



Paul Trott



INNOVATION MANAGEMENT AND NEW PRODUCT DEVELOPMENT

 Pearson

Sixth Edition

Innovation Management and New Product Development

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Innovation Management and New Product Development

Sixth Edition

Paul Trott

Portsmouth Business School



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Pearson Education Limited

Edinburgh Gate
Harlow CM20 2JE
United Kingdom
Tel: +44 (0)1279 623623
Web: www.pearson.com/uk

First published 1998 (print)
Second edition published 2002 (print)
Third edition published 2005 (print)
Fourth edition published 2008 (print)
Fifth edition published 2012 (print)

Sixth edition published 2017 (print and electronic)

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ISBN: 978-1-292-13342-3 (print)
978-1-292-16540-0 (PDF)
978-1-292-17069-5 (ePub)

British Library Cataloguing-in-Publication Data

A catalogue record for the print edition is available from the British Library

Library of Congress Cataloging-in-Publication Data

A catalog record for the print edition is available from the Library of Congress

10 9 8 7 6 5 4 3 2 1
20 19 18 17 16

Cover image: Max Margarit/Shutterstock

Print edition typeset in 10/12pt Sabon LT Pro by iEnergizer Aptara® Ltd
Print edition printed and bound in Slovakia by Neografia

NOTE THAT ANY PAGE CROSS REFERENCES REFER TO THE PRINT EDITION

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Preface

The demise of Kodak is a sharp reminder to all firms, even great big ones, that success today does not ensure success tomorrow. The ability of firms to develop new products and services that people want will surely help them survive into the future. But precisely how should firms go about this? The Kodak case is even more remarkable because Kodak was the pioneer in digital cameras – the technology that, ultimately, led to its decline in income. So, in this case, it is not a lack of innovation *per se* but how it is used to deliver value to the firm and its customers.

We are all well aware that good technology can help companies achieve competitive advantage and long-term financial success; just look at Google. But there is an abundance of exciting new technology in the world and it is the transformation of this technology into products that is of particular concern to organisations. There are numerous factors to be considered by the organisation, but what are these factors and how do they affect the process of innovation? This book will explain how and why the majority of the most significant inventions of the past two centuries have not come from flashes of inspiration, but from communal, multilayered endeavour – one idea being built on another until a breakthrough is reached (Johnson, 2010).

In this book we see that many of the old traditional approaches to management need to change and new approaches need to be adopted. Increasingly, managers and those who work for them are no longer in the same location. Often, complex management relationships need to be developed because organisations are trying to produce complex products and services and do so across geographic boundaries. Cross-functional and cross-border task forces often need to be created.

Objective of the book

It is designed to be accessible and readable. The book emphasises the need to view innovation as a management process. We need to recognise that change is at the heart of it. And that change is caused by decisions that people make. The framework in Chapter 1 (Figure 1.9) attempts to capture the iterative nature of the network processes in innovation and represents this in the form of an endless innovation circle with interconnected cycles. This circular concept helps to show how the firm gathers information over time, how it uses technical and societal knowledge, and how it develops an attractive proposition. This is achieved through developing linkages and partnerships with those having the necessary capabilities.

Target audience

This book is written for people who want to understand how firms can improve the way they manage their innovation processes to develop new products and services.

It can be used as a textbook for undergraduate or graduate courses in innovation management and new product development. A second audience is the manager who wishes to keep abreast of the most recent developments in the innovation field.

Special features

The book is designed with one overriding aim: to make this exciting and highly relevant subject as clear to understand as possible. To this end, the book has a number of important features:

- A clear and straightforward writing style enhances learning comprehension.
- Extensive up-to-date references and relevant literature help you find out more and explore concepts in detail.
- ‘Innovation in action’ boxes illustrate how real companies are managing innovation today.
- Clear chapter openers set the scene for each chapter and provide a chapter contents list, which offers page references to all the sections within the chapter.
- Learning objectives at the beginning of each chapter explicitly highlight the key areas that will be explored in the chapter.
- More photographs and images are included to help illustrate and enliven the text.
- Topical articles from the *Financial Times* illustrate how the subject is being discussed in the context of the wider business world.
- Summaries at the end of each chapter provide a useful means of revising and checking understanding.
- ‘Pause for thought’ questions are integrated within the text. These are designed to help you reflect on what you have just read and to check your understanding. Answers to all ‘Pause for thought’ questions are given on the book’s website (www.pearsoned.co.uk/trott).
- Comprehensive diagrams throughout the book illustrate some of the more complex concepts.
- Plentiful up-to-date examples within the text drive home arguments. This helps to enliven the subject and places it in context.
- A comprehensive index, including references to all defined terms, enables you to look up a definition within its context. See also the ‘Key words and phrases’ boxes at chapter ends. Key words are presented emboldened in colour within the main text.
- A substantial case study at the end of each chapter shows the subject in action within actual firms. These have been trialled on classes at several universities and have formed the basis of lively one-hour class seminar discussions.

What is new in the 6th edition?

- Three new chapters: ‘National systems of innovation and entrepreneurship’, ‘Market adoption and technology diffusion’ and ‘Business models’.
- ‘Innovation in action’ boxes in every chapter. These bring the subject to life by providing a real life illustration of how firms are managing innovation today.
- All chapters have been reviewed and updated with relevant references to the literature. Illustrations within chapters have been renewed. All case studies have been updated and modified where appropriate.
- Chapter 1 – there is a new case study on Apple. This new case study examines the increasing competition faced by Apple in the smartphone market and the rise of Samsung.
- Chapter 2 – this is a new chapter focusing on national systems of innovation and entrepreneurship. It emphasises the role played by the state in helping private firms grow. The subject of entrepreneurship receives substantial coverage by illustrating the linkages between these areas.
- Chapter 3 – this is a new chapter on market adoption and technology diffusion. The role played by lead users in the innovation process is explored. The chapter also covers the growing use by firms of crowdsourcing for new product ideas. The topic of frugal innovation is also included.
- Chapter 5 – a major new case study at the end of the chapter tells the story of how an innovation in the paper and board packaging industry may help it compete with polymers.
- Chapter 7 – a new section examines the issue of disruptive innovation and the innovation dilemma. This looks in detail at how it is possible for firms to offer what appears to be an inferior technology to a particular market segment and how, over time, that product can develop and overtake the original technology in terms of performance.
- Chapter 11 – a major new case study at the end of the chapter tells the story of how a nappy producer is considering using sensors in its products to indicate wetness. How will consumers react?
- Chapter 12 – this is a new chapter on business models. The chapter explains the link between business models and strategy and business plans. It discusses the many different forms of business models that exist, including the famous bait and hook business model that has been so effectively used by ink jet cartridge manufacturers and razor producers.
- Chapter 15 – the case study on eBay has been rewritten to include the eBay-PayPal separation. The growth in online payment systems forms a key part of this new case.
- Chapter 17 – a new section explores the area of innovation audits. This offers some practical guidance to firms wishing to assess their level of innovation capacity or those of others.

Web products

Log on to www.pearsoned.co.uk/trott to access learning resources, which include:

For students:

- Study materials designed to help you improve your results.
- Self-test multiple choice questions, organised by chapter.
- Answers to all ‘Pause for thought’ questions, to allow you to check understanding as you progress.
- Annotated links for each chapter to relevant companies and internet sites.

For tutors (password protected):

- Lecture notes and PowerPoint slides.
- Figures and tables from the book in PowerPoint colour slides.
- Key models as full-colour animated PowerPoint slide shows.
- Teaching/learning case studies.
- Answers to all end-of-chapter discussion questions.
- Multiple choice questions, organised by chapter for use in assessments.

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Acknowledgements

Author's acknowledgements

I am indebted to many for their ideas and assistance. My primary thanks go to the many academics who have advanced our knowledge of innovation and new product development and on whose shoulders I have been able to stand. The following reviewers provided feedback for this new edition: Jon Sundbo, Roskilde University, Denmark; Guus Berkhout, TUDelft; Helen Perks, UMIST; Niki Hynes, Napier University Business School; Mark Godson, Sheffield Hallam University; Paul Oakley, University of Birmingham; David Smith, Nottingham Business School, Nottingham Trent University; Fritz Sheimer, FH Furtwangen; Claus J. Varnes, Copenhagen Business School; Roy Woodhead, Oxford Brookes University; Patrick van der Duin, TU Delft, the Netherlands; Dap Hartman, TU Delft, the Netherlands; E J Hultink, TU Delft, The Netherlands; Phil Longhurst, Cranfield University; Zahed Subhan, Drexel University, USA; Christian M. Thurnes, Hochschule Kaiserslautern — University of Applied Sciences, Germany.

It has been a pleasure to work with my editor Rachel Gear, who provided encouragement, help and valuable suggestions. The task of writing has been made much easier by the support I have had from many people. First, all my students who have both wittingly and unwittingly provided constant feedback to me on ideas. Also, a big thank you to the team at Pearson Education. Any errors or omissions in the book are entirely mine.

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Text

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Part One

Innovation management

The purpose of this part of the book is to introduce and explore the concept of innovation management. Particular emphasis is placed on the need to view innovation as a management process. A cyclic model of innovation is introduced, which emphasises the importance of internal processes and external linkages. This raises the issue of the context of innovation and Chapter 2 demonstrates that innovation cannot be separated from the wider national system. The United States is often cited as a good example of a system that enables innovation to flourish: hence it is necessary to explore the economic factors that influence innovation and the role of entrepreneurship. The rate at which these technologies are adopted and used by consumers and society is the subject of Chapter 3.

Chapter 4 explores the issue of the organisational context and it is from this vantage point that the subject of managing innovation within firms is addressed. Virtually all major technological innovations occur within organisations; hence it is necessary to look at organisations and explore how they manage innovation.

Given that many new product ideas are based on existing products and may be developed from within the production or service operations function, Chapter 5 considers the role of operations within innovation. Many new product ideas may be modest and incremental rather than radical but the combined effect of many, small, innovative ideas may be substantial.

A major part of the process of innovation is the management of a firm's intellectual effort and this is the focus of Chapter 6. Patents, trademarks, copyright and registered designs are all discussed.

The principal message of this part is this: innovation is a management process that is heavily influenced by the organisational context and the wider macro system in which the organisation exists.

Chapter 1

Innovation management: an introduction

Introduction

Innovation is one of those words that suddenly seems to be all around us. Firms care about their ability to innovate, on which their future allegedly depends (Christensen and Raynor, 2003), and many management consultants are busy persuading companies about how they can help them improve their innovation performance. Politicians care about innovation, too: how to design policies that stimulate innovation has become a hot topic at various levels of government. The European Commission, for instance, has made innovation policy a central element in its attempt to invigorate the European economy (see Chapter 2). A large amount of literature has emerged, particularly in recent years, on various aspects of innovation and many new research units focusing on innovation have been formed (Martin, 2012).

There is extensive scope for examining the way innovation is managed within organisations. Most of us are well aware that good technology can help companies achieve competitive advantage and long-term financial success. But there is an abundance of exciting new technology in the world and it is the transformation of this technology into products that is of particular concern to organisations. There are numerous factors to be considered by the organisation, but what are these factors and how do they affect the process of innovation? This book will explain how and why most of the most significant inventions of the past two centuries have not come from flashes of for-profit inspiration, but from communal, multilayered endeavour – one idea being built on another until a breakthrough is reached (Johnson, 2010). The Apple case study at the end of this chapter helps illustrate Apple's rise and fall over the past 20 years.

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Learning objectives

When you have completed this chapter you will be able to:

- recognise the importance of innovation;
- explain the meaning and nature of innovation management;
- provide an introduction to a management approach to innovation;
- appreciate the complex nature of the management of innovation within organisations;
- describe the changing views of innovation over time;
- recognise the role of key individuals within the process; and
- recognise the need to view innovation as a management process.

The importance of innovation

Corporations must be able to adapt and evolve if they wish to survive. Businesses operate with the knowledge that their competitors will, inevitably, come to the market with a product that changes the basis of competition. The ability to change and adapt is essential to survival. But can firms manage innovation? The answer is certainly yes, as Bill Gates confirmed in 2008:

The share price is not something we control. We control innovation, sales and profits.
(Rushe and Waples, 2008)

Today, the idea of innovation is widely accepted. It has become part of our culture – so much so that it verges on becoming a cliché. But, even though the term is now embedded in our language, to what extent do we fully understand the concept? Moreover, to what extent is this understanding shared? A scientist’s view of innovation may be very different from that of an accountant in the same organisation.

The Apple Inc. story in Illustration 1.1 puts into context the subject of innovation and new product development. In this case, Apple’s launch of a new product in the mobile phone market will help Apple generate increases in revenue and grow the firm. Innovation is at the heart of many companies’ activities. But to what extent is this true of all businesses? And why are some businesses more innovative than others?

Illustration 1.1

Apple Watch app designers scramble ahead of launch

Apple has invited small groups of developers to its Silicon Valley offices to help them prepare their apps for its Watch, as it gears up for the launch at the end of this month.

Their creations range from exercise trackers and car-hailing services such as Uber, to a digital version of a painter’s palette board and an app for sending a tweet to astronauts passing overhead on the International Space Station, all from a user’s wrist.

In addition to its own messaging and fitness services, Apple is hoping a vibrant App Store will help persuade customers to spend between \$350 and \$17,000 on the Watch, its first new device since the iPad.

Developers say the technical and creative challenge is greater than when they had to rejig their iPhone apps for the iPad five years ago, due to the Watch’s tiny screen and control scheme.

Some developers are able to draw on their experience with other smartwatches, such as the



Source: Neil Fraser/Alamy Images

pioneering Pebble or Google’s Android Wear. Many are using much more rudimentary techniques, such as taping paper mock-ups to their arms, to figure out what might work best on the Watch’s 38–42mm screen.

Before March’s press event, only top-ranking iPhone developers such as Uber and Facebook were invited to Apple’s offices to test their Watch apps. In the

weeks since then, however, it has opened to more, with about 20 developers a day visiting its labs, according to those who have been there.

App makers are betting that Apple will succeed where other smartwatch makers have failed to sell in the many millions.



Source: Bradshaw, T. (2015), FT.com. 6 April.
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What is meant by innovation? And can it be managed? These are questions that will be addressed in this book.

‘. . . not to innovate is to die’, wrote Christopher Freeman (1982) in his famous study of the economics of innovation. Certainly, companies that have established themselves as technical and market leaders have shown an ability to develop successful new products. In virtually every industry, from aerospace to pharmaceuticals and from motor cars to computers, the dominant companies have demonstrated an ability to innovate (see Table 1.1). Furthermore, in The Boston Consulting Group’s annual report on the world’s most innovative companies, these same firms are delivering impressive growth and/or return to their shareholders (see Table 1.2).

Table 1.1 Market leaders in 2015

Industry	Market leaders	Innovative new products and services
Cell phones	Samsung; Apple	Design and new features
Internet-related industries	Google; Facebook	New services
Pharmaceuticals	Pfizer; GlaxoSmithKline	Impotence; ulcer treatment drug
Motorcars	Toyota; BMW	Car design and associated product developments
Computers and software development	Intel; IBM and Microsoft; SAP	Computer chip technology, computer hardware improvements and software development

Table 1.2 World’s most innovative companies

2014 Rank	Company	Revenue growth 2012–13 % change	R&D spending 2012–13 % change
1	Apple	9.2	32.4
2	Google	19.2	17.1
3	Samsung	17.0	27.8
4	Microsoft	5.6	6.1
5	IBM	–4.6	–1.2
6	Amazon	21.9	43.8
7	Tesla Motors	387.2	–15.3
8	Toyota	–3.9	–6.9
9	Facebook	54.7	1.1
10	Sony	–5.7	–18.8

Source: www.bcgperspectives.com/content/interactive/innovation_growth_most_innovative_companies_interactive_guide/, The Boston Consulting Group

Table 1.3 Nineteenth-century economic development fuelled by technological innovations

Innovation	Innovator	Date
Steam engine	James Watt	1770–80
Iron boat	Isambard Kingdom Brunel	1820–45
Locomotive	George Stephenson	1829
Electromagnetic induction dynamo	Michael Faraday	1830–40
Electric light bulb	Thomas Edison and Joseph Swan	1879–90

A brief analysis of economic history, especially in the United Kingdom, will show that industrial technological innovation has led to substantial economic benefits for the innovating *company* and the innovating *country* (see Illustration 1.2). Indeed, the industrial revolution of the nineteenth century was fuelled by technological innovations (see Table 1.3). Technological innovations have also been an important component in the progress of human societies. Anyone who has visited the towns of Bath, Leamington and Colchester will be very aware of how the Romans contributed to the advancement of human societies. The introduction over 2,000 years ago of sewers, roads and elementary heating systems is credited to these early invaders of Britain.

Illustration 1.2

A review of the history of economic growth

Economic historians argue that the world's economy has experienced unprecedented growth rates only after 1800, following millennial relative stagnation, because of the role of technology in affecting economic change.

The classical economists of the eighteenth and nineteenth centuries believed that technological change and capital accumulation were the engines of growth. This belief was based on the conclusion that productivity growth causes population growth, which in turn causes productivity to fall. Today's theory of population growth is very different from these early attempts at understanding economic growth. It argues that rising incomes slow the population growth because they increase the rate of opportunity cost of having children. Hence, as technology advances, productivity and incomes grow.

The Austrian economist, Joseph Schumpeter, was the founder of modern growth theory and is regarded as one of the world's greatest econo-

mists. In the 1930s he was the first to realise that the development and diffusion of new technologies by profit-seeking entrepreneurs formed the source of economic progress. One important insight arising from Schumpeter's ideas is that innovation can be seen as '*creative destruction*' waves that restructure the whole market in favour of those who grasp discontinuities faster. In his own words 'the problem that is usually visualised is how capitalism administers existing structures, whereas the relevant problem is how it creates and destroys them.'

Robert Solow, who was a student of Schumpeter, advanced his professor's theories in the 1950s and won the Nobel Prize for economic science. Paul Romer has developed these theories further and is responsible for the modern theory of economic growth, sometimes called neo-Schumpeterian economic growth theory, which argues that sustained economic growth arises

from competition amongst firms. Firms try to increase their profits by devoting resources to creating new products and developing new ways of making existing products. It is this economic the-

ory that underpins most innovation management and new product development theories.

Source: Adapted from Parkin, M. et al. (2008) and McCloskey, D.N. (2013).

Pause for thought



Not all firms develop innovative new products, but they still seem to survive. Do they thrive?

The study of innovation

Innovation has long been argued to be the engine of growth. It is important to note that it can also provide growth, almost regardless of the condition of the larger economy. Innovation has been a topic for discussion and debate for hundreds of years. Nineteenth-century economic historians observed that the acceleration in **economic growth** was the result of technological progress. However, little effort was directed towards understanding *how* changes in technology contributed to this growth.

Schumpeter (1934, 1939, 1942) was amongst the first economists to emphasise the importance of *new products* as stimuli to economic growth. He argued that the competition posed by new products was far more important than marginal changes in the *prices* of existing products. For example, economies are more likely to experience growth due to the development of products, such as new computer software or new pharmaceutical drugs than to reductions in prices of existing products, such as telephones or motorcars. Indeed, early observations suggested that economic development does not occur in any regular manner, but seemed to occur in bursts or waves of activity, thereby indicating the important influence of external factors on economic development.

This macro view of innovation as cyclical can be traced back to the mid-nineteenth century. It was Marx who first suggested that innovations could be associated with waves of economic growth. Since then, others such as Schumpeter (1934, 1939), Kondratieff (1935/51) and Abernathy and Utterback (1978) have argued the long-wave theory of innovation. Kondratieff was, unfortunately, imprisoned by Stalin for his views on economic growth theories, because they conflicted with those of Marx. Marx suggested that capitalist economies eventually would decline, whereas Kondratieff argued that they would experience waves of growth and decline. Abernathy and Utterback (1978) contended that at the birth of any industrial sector there is radical product innovation, which is then followed by radical innovation in production processes, followed, in turn, by widespread incremental innovation. This view was once popular and seemed to reflect the life cycles of many industries. It has, however, failed to offer any understanding of *how* to achieve innovative success.

After the Second World War, economists began to take an even greater interest in the causes of economic growth (Domar, 1946; Harrod, 1949). One of the most important influences on innovation seemed to be industrial research and development. After all, during the war, military research and development (R&D) had

produced significant technological advances and innovations, including radar, aerospace and new weapons. A period of rapid growth in expenditure by countries on R&D was to follow, exemplified by US President Kennedy's 1960 speech outlining his vision of getting a man on the moon before the end of the decade. But economists soon found that there was no *direct* correlation between R&D spending and national rates of economic growth. It was clear that the linkages were more complex than first thought (this issue is explored more fully in Chapter 9).

There was a need to understand *how* science and technology affected the economic system. The neo-classical economics approach had not offered any explanations. A series of studies of innovation were undertaken in the 1950s, which concentrated on the internal characteristics of the innovation process within the economy. A feature of these studies was that they adopted a cross-discipline approach, incorporating economics, organisational behaviour and business and management. The studies looked at:

- the generation of new knowledge;
- the application of this knowledge in the development of products and processes;
- the commercial exploitation of these products and services in terms of financial income generation.

In particular, these studies revealed that firms behaved differently (see Carter and Williams, 1957; Simon, 1957; Woodward, 1965). This led to the development of a new theoretical framework that attempted to understand how firms managed the above, and why some firms appeared to be more successful than others. Later studies in the 1960s were to confirm these initial findings and uncover significant differences in organisational characteristics (Burns and Stalker, 1961; Cyert and March, 1963; Myers and Marquis, 1969). Hence, the new framework placed more emphasis on the firm and its internal activities than had previously been the case. The firm and how it used its resources was now seen as the key influence on innovation.

Neo-classical economics is a theory of economic growth that explains how savings, investments and growth respond to population growth and technological change. The rate of technological change influences the rate of economic growth, but economic growth does not influence technological change. Rather, technological change is determined by chance. Thus, population growth and technological change are exogenous. Also, neo-classical economic theory tends to concentrate on industry or economy-wide performance. It tends to ignore differences amongst firms in the same line of business. Any differences are assumed to reflect differences in the market environments that the organisations face. That is, differences are not achieved through choice but reflect differences in the situations in which firms operate. In contrast, research within business management and strategy focuses on these differences and the decisions that have led to them. Furthermore, the activities that take place within the firm that enable one firm seemingly to perform better than another, given the same economic and market conditions, has been the focus of much research effort since the 1960s.

The Schumpeterian view sees firms as different – it is the way a firm manages its resources over time and develops capabilities that influences its innovation performance. The varying emphasis placed by different disciplines on explaining how innovation occurs is brought together in the framework in Figure 1.1. This overview of the innovation process includes an economic perspective, a business

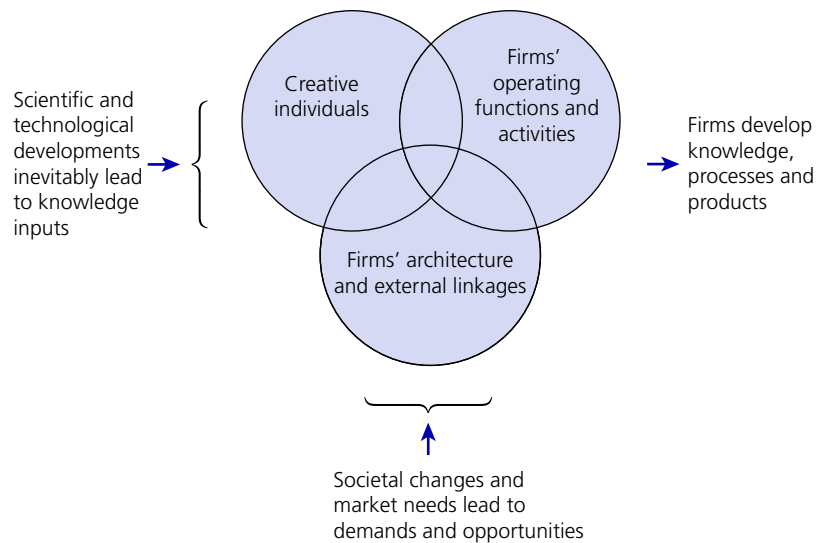


Figure 1.1 Overview of the innovation process

management strategy perspective and organisational behaviour, which attempts to look at the internal activities. It also recognises that firms form relationships with other firms and trade, compete and cooperate with each other. It further recognises that the activities of individuals within the firm also affect the process of innovation.

Each firm's unique **organisational architecture** represents the way it has constructed itself over time. This comprises its internal design, including its functions and the relationships it has built up with suppliers, competitors, customers, etc. This framework recognises that these will have a considerable impact on a firm's innovative performance. So, too, will the way it manages its individual functions and its employees or individuals. These are separately identified within the framework as being influential in the innovation process.

Two traditions of innovation studies: Europe and the USA

Benoit Godin has written extensively on the intellectual history of innovation. His work provides a detailed account of the development of the category of innovation. In his two papers 'Innovation Studies: The development of a speciality I and II' (Godin, 2010a; 2010b) he explains how two traditions emerged. The first in the USA was concerned with technological change as the use of inventions in industrial production and the second in Europe, which was concerned more specifically with commercialised invention. The European tradition, which was developed as late as the 1970s, restricted the previously broader definition of innovation as the introduction of change to a narrower focus on technology and commercialisation. Christopher Freeman is largely credited as responsible for this so-called European tradition, which shifted the focus of studies of innovation to the process from invention to diffusion and the consideration of policy issues, specifically economic growth. The idea of a professionalised R&D system was proposed as having a key role.