Introduction

Jan Fagerberg

This book contains 18 essays published during an equal number of years, that is, between 2000 and 2017.¹ They focus on questions such as:

- What is innovation?
- Is it primarily a rich-country phenomenon, or is innovation relevant in the developing world as well?
- What is the role of innovation in economic growth and competitiveness?
- What are the capabilities, technological as well social, that a country needs to develop to succeed in innovation?
- Can policy influence innovation and if so, how?
- What is the role of innovation (and innovation policy) in dealing with important challenges facing contemporary societies?
- How did the knowledge-base on innovation develop, and what are its main characteristics?

I hope the reader will find these questions as exciting as I do. Many of the answers may be found in Part I of this book, termed 'Essentials', although at a fairly general level, as these papers aim at providing syntheses of large bodies of research. Later sections go more into detail about the various issues. The papers in Part II analyse the evolution of innovation studies as a scientific field, the knowledge base underpinning it and the roles of scholars, networks and organizations in this process. Part III focuses on an issue that has been central to innovation studies from the very start, namely the role of innovation for development, growth and competitiveness, and the various capabilities that countries need to develop in order to get the greatest benefit from innovation and diffusion of technology. One important conclusion is that policy-makers need to give priority to strengthening the national innovation system, that is, 'the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies'.² The papers in Part IV delve further into the study of how national innovation systems evolve and the role of (innovation) policy in nurturing such systems and responding to important challenges facing contemporary societies (such as climate challenge). The remainder of this introduction provides some context about the research presented here, that is, on why (how) I came to focus on these questions in the way I did, as well as more information on the contents of the various sections.

Understanding innovation

My research career started as a fellow in international economics at the Norwegian Institute for International Affairs (NUPI) in Oslo in the 1980s. During that time I also enlisted as a part-time PhD student at the Science Policy Research Unit (SPRU) at the University of Sussex, where I encountered Christopher Freeman, Keith Pavitt, Nick von Tunzelmann and other

intellectual leaders in the then emerging field of innovation studies, each of whom had a lasting influence on my research. The focus of my thesis,³ completed in 1988, was on a central topic for SPRU researchers at the time,⁴ that is, the role of technology and innovation for growth and competitiveness. However, a country's ability to benefit from innovation and diffusion of technology also depends on what the economic historian Moses Abramovitz – who I had the privilege to work with in the early 1990s – called social capabilities, that is, wider social, economic and institutional factors that influence innovation-diffusion and its economic impact, which hence need to be taken into account.⁵ When I started to explore these matters there were very few data sources available that could be exploited to throw light on a country's innovation activities and the factors underpinning them. But more recently, the involvement of a number of international organizations (from the World Bank to, say, Transparency International) and researchers has greatly expanded the supply of information on these issues, opening up new possibilities for research that I – as Part III of this book shows – have been eager to exploit.⁶

However, in 1996 I was appointed professor at the University of Oslo, affiliated with a small, interdisciplinary center focusing on the role of science, R&D and innovation in society. I saw this as an opportunity to carve out a niche for innovation studies in the Norwegian university system and started to lobby for support. One of the ideas I came up with was to create an international innovation studies network through which the few Norwegian researchers and doctoral students interested in this topic could link up with leading scholars worldwide (that is, meet face-to-face at the workshops in Norway), and much to my surprise the Norwegian Research Council decided to support it. In suggesting this I was very aware of the interdisciplinary nature of the knowledge on innovation, and the need for such a network to draw on insights from different disciplinary frameworks, such as history, economics, business studies, management, sociology, geography, and so on. The purpose of the workshops was not to present papers but to discuss central issues of relevance for the study of innovation. The intuition was that in an interdisciplinary environment, differences in conceptual frameworks, ways to present the argument and style may easily block communication, and that particularly holds for written communication, so that it might be more fruitful to have a more informal, oral discussion about the central issues. This worked surprisingly well but, consistent with the basic idea, little came out of it in terms of communication to a broader audience, and as the project approached its end, that became more of a concern. After the last workshop I asked one of the participants, David Mowery (from University of California, Berkeley), if he was willing to join me in developing the discussions into a book format. He not only agreed but also helped to get Richard Nelson – a towering figure within the fields of innovation studies and evolutionary economics – to join the embryonic project, something that made it even more exciting.

The idea was to produce a comprehensive overview and synthesis of the current knowledge on innovation and its role in social and economic development, drawing – just as the innovation studies network had – on insights from different disciplinary and interdisciplinary research environments. In doing so I was inspired by a project Christopher Freeman had invited me into nearly twenty years earlier, in which a broad set of scholars with expertise on topics such as evolutionary economics, innovation and business studies came together at workshops to produce a joint volume on *Technical Change and Economic Theory*.⁷ The aim was to create a similarly inspiring environment with lots of interaction, workshops, and so on, albeit with an

even broader (interdisciplinary) focus. But for this financial support was needed, so I applied (successfully) to the European Commission for support through its framework-program, arguing (as was true I think) that the framework-programs had been instrumental in supporting the development of innovation studies, and that it was time to sum up and consider the lessons. The process included two workshops, in which the authors in a highly interactive fashion engaged in each others' work, and in this way the book became truly a collective effort.⁸ I thought a fitting title would be *Understanding Innovation* but David Musson of Oxford University Press said it would reach a larger audience as an *Oxford Handbook of Innovation*. The handbook was published in 2004 and has since been reprinted many times (as well as translated to Chinese). Two of the chapters in this volume (Chapters 1 and 9) were first published in the handbook.

Reflecting on my ambition to analyse and synthesize the knowledge-base on innovation, one question started to puzzle me, namely how to identify in a reasonably accurate and objective manner the contributions that have influenced the evolution of a scientific field such as innovation studies? Arguably, this may be particularly challenging in an interdisciplinary field lacking many of the institutional and organizational characteristics that characterize established disciplines. A possibility for looking more deeply into this issue emerged in 2007–8 with a research group on 'Understanding Innovation' at the Center for Advanced Studies (CAS) at the National Academy of Science in Oslo for which I was responsible.⁹ In doing so I was also greatly inspired by talking with one of the other members of the group, Ben Martin from the University of Sussex, who shared my interest in tracing the intellectual development of innovation studies and related fields of research, and was working on a paper on these matters.¹⁰ The work continued after the completion of the year at CAS through the EXPLORE¹¹ project, which explored the evolution of not only innovation studies but also two related fields, that is, entrepreneurship studies and STS.¹² Results from my search for ways to get a better grasp of the activities of the scholars that engage with innovation today, as well as an improved understanding of how the field has evolved towards its present stance, are included in Part II in this volume.

One topic that increasingly has attracted my interest concerns the role of innovation policy in supporting the economic dynamics of a country and helping to cope with problems that feature prominently on policy-makers' agendas, such as the climate challenge, and results from my work on these issues are included in Part IV of this volume. Between 2003 and 2008 I was responsible for the IPP (Innovation, Path-dependency and Policy) project, financed by the Norwegian Research Council, which focused on the Norwegian innovation system. While much previous work on national systems of innovation has been static in character and lacked historical depth, the IPP project applied a historical and evolutionary perspective. This led to a focus on the co-evolution of policy, the research infrastructure and key sectors in the economy. A paper summarizing the approach we developed in the project is included in Part IV of the present volume as Chapter 15.¹³ A new opportunity to delve further into policy-relevant issues came with the offer of an externally funded research professorship,¹⁴ which included funds for organizing international workshops, at Ålborg University in Denmark in 2011. One of these workshops, which focused on the policy challenges for Europe arising from the combined impact of economic stagnation and global warming,¹⁵ eventually resulted in the publication of the book *The Triple Challenge for Europe: Economic Development, Climate Change and Governance*, coedited with Ben Martin and Staffan Laestadius, by

Oxford University Press in 2015, from which two of the chapters in this volume (Chapters 17 and 18 in Part IV) originate.

Essentials

This section summarizes the state-of-the-art in innovation studies, with particular emphasis on the parts of field that are central to my research, and in this way serves a prelude to the chapters in the later sections that follow.

The very first chapter in the present volume, entitled ‘Innovation: A guide to the literature’, is according to Google Scholar my most cited (and certainly most widely read) work. It is included here as the first chapter because it engages with conceptual issues, for example, what innovation is about, discusses the challenges that innovative firms face, and presents an introductory overview of central topics within innovation studies. It is followed by a more theoretically oriented chapter, which provides a more detailed account of Schumpeterian innovation theory, considers its strengths and weaknesses, and discusses how the Schumpeterian agenda has progressed from around 1960 onwards (which marks the starting point for modern innovation studies). Rather than focusing on what distinguishes different strands of research in this area, the discussion in the chapter centers on what the various contributions have in common, that is, if there is a common (theoretical) core, the answer to which, the chapter argues, is affirmative. A central argument in these two chapters is that innovation, understood as attempting to try out new ideas for how to do things in practice, is a powerful source of change in all parts of society and is not limited to certain so-called ‘high-tech’ segments as some observers (at least implicitly) tend to assume. Following up on this line of argument, Chapter 3¹⁶ (co-authored with Martin Srholec and Bart Verspagen) presents an overview and discussion of the role of innovation in development, an issue that traditionally has been neglected (and continues to be so by many observers). This neglect, according to Chapter 3, reflects the much too narrow understanding of innovation historically employed by many scholars working on these topics. Finally, I have included a recent paper on innovation policy, which among other things highlights the implications of a broad understanding of innovation for the role innovation policy may play, and consider issues of relevance for design, implementation and governance of innovation policy.

The emergence of Innovation Studies as a scientific field

The chapters in this section extend the analysis in Chapter 1 by focusing in more detail on what characterizes the field of innovation studies today, what the most important contributions are (and the scholars and research environments behind them), and how the field has evolved to its present stance.

As Chapter 5, written together with Bart Verspagen, explains, the field of innovation studies started to develop in the early post-Second World War period, mostly confined to a few research units in the USA and the UK and two disciplines, economics and sociology. During the 1970s and 1980s the field grew larger and more interdisciplinary in character. Important theoretical developments during this period, such as the revival of evolutionary economics (for example, Nelson and Winter 1982, see Chapter 2), greatly influenced the analysis of innovation in firms. Moreover, as the field grew, the focus of research shifted from concentrating mainly on innovation in firms to the broader societal context, including policy-related matters. This broadening of the scope of research culminated with the formulation of

the national innovation system approach around 1990 (see Chapters 4 and 14). Thus, as the chapter points out, during these years a core literature on innovation and its role in social and economic change developed. Organizational and institutional features characteristic of scientific fields, such as dedicated journals and professional associations, also emerged by the 1980s and 1990s and continue to play a prominent role in the field.

Nevertheless, it would be premature to conclude from these developments that innovation studies have developed into something akin to a discipline. To throw more light on how the field works a web survey of innovation scholars who identify themselves as being part of innovation studies was conducted (using a so-called snowball methodology), the results of which are reported in Chapter 5. The research verified that – as in other fields – innovation scholars tend to work together in smaller groups associated with leading academics and often are confined to a limited geographical area. The main research question entertained by the study, then, was to what extent these smaller groups can be said to be embedded in larger communities held together by common cognitive and/or organizational features. The research showed that so-called ‘cognitive communities’, the largest (and most central) of which was called ‘the Schumpeter crowd’, play an important role in integrating the overall network of innovation scholars, although by comparison with other social science disciplines, organizational and institutional aspects remain relatively weak in the field of innovation studies.

Chapters 6 and 7 are concerned with emergence of organizations (centers, departments, and so on) focusing on innovation studies and related areas of study, and the roles of academic entrepreneurship and environmental factors in shaping these initiatives and their outcomes. Chapter 6 (coauthored with Morten Fosaas, Martin Bell and Ben Martin) is mainly concerned with the critical role of Christopher Freeman – arguably the single most important academic entrepreneur in this area – and draws on a blend of historical research and bibliometric analysis. Chapter 7 (written together with Tommy Clausen and Magnus Gulbrandsen) is based on a web-survey of leaders of existing centers/departments as well as a number of case studies of initiatives in this area including some that eventually failed. The research shows among other things that the probability of survival for such initiatives, claiming to deliver societally useful knowledge unavailable elsewhere, is greater in universities than in other parts of society, is positively affected by the ability to engage in teaching programs (for which the new unit is able to exercise academic control), and that support from university leaderships and external sources is vital.

Finally, Chapter 8 (with Morten Fosaas and Koson Sappasert) traces the evolution of the scholarly literature on innovation, and by implication the scholars that produce it, over half a century or more, through exploitation of a previously unexploited data source, namely citations in handbooks¹⁷ surveying the field or important parts of it.¹⁸ The analysis illustrates among other things the evolution of innovation studies from a small, disciplinary-based activity sited in a few locations to a large, multi- and interdisciplinary field, and the roles of central academics (such as Freeman), organizations (such as SPRU) and institutions in this process. It also demonstrates, as mentioned above, the changing nature of the research agenda in this area. Nevertheless, the field’s tremendous growth also implies challenges, including the risk that different parts, such as innovation management (which has expanded in recent years) and social science (which used to dominate), may drift apart. Although this may be seen as a natural consequence of increasing specialization and diversification in a growing area of

science, a possible downside is that lack of interaction between scholars studying different parts of the innovation system may hamper the development of a holistic understanding of the phenomenon.

Innovation, growth and development

The question of why some nations prosper while others stay poor is a classic topic in economic research. As Chapter 9, written together with Manuel Godinho, points out, Adam Smith struggled with this issue in the 18th century, and the topic has continued to be surrounded by controversy. The argument that it has something to do with technology and innovation, and policies supporting it, was presented early on by scholars such as Friedrich List, among others. However, mainstream economists and international organizations such as the World Bank have traditionally downplayed the role of interventionist politics for economic development and instead recommended practicing openness to trade and allowing markets to operate as freely as possible, what around the turn of the 21st century came to be known as the ‘Washington consensus’. The underlying argument was that economic catch-up is a rather easy affair, as long as markets are allowed to ‘do their job’. In contrast, the proponents of more interventionist politics emphasize the challenging nature of the venture. Chapter 9 traces the development of this controversy, considers the arguments behind the various positions and looks in more detail at the politics behind examples of successful catch up. The evidence shows that countries that succeeded in catch-up generally intervened rather heavily in the economy, although in different ways, depending on the specific circumstances.

So politics matter but how? Some say that what politicians have to do is pick the right ‘activities’. Some economic activities, it is argued, are simply much more technologically progressive, productive and profitable, and countries that manage to specialize in those will be at an advantage.¹⁹ Chapter 10 considers the merits of the argument for a sample of countries on different levels of development. The analysis shows that specialization and changes in specialization patterns account for very little of the observed differences in cross-country productivity growth. Hence, it appears that the factors that matter for the differential economic performance of countries are more general in nature and affect a range of economic activities. This finding is consistent with the observation that present-day developed countries specialize in different activities, yet exhibit broadly similar levels of productivity and income.

Chapters 11–13 suggest a framework for analysing why growth differs across countries and provide supporting evidence. These chapters argue that a country’s level of development reflects two sets of factors: technological capability and social capability, both of which have been identified in the literature, but seldom taken into account together (as is essential). The former concerns the ability of an economy to identify, acquire, absorb, exploit and develop technology, capabilities that are to a large extent associated with firms.²⁰ However, firms do not operate in a vacuum, but interact with other firms and organizations, private and public, that influence the level of technological capability of a country’s business sector. Social capabilities,²¹ in contrast, are characteristics of the broader (national) environment surrounding firms that provides a framework for their activities (laws, norms, regulations, and so on) and furnishes them with various types of resources (skills and finance for example). It follows that both technological and social capabilities matter for economic development and thus both need to be taken into account in the analysis. As pointed out earlier, when I started to work on these matters there were very few data sources available that could throw light on a country’s

technological and social capabilities but more recently the supply of information on these issues has greatly expanded, opening up new possibilities for research. Chapters 11 and 12 exploit this new opportunity, using factor analysis to weigh the importance of related types of evidence. While the analysis in Chapter 11 (written together with Martin Srholec and Mark Knell) is based on a formal open economy model, which leads to the identification of four different types of ‘competitiveness’, Chapter 12 (with Martin Srholec) adopts a more flexible framework in which the various capabilities are distinguished through statistical analysis (rather than identified in advance through a theoretical model). However, the overall conclusions are the same, what drives economic development (and catching up) in the global economy is accumulation of technological and social capability, while other factors (which economists tend to emphasize much more) are of much lesser importance. The implication is that policy-makers need to focus on supporting growth of (technological and social) capabilities, or – as Chapter 12 puts it – building the national innovation system.

The final issue considered in this section concerns the interaction between technological capabilities on the one hand and social capabilities on the other hand. Many empirical applications of Abramovitz’s perspective have narrowed the concept of social capability to education and, occasionally, finance. However, Abramovitz’s concept was much broader and included aspects related to a country’s governance and the prevalence of (social) norms, and so on. Such factors are very difficult to measure with precision but Chapter 13 (coauthored with Maryann Feldman and Martin Srholec) attempts to do just that for a sample of US regions and European countries. The results indicate that less tangible social factors, for example, the degree of ‘social cohesion’ in a society, do indeed affect the development of technological capabilities, and thus deserve a central place on both research and policy agendas.²² The implication is that politicians should take care to avoid policies that harm social cohesion, because this may have very negative long run consequences, not only in the social domain, but also with respect to technological capability and economic performance. From this perspective it is discomfoting to observe that the EU’s political leadership, in spite of paying lip-service to goals of increasing social cohesion and fostering economic convergence, in fact have pursued policies that produce just the opposite (see Chapter 17).

Innovation systems, (grand) challenges and policy

The literature on national innovation systems emerged around 1990, and quickly became popular among policy-makers, who saw it as a welcome addition to the rather sterile ideas coming out of traditional economic thinking at the time. Chapter 14 (with Koson Sapprasert) traces the emergence and spread of the approach. As explained in several chapters (see, for example, Chapters 4 and 15), the new approach generated some advice that policy-makers found helpful, such as supporting capability-building in firms and facilitating interaction among the various actors in the system, and policy instruments reflecting such new insights gained in prominence. Early attempts to apply the NSI approach to various countries²³ nonetheless focused on descriptive ‘snapshots’ of these systems, revealing large differences among different national systems but offering little by way of explanations and performance implications of these differences. Chapter 15, coauthored with David Mowery and Bart Verspagen, attacks this problem head on through a case study of the evolution of the Norwegian national innovation system. The chapter argues that the Norwegian innovation system, like those of other advanced economies, reflects the interaction (or coevolution) between the

industrial structure of a country on the one hand and its political systems and institutions on the other hand. Since industries differ with respect to how innovation is performed and hence also what they need from the external environment, a country's specialization pattern influences the development of its national innovation system and vice versa. For instance, as the chapter shows, Norway's natural-resource-based industries invest little in R&D, leading to a low share of industrially funded R&D investment in GDP when compared to most other developed countries. In Norway this is sometimes highlighted as a matter of great concern for policy-makers. As the chapter notes, however, the relatively low level of industrial R&D in Norway is similar to that of other advanced resource-based economies. This illustrates the pitfalls with basing policy advice on a single metric. Arguably, detailed analysis of the working of the national innovation system is needed to identify the problems that need to be addressed.²⁴

Chapter 16 extends the analysis by comparing the Norwegian pattern of development with those of two neighboring countries, Finland and Sweden. The comparative analysis shows that while there are similarities in the development of these national innovation systems, there are also important differences, and that these differences not only reflect differences in specialization patterns but also have to do with differences in history, politics and institutions. For example, Finland and Norway gained independence only during the last century or so, while Sweden has a much longer history as an independent nation state. As a result, central institutions and public sector organizations, such as universities, have a much longer history – and play a much more important role today – in the Swedish national innovation system than in the two other countries. Moreover, as the chapter shows, R&D providers outside the university sector have a long history in Finland and Norway, and continue to play an important role and receive ample public funding, while in Sweden such organizations hardly exist. Instead, the nation's domestic universities perform many of the roles associated with non-university research institutions elsewhere in the Nordic region. However, it is not obvious that such (historically produced) differences should be a concern for policy-makers, as different institutional set ups may well be equally efficient. Arguably, mechanical transfer of so-called 'best practice' from one national system to another may easily do more harm than good. In fact, as shown in a large meta-study of innovation policies, implementation of identical policy instruments may have very different consequences in different nations.²⁵ Sensitivity to context is therefore essential when designing and implementing innovation policy.²⁶

The challenge of analysing the dynamics of national innovation systems has been addressed by a number of studies.²⁷ Chapter 4 presents an overview and synthesis of this literature, while Chapter 16 considers the implications in a Nordic context. It is pointed out that although national innovation systems differ in important respects, what goes on within such systems – that is, the dynamics – share important communalities. Several specific processes that influence innovation dynamics within a country are highlighted, including provision of knowledge, supply of skills, finance, demand and institutions. It is argued that these processes are to a large extent complementary, for example, it is of little help to have relevant knowledge if you lack the required skills to implement them, or if finance or demand is not forthcoming. Hence, as the chapters point out, policy failure in one domain (process) may easily harm the dynamics of the entire system. Moreover, the various processes that matter for innovation are influenced by a large number of policy-makers in different domains, and effective innovation policy accordingly requires coordination and alignment of the actions of diverse policy actors.

Thus, policy coordination, what Chapter 4 calls ‘strategic innovation system management’, emerges as an important aspect of innovation policy.

Innovation is about solving problems, and this makes innovation policy particularly useful as a tool to solve problems high up on policy-makers’ agendas. Chapters 17 (with Bart Verspagen) and 18 (coauthored with Staffan Laestadius and Ben Martin) of the present volume are concerned with two pressing problems in Europe, namely the unsatisfactory economic performance of the last decade (that is, the European stagnation) and the climate change challenge. It is shown that these two challenges are intimately related, as any attempt to increase growth is *ceteris paribus* likely to lead to increased emissions of greenhouse gases, thereby making the climate problem even harder to solve. Chapter 17 mainly focuses on economic issues, and shows among other things that the economic stagnation and the tendency towards divergence in productivity and living conditions within Europe have deep historical roots that reflect differences in economic structure and capabilities. Moreover, the austerity policies of the last decade, patterned on the German experience from earlier decades, have not been helpful in addressing these problems and it is evident that a new policy stance is needed. As Chapter 18 points out, however, any new policy stance also has to take into account the need to deal with climate change by reducing long-term growth in emissions of greenhouse gases to a negligible level, requiring a very extensive change in the way Europe’s economy works, for which innovation – and innovation policy – arguably will be essential. This type of innovation policy, which provides a sense of direction to the collective innovation journey and rallies potential contributors behind it, may be relevant for a wide range of activities essential for the transition to a sustainable economy. However, as pointed out above, in order to be effective, such a policy may have to link and coordinate different policy arenas. Thus, the transition to sustainability requires more than technological innovation; new – innovative – forms of governance and institutions are also needed.

Notes

1. An earlier collection, covering the period up to 2000, was published in 2002 (Fagerberg 2002).
2. Freeman 1987, p. 1.
3. The thesis can be downloaded from <https://ideas.repec.org/p/pramprapa/59156.html> (accessed November 27, 2017).
4. See, e.g., Freeman et al. 1982, Dosi et al. 1990 and von Tunzelmann 1995.
5. Abramovitz 1986, 1994.
6. Most of the work reported in Part III is done jointly with Martin Srholec, who I had the pleasure to work with from the early years of the new millennium onwards, first as PhD supervisor and then as colleague.
7. Dosi et al. 1988.
8. Most of the work on the handbook took place while I was on sabbatical in Lisbon during the academic year 2002–2003. I am indebted to ISEG, particularly Manuel Mira Godinho, for an excellent working environment and the Gulbenkian Foundation for economic support.
9. For more information see <https://cas.oslo.no/research-groups/understanding-innovation-article324-827.html> (accessed November 27, 2017).
10. Martin 2012.
11. See Fagerberg, Landström and Martin (2012) for an overview of results from the EXPLORE project. The project was financed by the European Commission (DIME network of excellence).
12. The project was finalized during my sabbatical at SPRU, University of Sussex during the academic year 2009–2010. I am indebted to SPRU, particularly Ben Martin, for providing a highly inspiring working environment as well as economic support during the stay.
13. The paper draws on a book, co-edited with David Mowery and Bart Verspagen, entitled *Innovation, Path Dependency and Policy: The Norwegian Case*, published by Oxford University Press in 2009.
14. The professorship, with a duration of five years (2011–2016), was at the Department of Business and Management at Ålborg University (and affiliated with the IKE research group there). Gratitude must be

- expressed to the department, and Birgitte Gregersen in particular, for offering me this opportunity and to the Obel foundation for financial support.
15. The workshop, which took place in Ålborg in 2012, was the second of its kind. It was preceded by a workshop on 'The Future of Innovation Studies' in 2011, resulting in the publication of a book on the subject on Oxford University Press two years later (Fagerberg, Martin and Andersen 2013). A later workshop (in 2013) had 'Innovation Policy' as its main theme. Chapter 4 in the present volume is an elaborated version of a paper presented at that workshop.
 16. This chapter is an abridged version of a larger study (Fagerberg, Srholec and Verspagen 2010).
 17. A common feature with new, interdisciplinary scientific fields such as innovation studies is as mentioned that the organizations and institutions normally characterizing scientific work, such as professional associations, journals, departments etc., are weak, and that the identification and spread of state-of-the-art knowledge therefore may happen through channels that are less prominent in more established areas. One such channel, which has proven to be important in innovation studies (but also in several other areas), is publication of so-called handbooks. On the assumptions that authors of handbook chapters are experts in their respective field; that they refer to the most important works of relevance for their subject; and that handbook editors exercise sufficient academic control, references in handbooks may be used as a source of information on the evolution and state-of-the-art of a scientific field.
 18. This data source is also exploited, although to a lesser extent, in Chapters 6 and 14.
 19. See, e.g., Lucas 1988, 1993; Reinert 1993.
 20. Kim 1997; Lall 1992.
 21. Abramovitz 1986, 1994.
 22. For another attempt to pursue these hard-to-research but arguably very important matters, this time for a cross-section of countries using data for the World Values Survey, see Fagerberg and Srholec (2009).
 23. See, e.g., Nelson 1993.
 24. Edquist 2004, 2011.
 25. Edler et al. 2016.
 26. Edler and Fagerberg 2017.
 27. Edquist 2004; Bergek et al. 2008.

References

- Abramovitz, M. (1986), 'Catching Up, Forging Ahead, and Falling Behind', *Journal of Economic History*, **46**, 386–406.
- Abramovitz, M. (1994), 'The Origins of the Postwar Catch-Up and Convergence Boom', in J. Fagerberg, B. Verspagen and N. von Tunzelmann (eds), *The Dynamics of Technology, Trade and Growth*, Aldershot, UK and Brookfield, VT, USA: Edward Elgar Publishing, 21–52.
- Bergek, A., S. Jacobsson, B. Carlsson, S. Lindmark and A. Rickne (2008), 'Analyzing the Functional Dynamics of Technological Innovation Systems: A scheme of analysis', *Research Policy*, **37**, 407–29.
- Dosi, G., C. Freeman, R. Nelson, G. Silverberg and L.G. Soete (eds) (1988), *Technical Change and Economic Theory*, London: Pinter.
- Dosi, G., K. Pavitt and L.G. Soete (1990), *The Economics of Technical Change and International Trade*, London: Harvester Wheatsheaf.
- Edler, J. and J. Fagerberg (2017), 'Innovation Policy: What, Why and How', *Oxford Review of Economic Policy*, **33** (1), 2–23.
- Edler, J., P. Cunningham, A. Gök and P. Shapira (eds) (2016), *Handbook of Innovation Policy Impact*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing.
- Edquist, C. (2004), 'Systems of Innovation: Perspectives and Challenges', in J. Fagerberg, D. Mowery and R. Nelson (eds), *Oxford Handbook of Innovation*, Oxford: Oxford University Press, 181–208.
- Edquist, C. (2011), 'Design of Innovation Policy Through Diagnostic Analysis: Identification of Systemic Problems (or Failures)', *Industrial and Corporate Change*, **20**, 1–29.
- Fagerberg, J. (2002), *Technology, Growth and Competitiveness: Selected Essays*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing.
- Fagerberg, J. and M. Srholec (2009), 'Innovation Systems, Technology and Development: Unpacking the Relationship(s)', in B.-A. Lundvall, K.J. Joseph, C. Chaminade and J. Vang (eds), *Handbook of Innovation Systems and Developing Countries. Building Domestic Capabilities in a Global Context*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing, 83–115.
- Fagerberg, J., S. Laestadius and B.R. Martin (eds) (2015), *The Triple Challenge for Europe: Economic Development, Climate Change and Governance*, Oxford: Oxford University Press.
- Fagerberg, J., H. Landström and B.R. Martin (2012), 'Exploring the emerging knowledge base of "the knowledge society"', *Research Policy*, **41** (7), 1121–31.

- Fagerberg, J., B.R. Martin and E.S. Andersen (eds) (2013), *Innovation Studies: Evolution and Future Challenges*, Oxford, UK: Oxford University Press.
- Fagerberg, J., D. Mowery and B. Verspagen (eds) (2009), *Innovation, Path Dependency and Policy: The Norwegian Case*, Oxford: Oxford University Press.
- Fagerberg, J., M. Srholec and B. Verspagen (2010), 'Innovation and Economic Development', in B. Hall and N. Rosenberg (eds), *Handbook of the Economics of Innovation*, Vol. II, North Holland, 833–72.
- Freeman, C. (1987), *Technology Policy and Economic Performance: Lessons from Japan*, London: Pinter.
- Freeman, C., J. Clark and L.G. Soete (1982), *Unemployment and Technical Innovation: A Study of Long Waves and Economic Development*, London: Pinter.
- Kim, L. (1997), *Imitation to Innovation: The Dynamics of Korea's Technological Learning*, Harvard: Harvard Business School Press.
- Lall, S. (1992), 'Technological Capabilities and Industrialization', *World Development*, **20**, 165–86.
- Lucas, R.E. (1988), 'On the Mechanisms of Economic Development', *Journal of Monetary Economics*, **22**, 3–42.
- Lucas, R.E. (1993), 'Making a Miracle', *Econometrica*, **61**, 251–72.
- Martin, B.R. (2012), 'The Evolution of Science Policy and Innovation Studies', *Research Policy*, **41** (7), 1219–39.
- Nelson, R.R. (ed.) (1993), *National Innovation Systems: A Comparative Study*, Oxford: Oxford University Press.
- Nelson, R.R. and S.G. Winter (1982), *An Evolutionary Theory of Economic Change*, Cambridge, MA: Harvard University Press.
- Reinert, E. (1993), 'Catching-Up From Way Behind. A Third World Perspective on First World History', in J. Fagerberg, B. Verspagen and N. von Tunzelmann (eds) (1994), *The Dynamics of Technology, Trade and Growth*, Aldershot, UK and Brookfield, VT, USA: Edward Elgar Publishing, 168–97.
- von Tunzelmann, G.N. (1995), *Technology and Industrial Progress: The Foundations of Economic Growth*, Aldershot, UK and Brookfield, VT, USA: Edward Elgar Publishing.