

# Introduction

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By the end of the twentieth century, the developed economies had been characterized, variously, as information economies, knowledge economies, post-industrial economies and, more recently, 'new economies'. In strictly factual terms, however, the characteristic that leaps most noticeably to the eye is the strong and sustained growth over recent decades of the share of services in employment and in nominal GDP. Although economists and other social scientists have been producing noteworthy studies of these activities for a long time, in an attempt both to explain their growth and to examine the economic and social challenges they pose, the relative share of research on services can be said still to be lagging behind that of services in economic activity.

Two of the principal topics that researchers on services have been concerned with are, on the one hand, productivity and, more generally, performance in service activities and, on the other, innovation in and through services. These two questions are obviously connected, if it is accepted that medium and long-term economic performance are strongly linked to the dynamism of innovation. This dual issue lies at the heart of the present book, which has its origins in an international conference held in the northern French cities of Lille and Roubaix in June 2000 and attended by most of the leading researchers on these topics.

All the contributors to this book have long experience of theoretical and empirical research on services. Their extensive empirical knowledge of services has led most of them to identify an often very wide gap between the stylized facts they present and the tools economists have traditionally used to interpret these facts. The productivity question is a puzzle in many so-called 'stagnant services', where the data provided by national accountants show little or no increase in productivity, while closer empirical observations and case studies reveal that some of these sectors are in fact as dynamic as many manufacturing industries. How can these opposing views be reconciled? Several arguments have been put forward, but none seems to account adequately for such a 'cognitive gap'. For this reason, it would seem unwise to reject the hypothesis that many service outputs are being wrongly conceptualized and measured.

It is not our contention that the main economic tools (growth, productivity,

or the substitution of capital for labour, among others) currently used for such purposes should be abandoned. Far from it. Many of the current measurement methods could be improved, especially in the vast field of service quality assessment. However, there is some doubt as to whether this type of 'incremental' improvement will be sufficient to capture efficiency and quality gains in sectors such as health, education, social and care services, finance and insurance, and even retailing and eating and drinking places. More 'radical' conceptual innovations are likely to be needed. This book provides some pointers to the innovations – of both types – required if the economic performances of services is to be accurately measured.

The same applies to innovation in and through services. Many of the existing theories and concepts undoubtedly constitute powerful tools for understanding some at least of the innovation processes in services. For example, neo-Schumpeterian theories take account, to a certain extent, of the diversity of technological trajectories in services, while neoclassical approaches may help to understand the impact of innovation and R&D on growth (see Chapter 7).

At the same time, however, most of the existing approaches, and the corresponding measurement methods and classifications used in national surveys and other studies, retain much of their bias towards manufacturing and technology and fail to capture some of the fundamental aspects of innovation in services.

Just as productivity levels are said to be low, so innovation in services is often said to be non-existent or confined to the adoption of technologies originating in manufacturing industries. Thinking of this kind can cause serious difficulties in an economy dominated by services, since it precludes efforts (particularly on the part of the public authorities) to develop ways of energizing an area of activity of great importance for the future of firms, industries and nations.

These misconceptions have their origins in the manufacturing and technological bias of our analytical apparatus. In most neoclassical economics, innovation is perceived through the concept of the production function and is limited to process innovation (as incorporated into technical equipment). From this perspective, it is but a short step to reduce innovation in services to the mere adoption of technical equipment produced by the only driving force supposedly capable of innovation in the economy, that is manufacturing industry. Thus the main body of literature implicitly or explicitly related to innovation in services focuses on the generic theme of the spread and the impact of the new (informational) paradigm on services.

Recent economic analyses (based on evolutionary and neo-Schumpeterian approaches), which are more sensitive to the characteristics of the 'black box' of the firm (that is to learning phenomena and the mediums through which

they are enacted – routines – and to the tacit and idiosyncratic aspects of technologies) and more inclined to accept a broader definition of innovation, have not succeeded in ridding themselves of this technological bias. In such analyses, services are generally dominated by the suppliers of their technical equipment.

This general conception of the technological and adopted nature of innovation in services has certain corollaries that it is important to emphasize. Services are, allegedly, as unacquainted with R&D as they are with innovation, despite the large number of engineers and managers now employed in service industries. That this is a widely held view is demonstrated by the fact that national and international indicators of R&D and innovation (the Frascati and Oslo manuals, for example) almost completely ignore the specificities of service activities.

The five chapters of this book devoted to innovation in services may adopt a number of different theoretical perspectives, notably neoclassical and neo-Schumpeterian ones, but they share the common aim of going beyond this technological bias. These chapters not only focus on the specificity of innovation in services, but two of them (Chapters 10 and 11) also reverse the subordinate relationship between manufacturing and services in so far as they focus on the active role played by knowledge-intensive services in their clients' innovation processes (including those in manufacturing industry). William Baumol's chapter goes even further in the rehabilitation of services, stressing as it does that R&D is itself a prominent service activity.

## THE MAIN CONCEPTUAL LINK BETWEEN THE TWO PARTS OF THE BOOK: KNOWLEDGE

We have already advanced one argument of a general nature in order to explain why we have seen fit to gather together within one and the same volume chapters focusing, on the one hand, on productivity, growth and performance in service industries and, on the other, on innovation in and by services. The argument runs as follows: medium and long-run economic performance depends crucially on the dynamism and forms of innovation. And since services now account for almost three-quarters of all economic activity in the developed countries, there are good grounds for believing that innovation linked to services is a major factor in determining performance at global level.

In fact, however, the strongest link between the two parts of the book, the link on which its overall coherence is founded, is located on the conceptual level and can be summarized by a few key words: co-production, service quality (and the corresponding innovations and performance) and, above all, knowledge and intelligence.

Most of the contributors to this book are convinced that, in practice, innovation and performance in services flow increasingly from the mobilization of intelligence and knowledge. Consequently, their theoretical analyses must themselves be innovative, bringing new concepts, new methods and new models to bear on the economics and socio-economics of knowledge. Knowledge is a key component of production (for example: how can activities whose principal output is knowledge be rationalized? What is the role of information and communication technologies (ICTs) and knowledge-intensive business services in these processes?), in consumption (how do users contribute to this knowledge economy?) and in the relations between production and consumption: cooperation, market transactions, social transactions and service relationships, and so on.

Of course, intelligence has always been an essential ‘factor of production’ in economic history. Moreover, it is as decisive a factor in manufacturing or agriculture as in services. However, examination of the facts shows beyond any shadow of a doubt that the intellectual component of economic activity is growing steadily in importance. Services are particularly affected by this trend. Firstly, they have certain specific characteristics, particularly in the area of direct cognitive interactions with users. Secondly, they are extremely revealing of complex situations in which the core of the output becomes a problem-solving activity. Finally, as William Baumol points out in Chapter 7, they include what is perhaps the ‘king’ of activities in the knowledge economy, namely R&D.

Thus the title of the book, ‘Productivity, innovation and knowledge in services’, can be understood as expressing, in shorthand, the linkage that exists in services between issues relating to performance and innovation and those relating to knowledge.

## A DETAILED SUMMARY OF THE BOOK

Traditional measures of productivity growth suggest that gains in service industries in the United States have been very low since 1979. However, other indices of ‘technological activity’ show that service industries have actually been more technologically active than goods producing industries over this period. In Chapter 1, Edward Wolff investigates different indicators of technological activity among goods producers and service providers. For example, investment in computerization has been much greater in services than in goods-producing industries (about three times as high since 1977). The educational attainment of the workforce and other skill indices are higher in service than in goods-producing industries over this period. Moreover, the degree of change since 1970 in the occupational composition of employment has been almost as great in service industries as in goods-producing industries.

The upshot of the chapter is that so-called stagnant services, as portrayed in the standard cost-disease model, are *not* technologically inert. Though these industries show up with close to zero productivity growth, they are very active and have undergone major changes over time by other technological indices. Indeed, by some of the indices (mean skills, mean schooling, share of knowledge workers, investment in OCA (Office, Computing and Accounting equipment) and age of capital), these sectors are more technologically active than goods producers or progressive services.

Is the poorer productivity performance of services in recent years due to the fact that their output is becoming increasingly difficult to measure? This could be a substantial part of the explanation. The distinguishing features of service industries in the post-1980 period are both their high rate of computerization and their high degree of employment restructuring. It is likely that both are associated with a more heterogeneous output. The high degree of computerization found in finance, for example, has been responsible for the creation of a bewildering array of new financial products. The same appears to be true of the insurance industry and business services. Likewise, the fact that the degree of employment restructuring increased substantially between the 1970s and 1980s might be associated with an increasing variety of service products. It is possible that the more heterogeneous output has made service output harder to measure over time and that the apparent low productivity growth in services after 1980 is in fact a measurement problem.

But there are two other possible explanations. The first of these could lie in the high adjustment costs associated with the introduction of new technology. According to this line of argument, productivity growth in the so-called stagnant services should increase to more normal levels in the future as the IT revolution reaches maturity.

The second explanation is that service providers are now able to use this new technology to increase profits in other ways besides augmenting productivity. In particular, they may be employing IT for product differentiation rather than productivity enhancement. If this is the case, then the low productivity growth measured for the 'stagnant' services might persist indefinitely.

In Chapter 2, Jean Gadrey shows that certain conceptual issues relating to the definition of output in many 'stagnant' services give rise to serious measurement problems. This chapter summarizes the findings of a research project carried out between 1989 and 1992 in close cooperation with Thierry Noyelle and Thomas Stanback of Columbia University. The aim of the project was to compare productivity in services in France and the United States, and in particular to ascertain whether productivity in services was indeed weaker and productivity gains lower in the United States than in France and whether this could explain the very high levels of job creation in the American service sector and the relatively modest levels in France. This interpretation was very

widespread in the early 1990s and is still advanced today. According to Gadrey, this explanation is, for the most part, an illusion and the main answers to the question are conceptual and methodological in nature. Furthermore, by showing the limits of the traditional concepts in the case of an international comparison, useful pointers can be gleaned as to how to interpret the so-called 'productivity paradox' in each country.

In most services the USA appears to have a real technological and organizational lead. Services in France do not lag behind in all their technological characteristics. However, in most of the comparisons undertaken, the gap is significant. How can America's undoubted technological and organizational lead in many services be reconciled with the very poor productivity records of these industries? Gadrey's answer to this paradox has two main thrusts.

Firstly, he advocates what can be described as a functional approach to service activities. Most service industries can be analysed as a combination of three sets of 'production' functions: informational functions, material logistical functions and direct service functions, which involve face-to-face contact with clients, customer care and assistance, advice and so on.

Service industries in the USA seem to have a noticeably higher level of efficiency than their French counterparts in the first two fields (those in which most advanced technologies can be introduced) and to provide a greater volume of direct services to customers, with relatively more people employed to perform this third category of functions. Traditional measurements of output, such as the volume of goods sold in retailing, the number of people admitted to hospitals (possibly supplemented by a complexity index), tons of goods  $\times$  kilometers carried in air transportation, premiums or losses incurred at constant dollars in insurance and so on, do not take account of the amount of direct service produced; their use is likely, therefore, to lead to the conclusion that overall labour efficiency in the USA is relatively poor.

Secondly, Gadrey develops a new conceptual approach to output in service activities. The core idea behind this approach can be grasped from one question, which arises out of one of the five case studies undertaken by Gadrey and his colleagues. In the supermarket industry, do we get the same output when, for the same basket of goods bought, we get our purchases bagged, delivered to our homes if necessary, or carried to our car on request, when we have 50 per cent more varieties of goods (stock-keeping units) to choose from, when the store's opening hours per week are twice as long, when there is a customer assistance counter, when more scanning systems save our time at the checkout counter and when, in addition to this identical basket, we can also buy hot food 'to go' as well as other kinds of prepared food (from salad bars, for example)? What the French-US comparison shows is that more people are employed in the typical American supermarket for roughly the same volume of goods traded, not because of lower 'productivity' but, if output is analysed as a

combination of services associated with the trade of goods rather than simply with the volume of goods themselves (the usual method based on sales at constant prices), because the output of US supermarkets is fundamentally different.

Moreover, if this more complex, service-based approach is adopted, it can be shown that, during the 1980s, the average US supermarket clearly increased its performance in terms of quality and quantity of services delivered, leading to a decrease in its 'productivity' as measured in the traditional way, while its French counterpart was improving 'productivity' by restricting its service component and developing the 'self-service' and large-scale strategy pioneered in the USA during the 1950s, 1960s and early 1970s. This example indicates the general approach: in a service economy, we need thoroughly to reappraise the traditional concepts of output and the methods used to measure it and to evaluate the significance of the rising level of service provided.

In the last part of this chapter, Jean Gadrey shows that improved and more complex procedures might be used in order to provide better estimates of efficiency changes in services. In most cases, this involves introducing the main variables neglected in the traditional approaches: service complexity, intensity and outcomes.

In Chapter 3, Jacques De Bandt and Ludovic Dibiaggio deal with the so-called 'learning' economy as a source of conceptual difficulties that make it necessary to develop new theoretical categories for evaluating performance. In developed countries at least, productive systems have been undergoing deep and wide-ranging changes since the early 1970s. Two of the most important of these changes have been the growth of information-related activities (computers and software, information systems and so on) and, particularly from the 1980s onwards, the development of R&D activities and innovation systems.

This chapter puts the emphasis on a set of new phenomena and realities, of which it can be shown that they cannot be handled within the framework of the old industrial paradigm. A new paradigm is required, one that has as its main reference point the role of knowledge in production and value creation. At the core of this analysis is the capacity to produce knowledge in response to specific questions (or problems or needs) when the question, in turn, is a source of knowledge creation. Distinctions have to be made, on the one hand, between different types of knowledge of varying degrees of complexity and, on the other, between different modes of organization in productive systems.

The status of knowledge depends essentially on the context in which it is used. Rather than simply emphasizing knowledge-intensive activities, De Bandt and Dibiaggio focus on the level of commonality in the environment in which knowledge is re-used. Indeed, knowledge standardization – through codification or routinization – depends on the reproduction in similar contexts of actions or decisions that have already been tried and tested. Self-evidently,

therefore, the introduction of ICTs may improve knowledge standardization. However, new technologies may also increase the set of problems to be solved, raise users' expectations and open up new opportunities for knowledge creation.

Working within this framework, the authors draw up a typology of contextual situations that affect the nature of the cognitive process as it is implemented. They put forward *simple*, *problem-solving* and *complex situations* as three archetypes of decision-making or learning situations. Each archetypal situation is defined in terms of the agent's familiarity with the question he/she has to answer, the problem he/she has to solve or the situation in which he/she has to behave.

In all situations in which only 'simple' knowledge has to be produced, either because the situation is simple or because it can be simplified, ICTs can perform the tasks and produce considerable efficiency gains. Some progress is equally possible in some of the 'problem-solving' situations, to the extent that certain standardization procedures are feasible. However, there is another, concurrent trend towards contextual specificity, customization and complexity. Because of the competencies required, complex knowledge has to be co-produced through organizational learning processes. As a result, co-production – which is at the heart of the 'service relation' – becomes a central aspect of the new modes of production.

In Chapter 4 Bernard Chane Kune and Nanno Mulder provide an international comparison of productivity in the transportation sector, with a focus on total factor productivity (TFP). Labour productivity is often regarded as an approximate measure of service provider efficiency. Since services are supposed to use relatively little capital, this partial measure is seen as a proxy for overall efficiency. However, in many services such as transport, capital is a major production factor. Thus in order to accurately assess the overall efficiency of these services, labour productivity measures should be complemented by measures of capital and TFP. For France, it has been impossible to date to estimate capital productivity and TFP for the transport sector as a whole for want of any estimates of capital inputs. This chapter aims to fill this gap by providing new, detailed estimates of capital input in French transport from 1970 onwards. These data are used in combination with series on output and labour input to estimate productivity. Finally, the performance of the French transport industry is compared with that of the German, UK and US industries.

In contrast to many other studies of productivity, the contribution of capital to production is *not* measured by the value of the stock of assets but by the volume of services rendered by this stock (this method is also referred to as the 'Jorgenson approach'). Capital services are measured by the product of the volume of capital, approximated by the net capital stock, times its user cost.

The latter is estimated by the sum of depreciation, the real interest rate and capital gains. The net stocks of transport equipment in air and maritime transport are measured by administrative records. The stock of other assets is estimated by the perpetual inventory method, which sums several years of capital formation and deducts assets that reached the end of their service life. Detailed series of investment and discards are compiled for eight different sub-sectors of the transport industry, showing for each a breakdown into infrastructure, transport equipment, and other machinery and equipment.

In the second part of the chapter, productivity results are presented. Total factor productivity is estimated using the Törnqvist discrete approximation to the Divisia index. The variance of productivity patterns across sub-sectors of the transport industry is not unique to France, as is illustrated by a comparison with Germany, the United Kingdom and the United States. Overall productivity gains in Germany and the United Kingdom were similar to those in France. The three European countries outperformed the USA. At the sub-industry level, it turns out that air transport is the industry with the largest capital gains in all countries. The USA is the only country with large productivity gains in railways. France outperformed other countries in terms of productivity growth in air and maritime transport. In the other industries, French productivity growth was below that of the other countries.

In Chapter 5, Pascal Petit analyses the potential for growth and productivity in modern, highly tertiarized economies whose growth regimes are currently being influenced by wide-ranging technological changes driven by ICTs. Such economies offer considerable potential for growth but there are many constraints on the realization of that potential. In particular, the dynamism of certain sectors and the improvement in the welfare of certain social categories has to extend to other sectors and other social categories. This cannot be achieved simply by redistributing productivity gains and the associated incomes but will have to be accompanied by significant changes in activities and in those groups that are lagging behind.

This chapter seeks to clarify the terms of the choices for such a redistribution of income and knowledge, using a sectoral growth model for the main OECD countries that could account for the shift towards knowledge-based economies. This transformation denotes less an abstract accumulation of information and knowledge that is difficult to measure than a general (though uneven) enlargement of the strategic behaviours of economic agents who can access, by means that have to be specified, more information and knowledge. Services to firms and households play a key role of intermediaries in this access. They take advantage for that purpose of the contemporary interdependent developments of three structural changes, initiated decades ago: globalization, education and a new technological system based on ICTs.

Petit attempts to show how services interact with the development of these

structural changes constituting some multi-layer network supporting the various externalities that can fuel a process of endogenous growth. For such mechanisms of economic growth to reach some sizeable momentum the role of intermediation of services, for both firms and individuals, has to be comprehensive and lasting. In this perspective the outcomes of various OECD countries in the 1990s are discussed. This discussion underlines that in such transition period the Scandinavian countries may give more insights on what the real dynamics of knowledge-based economies could be than the Anglo-Saxon countries.

In Chapter 6, Emmanuel Lazega also focuses on knowledge and the standardization thereof, but this time from a sociological or 'socio-economic' perspective. He examines the relationship between distributed knowledge and economic performance in a professional or 'collegial' organization. He identifies a few conditions under which the pattern of knowledge flows is most productive for firms providing professional services with an emphasis on quality. In such organizations, the production of services for clients is difficult to routinize, since professional expertise and advice cannot be easily standardized. Consequently, 'internal' transaction costs related to flows of resources, including knowledge, can be assumed to account for a high share of total costs for the firm as a whole. The practical problem for such firms is to find ways of reducing complexity and constructing certainties in order to learn from their own experience and provide high-quality advice for clients. In order to produce such knowledge-intensive work on a regular basis, intelligence is shared in two types of situation at least: in joint work on cases or in case-related advice relationships. Saying that intelligence is 'shared' does not, however, do justice to what really happens in the flows of intelligence. The important characteristic of such flows is shown to be that knowledge as a resource is efficiently distributed/allocated through two processes: selection of exchange partners who share common identities in dense subsets (social niche seeking) and concentration of the authority to know (through competition for status). Some members emerge as having the authority to know, although such status is fragile. This allocation of knowledge is a micro-political learning process, but it is also efficient. Efficiency can be measured, it is argued, by drawing on statistical evidence on the relationship between crude measurements of economic performance and position in social networks concerned with the allocation of knowledge.

An empirical study of a medium-sized corporate law firm in the north-eastern United States is used for this purpose. Distributed knowledge is measured through two types of networks: a network of co-workers, with whom the 'whole picture' of the case is shared, and the advice network within the firm. Members' individual performance data (hourly rates, number of hours worked, fees brought in) are analysed as an effect of position in this network.

Dependence of economic performance on the overall pattern of ties in the two networks is established. This suggests that proxy measurements of productivity based on social network analysis are possible in knowledge-intensive organizations, a thorny issue in contemporary economics.

In Chapter 7, William Baumol reminds us that R&D is a service activity that is likely to be the current 'king of the services and perhaps even of the economy as a whole'. This chapter tells a feedback story, indicating how R&D activity affects the productivity performance of the economy and how, in turn, the economy's degree of success in productivity growth affects the magnitude of R&D activity. The result is the skeleton of a model of the interactions of growth and R&D that is truly endogenous and, moreover, not ahistorical, unlike most theoretical analyses in this arena.

The analysis is conducted in three sequential steps. In the first, the production of new information through R&D activity stimulates productivity growth *in industry*. In the second, the price (real cost) of *information production and dissemination* rises as a result. This is because these activities are 'asymptotically stagnant', that is they are characterized by productivity growth that is initially high but, with the passage of time, tends to lag further and further behind that of industry. In the third step, information grows relatively more costly and, as a result, other inputs tend to be substituted for information in the production process. For example, when R&D costs have risen, a firm that wants to increase its output may decide not to invest more in R&D with a view to increasing the productivity of its machines but to buy additional machines of the current type instead. Thus the rising cost of the innovation process can cut the derived demand for innovative activity. That in turn impedes productivity growth, thus reversing the first of the three steps of the inter-temporal process in its next iteration.

The main implication of this model might be that the very success of the R&D sector may conceivably sow the seeds of a future price impediment to demand for its output. Much depends on the occurrence of significant breakthroughs, either from truly independent innovators or from routine business R&D activities.

In Chapter 8, Ian Miles conducts a survey of studies of innovation in services. Different phases in the evolution of these studies are identified.

1. Services were neglected for a long time. In the early days of political economy, agriculture and manufacturing, not services, were the important areas of economic activity.
2. Services then started to become an important economic phenomenon, accounting for a major share of employment and GDP in developed countries. Nevertheless, the study of innovation in services was suffering from inertia and lagged behind the recognition of the importance of services.

- Most of the studies were concerned with explaining the growth of the tertiary sector rather than investigating the meaning of innovation in services, which was regarded as very limited.
3. Barras's model is often considered to be the first attempt to build a theory of innovation in services. Like other models and surveys – especially evolutionary taxonomies of technological trajectories in service industries – it is based on a concept of innovation limited to the technological dimension that has been formalized in OECD manuals.
  4. Several more recent studies and surveys have sought to go beyond this technological bias. These studies focus on the specificities of service activities, both in terms of the nature of innovation and of the models of innovation organization.
  5. The main conclusion of Ian Miles's chapter, and the last stage in the evolution of studies of innovation in services, is that such studies have undergone a process of 'tertiarization'. The enhanced understanding of issues around innovation in services that should ensue is likely to shed further light on innovation in the economy as a whole, far beyond the service sector itself. There are several reasons for this tertiarization: manufacturers often manage service activities in which they may innovate and KIBS (knowledge-intensive business services) are playing an important and growing role in the whole innovation system.

In Chapter 9, by Maria Savona, the link between demand, innovation and growth in services is empirically addressed, looking at the case of Italy. The analysis attempts to disentangle the role of demand vis-à-vis technological change in explaining the different patterns of growth across services. It is argued that it is the composition of demand for services by different destination markets, besides the widening of technological opportunities provided by the information and communication technology paradigm, which accounts for the diverse patterns of growth in services.

The empirical analysis explores the sectoral composition of demand for services by different destination markets (primary and manufacturing sectors, market and public services, final consumers), which represents the sectoral division of labour between services and other branches of the economy. Further, the main innovative profiles, as a result of the diverse impact of technological change on service sectors' innovative performance, are identified. Finally, the dynamics of growth experienced by service industries in the decade 1991–96 are shown. The three sets of descriptive evidence are then used in a regression framework, to endogenously take into account the role of demand and technological change in explaining sectoral differences in the rate of growth across service industries.

The results of the empirical analysis confirm that a sectoral specialization

towards intermediate producer demand (manufacturing sector and business services sector) is a necessary condition for a positive growth performance of services. On the other side, the exploitation of the technological opportunities provided by the new ICT paradigm is not a sufficient condition for a positive growth performance when service industries are specialized in final and intermediate distributive demand (trade and finance sectors).

Chapters 10 and 11 are devoted to knowledge-intensive business services (KIBS). KIBS can be defined as activities in which knowledge is both the input and the main output. These activities pose theoretical problems associated with two fields of economic theory: the economics of service industries and that of information and knowledge.

Before dealing with the role of KIBS, Pim den Hertog's chapter adopts a managerial perspective in order to develop, first, a theoretical model of innovation in services and, second, a typology of innovation patterns in services. The innovation model has four interlinked dimensions: new service concept, new interface, new delivery system and new technological options. On the basis of this model, several patterns of innovation are identified: supplier-dominated innovation, innovation within services, client-led innovation, innovation through services and paradigmatic innovations.

However, the main purpose of Chapter 10 is to examine the role of KIBS in innovation systems. Three different roles are distinguished: KIBS as facilitators (supporting the client in the innovation process), KIBS as carriers (transferring an innovation from a given place to a client) and KIBS as sources of innovation (playing a major role in developing innovation in client firms).

The main conclusion of this chapter is that, in view of the major role they play in transferring, creating and combining knowledge, KIBS should be seen as 'a second knowledge infrastructure', the first being the 'public knowledge infrastructure' made up of research and technology organizations and higher education institutions.

Chapter 11, by Faïz Gallouj, has two main goals. Firstly, it seeks to describe a normal service transaction in terms of the various basic modes of knowledge processing and production used by KIBS firms. The service provider's main activity can be described as the transfer of knowledge from one or several sources to a receiver (the client considered from a different analytical point of view). The term 'transfer' denotes the various interventions of the KIBS provider in the different dimensions of knowledge: its (physical) circulation, its nature (tacit versus codified knowledge), its scope (general versus specific or localized knowledge) and its structure (association and dissociation of knowledge). However, the quality of the previous interventions by the KIBS provider also depends very much on the quality of the sources and the receivers.

Secondly, the chapter seeks to establish the links and boundaries between a

normal transaction of this kind and innovation. Two difficulties have to be overcome. Firstly, the same basic knowledge processing mechanisms are mobilized in innovation projects and in normal service transactions. However, this should not lead to the conclusion that all KIBS transactions constitute innovations. Secondly, it is necessary but difficult to distinguish innovation in KIBS from innovation through the use of KIBS, that is the contribution of KIBS providers to innovation in their client organizations. Both forms of innovation draw on the same organizational memory and feed back into the same memory. Moreover, the highly interactive nature of many knowledge-intensive business services disrupts the ownership regimes of certain forms of innovation.