishers, associations, referees, and editors have made to uphold quality, and to make sure that a setting was created and maintained where relevant and fruitful discussions could be staged.

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1 Introduction

How to analyze the knowledge economy? How, in other words, to understand the changing and extending role of knowledge in the economy? Depending on how one defines 'knowledge economy', economies the globe 'round should always have been referred to as knowledge economies (Leydesdorff 2006). As the pace of innovation increases and knowledge assets¹ are increasingly recognized as important input in production processes that need to be recognized explicitly and can even be output that even for-profit organizations seek to develop for their own sake, as economic processes increasingly require intended or unintended self-organizing coordination between parties, and where the prospects of firms may be more related to their prospects for future profits based on newly developed goods than on current sales, one may well claim that currently most economically developed economies today can be characterized as a knowledge economy.

I argue that one necessarily needs to use a range of theoretical insights, at multiple aggregation levels, and from different perspectives to start to approach this question. The role of knowledge, knowledge development, and knowledge diffusion is discussed at the micro level of individuals and firms, but also at the level of groups of firms and sectors, as well as at the level of the economy at large.

The development of new knowledge is the result of individuals cooperating in groups, sometimes within a single organization, sometimes across the boundaries of an organization in a disciplinary field. Knowledge development thus, certainly *ex post*, can be recognized to follow specific trajectories. The trajectories align with routines and institutions that guide the search for, and further development of, knowledge. Knowledge or technological trajectories do not prevent one from explaining novelty, but rather explains how new insights can emerge, and with whom.

Trajectories are kept alive by people cooperating, working together to further knowledge. Cooperation may be motivated quite differently; people rarely have unmixed motives. Cooperation can be, and has been, studied by looking at the structures for cooperation – social networks. Specific patterns have been found to hold across a differing set of organizations. This sheds important light on the issues at hand. What is left out of this equation is the content of the relations depicted in these network structures. Specifically, in the context of trying to develop new knowledge – where the outcome hoped for may not materialize, the usefulness of what is found cannot be predicted, the input each party gives may not always be monitored, and breach of trust can largely go unpunished

2 Knowledge Economies

– there is a need not just to analyze the structures of social interactions, but the content too. How do relations get started, how may relations be drawn upon, when can they come to an end? Social capital, and the trust that supposedly ensues, is too easily ascribed to a social network. In line with what former president of the American Economic Association, Kenneth Boulding, suggests, one may look at gift exchange as the theoretically more encompassing framework for such interactions. It is a theoretical framework that offers a richer perspective as communication and interpretation or framing enters the picture too.

Child and Faulkner (1998) may be the only ones to have hinted at the micro foundations for relations between firms – such as high-tech firms, or firms in a specific region – going through specific individuals. Managers of firms are an obvious link. Formal and informal relations between others can also constitute relations that cross firm boundaries. In anticipating the effects of such relations, firms decide where best to locate. This shows in the geographical patterns of economic activity as well as in macro analyses of communication structures that constitute preconditions for knowledge transfer. The latter is included here as well, measured in terms of entropy indicating the extent to which uncertainty in a knowledge economy is (locally) reduced due to (the possibility) of expectations being aligned by communication. Communication both requires and may create, if parties are willing, a shared frame of reference.

All too readily, economists have tended to ignore issues of interpretation and framing, sticking rather to a view that is most readily summarized in Figure 1.1;



Figure 1.1 The standard economic view of knowledge and learning

Source: DaDA, courtesy of © Gilia van Dijk filmprodukties, 1994.

the knowledge people have consists of explicit information that can be easily inspected. Somebody's knowledge is like books one carries around on one's head. Chapter two discusses this at more length, and argues how this view must be altered if a degree of realism is sought.

If the dynamics of a knowledge economy should be conceived of differently, if communication and miscommunication are of import, and if the concept of knowledge itself must be reconceptualized at least by economists, should then the way in that one is to evaluate relevant phenomena also be altered? In a final chapter to this monograph, I argue that indeed the usual Paretean welfare economics should be complemented by the kind of dynamic considerations of communication that play out in the longer term that are hinted at by Schumpeter. In particular, institutional changes to the system of Intellectual Property Rights (IPRs), central institutions in a knowledge economy, are scrutinized.

Obviously, then, insights from economics and management are presented, but these are combined in a coherent manner with insights from sociology (particularly network theory), social psychology, science studies and information theory (scientometrics). These are the most salient perspectives to be discerned from the manuscript. In addition, for these various aggregation levels, empirical analyses are presented that indicate just how, and where, knowledge impacts the dynamics of the economy. As a result, the monograph you now have in your hands can easily be distinguished from its 'competitors'. It fills a void in the literature. Even though it is interdisciplinary in spirit, it offers a coherent analysis, theoretically as well as empirically, of the topic. Others either offer an analysis from a specific perspective (Cooke 2002; Rooney *et al.* 2005; Foss 2005), seem to lack coherence even though they might have other strengths (Rooney *et al.* 2005; Dolfma and Soete 2006), or do not offer the unique combination of theoretical discussion and empirical analysis (Rooney *et al.* 2005). Some hardly offer empirical material (Foss 2005 includes 'critical essays'), or are rather reflective (Thrift 2005).

While I primarily write this book as an economist, one will find that insights from management, philosophy, (economic) sociology and network analysis, economic geography and public policy are actively drawn on and integrated into the framework. Graduate, as well as undergraduate, students should be able to understand its argument, and fellow scholars may find useful insights here as well. The phenomenon discussed is clearly tropical, and the angles taken appreciable, so policy makers may also find it informative. I have certainly tried to cater to this group also.

2 Knowledge and learning

‘The Caterpillar {said} sternly “Explain yourself!” “I can’t explain myself, I’m afraid, sir,” said Alice “because I’m not myself, you see.”’

Lewis Carroll – *Alice’s Adventures in Wonderland*

‘Knowledge’ takes a central place in the economy, but is a rather undertheorized concept in the economics literature. The metaphor pervasively used in economics to understand knowledge is that of ‘capital’. Taking capital as a metaphor of knowledge introduces problems, as becomes apparent when economics addresses issues of learning and technological development. Instead, it is argued that economists could learn from what philosophers as well as psychologists have said about how to understand knowledge. In the fields of technology studies and the history of economics, such views have had some impact.

2.1 INTRODUCTION

The newly emerging reality of our economies today is that they are knowledge economies (OECD 1996b). This is recognized in diverse strands of thought in the economics discipline after the puzzling findings in the Growth Accounting literature (e.g. Denison 1967). Romer (1987, 1993) has been developing ideas about how knowledge impacts on economic growth, better known as New Growth Theory. The work of Baumol (2002) relates to this. Studying a dynamic, knowledge-based economy requires that a conceptual understanding of knowledge is developed to be used in economics. This chapter, therefore, first finds fault with some conceptualizations that have some currency in economics, then looks more closely at some of the features of the concept of knowledge, such as are relevant, and subsequently discusses the merits of the views of knowledge expounded here.

2.2 KNOWLEDGE IN ECONOMICS: CAPITAL

According to Nobel Laureate in economics Friedrich Hayek, the concept of ‘knowledge’ is central to economic theory (1937, 1945). Many strands in

economics have, however, largely neglected the discussions on the subject of the nature of knowledge – epistemics is largely ignored. The view on knowledge, whether implicitly subscribed to or explicitly taken, has important consequences for the development of economic theory. The opposite is also true – a scholar's epistemic position relates to the kind of economic theory adopted. Because the concept of knowledge is such an elusive one, economists, in search of a way of grasping it, have tried to come to grips with it by employing the known concept of capital in a way that stretches its original use.¹ I draw on ideas proposed by philosophers and psychologists who have studied the concept of 'knowledge' to make the case that knowledge is not usefully treated as if it were capital.

To most economists, the metaphor of capital seems most useful in dealing with 'knowledge'. Such comparisons of knowledge with capital are the cornerstone of human capital theory, as developed by Becker and others. A consequence for economic theory of perceiving of knowledge as if it were capital is that the phenomena of technology and technological change present theoretical difficulties.

In order to find a description of what is generally taken as capital by economists, one can perhaps best go back to one of the founding fathers of the science. Marshall (1920) is one of the most influential among them, and, moreover, quite explicit with regard to what is to be regarded as capital. 'Capital' is a collection of goods external to the economic agent that can be sold for money and from which (hence) an income can be derived (Marshall 1920: 71). In this regard, Marshall is following the lead of Adam Smith in his *Wealth of Nations* (1776: see for instance paragraphs II.i.1 and II.i.17). Capital is something tangible to these early economists, although Machlup (1984: 403) does not hold that capital is necessarily tangible. Nevertheless, if one is to inquire about the way the concept of capital is used today, the positions taken by these authors still seem to hold their own. Hennings (1987) has provided a lucid overview of the way in which the concept of capital is used in economic theory from the day of its inception, to present times. In this article, it is argued that capital is considered in the history of the development of the concept to be something tangible, external to the economic agent, that can, moreover, be measured or valued in terms of money.

Figure 1.1 is one frame from an animation picture called DaDA. The knowledge that people in the imaginary world of this motion picture have is measured by the number of books that each of them carries on his head. Furthermore, by consulting the books, one can easily determine the nature and amount of knowledge somebody has acquired. This is the idea of learning as the linear and unidirectional accumulation of knowledge that inspires human capital theorists. It does not resemble the way of conceiving of knowledge that is generally adhered to in philosophy and psychology, as I will indicate below.

Several authors, working in diverse fields of the social sciences, have drawn on ideas propounded in economic theory to build theories to explain human behavior. An important concept used in this regard is the concept of 'capital' in lieu