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Abstract

Concepts of innovation systems have attracted considerable interest over the last decade. These ideas have rapidly become the focus of policy discourse and formulation. The ultimate aim of innovation system approaches is that endogenising innovation performance may be achieved through understanding the structural environment of firms and the systemic interactions between innovative efforts of the firm and its environment. The thesis underlying this paper is that this can only be attained with endogenising the structure of innovation systems. A fully dynamic understanding of systemic innovation and economic growth requires an integration of innovation performance and evolving innovation systems. It is suggested in this paper that the interaction between innovation and the development of complex divisions of labour affords an avenue towards such understanding, opening for a fuller understanding of structural change in economic and innovation systems.

This avenue opens also up for a richer description of various types of services and their interaction with other sectors. The second half of the paper outlines briefly aspects of the role and development of some broad types of services; distribution, financial, business and consumer services, and their relations to other sectors of national economies.

Keywords: Innovation systems; Division of labour; Services; Economic growth

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Dynamic innovation systems: Do services have a role to play?

"*The social process is really one indivisible whole*"
J. A. Schumpeter[1]

What are innovation systems?

Since its inception about 10 years ago, the concept of 'national innovation systems'[2] has gained wide popularity in both research on innovation and technical change and in deliberations on innovation and technology policies. In the OECD Technology/Economy Programme a 'systemic' approach, and through this the concept of national innovation systems, was used as a main backbone for mediating and making sense of the broad array of insights on technological change and economic growth that was synthesised, OECD 1991, 1992. The approach was used to call attention to characteristic features of why and how firms innovate, and to the need of broadening attention of technology policies in enhancing national technological opportunities and capabilities, to 'technology in a changing world'.

With systemic; multifunctional and interlinked, innovation, the concept of innovation systems must evidently be inter-woven with industrial dynamics, intimately linked as these systems are to the relations between innovating firms and their environment. At the same time their structure and functionalities are affected by initiatives beyond the commercial objectives of firms. Policy measures like R&D or diffusion programmes, and establishment of technology service institutions may have permanent impact on the structure of innovation systems. As a representation of systemic innovation, innovation systems have both endogenous and exogenous dimensions. This essay focuses the endogenous dimensions of innovation systems. Our interest is in

1 Schumpeter [1934] 1961, opening statement.

2 The term was first introduced in 1987 by Chris Freeman in a book on the economic performance of Japan. Freeman refers to Bengt Åke Lundvall as the originator of the term, when he suggested the title of a section in Dosi et al 1988 describing national institutional systems of technical change and innovation. From its inception two variants has been in use, national systems of innovation, used by f.i. Freeman and Lundvall, and national innovation systems, as used by Nelson, reflecting also conceptual differences between the variants. We use the latter term, but interpret it in the Lundvallian 'broad' sense.

understanding gross features of innovation systems and their dynamics from the perspective of economic activities. The discussion will be general, detaching the arguments from particularities of specific innovation systems.

We will not give a representative review of the literature on innovation systems, consultation of the three edited volumes Lundvall 1992a, Nelson 1993a and Edquist 1997a, as well as Freeman 1995, is highly recommended. Rather we will discuss some of the basic ideas underlying this concept, using this to identify a perspective of understanding innovation systems in a dynamic context. From this, a framework will emerge that allows identification of some broad issues relating to the roles that service sectors may play in innovation systems.

Nelson 1993a is primarily based on an organisational approach, focusing the role of a institutional technological infrastructure, in the form of public or para-public knowledge generating institutions and public programmes and initiatives towards technical change. Lundvall's approach is a broader conceptualisation of innovation systems, focusing interactive learning as a general complementary aspect of economic interaction. As such it encompasses both the structure of economic interactions, the exchange relations, and the social and institutional structure within and around these 'economising' relations.

Our approach is the same as Lundvall's; this chapter may be seen as an elaboration of elements underlying this conceptualisation of systemic innovation. Since innovation and learning are social processes, embedded in a wider set of social action, an economic system and a wider social system may become nearly indistinguishable when dynamic changes in the system of economic agents are considered. In terms of its social extension the innovation system may encompass the 'whole social system'; systems like the economic system, consisting of economic agents involved in 'economising' exchange based on present endowments and technological data, are more restricted subsets of the innovation system. What first of all distinguishes innovation system is the particular focus; innovation processes as generators of change in the economic system, and their repercussions in terms of social changes, *mediated through* the economic system.

Lundvall starts his argument from two general facts about modern economies, a highly specialised vertical division of labour and 'anthropological constancy' of innovation; the general presence of innovation processes, everywhere and at all times. This is supplemented by one significant observation; capabilities for successful innovation is not solely relying on functional, or technological knowledge; it also depends on a competence of user needs, the need to know the users' business. If we broadly distinguish between technological and commercial capabilities[3], the essential aspect of firm-level development is balancing challenges and opportunities in these two spheres.

A highly-developed economic division of labour implies directly that a substantial amount of innovations will be addressed towards users that are different from innovators, they will be product innovations. Hence needs arise for extended bi-directional information flows, going beyond the information transmitted through the price mechanism. These needs, being ever-present, lead to markets characterised by organisational modes of interaction that are neither 'arm's length' markets, nor organised hierarchies. User-producer linkages will thus form a significant constitutive force for interactive learning in innovation systems. Such market structures would be pronounced when commercial and technological uncertainties are large, as when the 'environment' of an industry is perceived by the actors to be turbulent[4] or where asset-specificites are important. Managing complex environments also presumably enhance the value of specialisation, or 'division of knowledge'.

Three insights have facilitated diffusion of the innovation system concept. First, innovation is a basic characteristic of market systems. As market systems cannot ever be perfectly isolated from creation of commercial opportunities and challenges, knowledge about which is costly and time-consuming to acquire, the structure of competition is altered. Information requirements of actors are far from satisfied by information being mediated by price differentials. Innovation becomes a natural

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[3] Two notes on terminology. We use the terms competence and capability interchangeably. Economic capabilities include technological *and* commercial capabilities.

[4] That business environments in the 1990's are turbulent, is well accepted as a 'stylised fact' in the business press. In general, perceived turbulence may enhance efforts to stabilise social and ecnomic relations that are regarded as essential, at the same time as leading to a concentration towards essential activities. These are general arguments that, inferring from the literatures, strengthen the proliferation of network structures, emergence of new organisational and governance modes, etc.

mode of acquiring competitive advantages, requiring significantly richer information. Incessant innovation leads to a market 'history'; innovation is 'dynamic' or 'historic' in a strong sense, where price-based market histories are time-dependent in a much weaker sense. Hence, innovation is a main explicant of dynamic, endogenous evolution of market systems.

Secondly, the role of technological information in market systems implies that innovation is an economic phenomenon that involves all the different ways firms acquire information about such opportunities and shape and utilise them for commercial purposes. Innovation is multi-functional; information gathering and use, and related development of capabilities, are integrated into firms' ordinary commercial functions and objectives. Innovation, the realisation of such opportunities, involves a recombination of factors from various dimensions of these functions and activities.

Thirdly, it is a multi-organisational phenomenon; from the vantage point of an innovating firm, innovation is shaped by interactions between this firm and multiple other organisations. This includes linkages to its various suppliers, competitors, and customers, technological infrastructures, professional networks and environments, etc. Influences extend beyond the immediate environment of innovating firms in space and time. Innovation, changing behaviour, of 'nearest neighbours is a function of *their* 'nearest neighbours', extending influences to 'next-to-nearest neighbours', etc. A firm's innovation patterns is also a function of its expectations of neighbours' future behaviour, in particular of customers, suppliers and competitors.

These three general factors, innovation as a dynamic process involving mutual and multi-functional interactions with a varied, and organisationally structured, environment, have contributed significantly to the immense popularity of the term. This is not the least due to the immediate potency it suggests for policy formulation. Catching the systemic, inter-dependent character of innovation and technical change (Soete and Arundel 1993), the term proposes to encapsulate determinants of 'created' comparative advantages. At the same time, in these same points lie the main weaknesses of the term; conceptually it is vague, seemingly all-encompassing, without the ability of providing differentiating ability to function as the 'focussing device' suggested by Lundvall (Lundvall 1992b). We agree with Edquist that at

present it is at best a 'conceptual framework' (Edquist 1997b). Whether a 'national innovation system' (NIS-)approach will ultimately evolve into a general theory of *the* innovation system, or if it is better to pursue a theory of specific innovation systems, is still an open question. Maybe the optimal path is to develop the framework into a general 'meta'-theory that allows comparing detailed innovation theories, a mind-set or 'frame of reference' for innovation studies and policy formulation. The last outcome would fulfil Lundvall's focussing device.

Whatever the ultimate objectives for studying innovation systems, as we have seen the concept raises dynamic issues, by implication both at systemic and microscopic level. Promulgated through the links of an innovating firm to its business environment, systemic innovation implies an endogenous evolution of innovation systems. One approach to understand innovation systems would be to map interactive dynamics of specific innovation activities. But when the perspective is more general, these dynamics must be linked with the processes of industrial evolution and inter-industrial dynamics.

It is evident that the nexus of innovation system is the individual firm, the organisation that makes the decision to implement the innovation. This raises three issues that we will discuss very briefly; (1) the concept of innovation, (2) the underpinnings of innovation behaviour, and (3) the systemic dimensions of the concept.

(1) The implied concept of innovation of these arguments is wide, generally speaking it may be denoted as changes in economic behaviour. This is evidently including, but wider than product and process innovations discussed in most survey-based innovation studies, and wider than Schumpeter's concept of innovation (ref. below). It reflects the wider challenges and opportunities economic agents are faced with, beyond more or less arbitrary limits set by observers of innovation. However, as interest is primarily towards structural dynamics of economic *systems* or *general* micro-level dynamics, innovation may be limited by resort to criteria of 'transferability' of innovations. Relevant aspects of economic behaviour must be observable, adoptable or modifiable by other firms. Furthermore, since the main interests evidently lie with 'endogenous changes in economic behaviour', the innovation concept may be restricted to processes where the implementation decision

has an autonomous role; firms may choose to implement an innovation or not. Innovation so limited involves a deliberate intention of innovating firms. Lastly the set of implied innovations may be delimited with recourse to 'innovation height'. The standard approach of survey-based innovation studies is to limit innovation to 'new or significantly changed' products and processes.[5]

(2) Secondly, innovation is developing new capabilities or new combinations, and transforming them into economic behaviour at the level of individual firms. Hence continual changes of (economic) behaviour imply antecedent and subsequent firm-based learning; learning is a vital process underlying innovation systems. The idea of innovation systems grew out of analyses of interactive learning in user-producer relations (Lundvall 1985, 1992a). Learning includes, but extends beyond formal and rote learning, learning-by-doing and learning-by-using. Interactive learning, or learning-by-interacting is the dominant form. In social psychology the observation has been made that "outside the laboratory and the school, cognition is almost always collaborative" (Levine, Resnick and Higgins 1993). With increased social dimensions to learning, learning must to a larger extent be treated as an active undertaking. Learning cannot any longer be considered as "inevitable and uninfluenceable consequences of doing. Rather, learning [must be] viewed more actively, and it is apparent that resources can be applied to learning" (Nelson and Winter 1982); a characteristic feature of many present day organisations is a systematic effort to extend capabilities to learn (Johnson 1992). This suggests that organisational effort will be directed towards those measures that enable appropriation of what is perceived as important informational inputs (as well as the necessary redundancy in such inputs) and institutionalisation of information 'broker' or 'filter' functions. A substantial part of this will thus be efforts to internalise and control informational requirements of importance to organisational development.[6]

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[5] With this definition of innovation from the OECD Oslo-manual, the interpretation of 'new or significantly changed' is left to respondents of survey questionnaires. This limitation is open to scrutiny; the implicit assumption is obviously that innovation height is correlated with economic impact, even within the 'incremental region of the spectrum.

[6] The author recently participated in a round table discussion with several CEOs and managers from a wide range of knowledge intensive service firms, on issues pertaining to innovation and company development. The managers were asked what the main threats to their business were today, and what they regarded as the main objective to achieve during the next 5-10 years. The author was struck by the almost unanimous appraisal, first of a lacking grasp of changes in the companies competitive and social environment as the most important threat, and similarly that gaining control

(3) Thirdly, innovation systems may be described in a particular or in a general sense. We may describe it referring to a particular firm, a particular incident, or to a particular category of innovation processes. Or we may describe innovation systems from the angle of certain technologies, industries or geographical areas. What different approaches have in common is that they attempt to incorporate social and institutional structures wherein innovation is generated. The systems are presented as structural models of the social environment of techno-economic adaptations shaping innovation trajectories and paradigms. Innovation systems attempt to model the site and environment of interactive learning and innovation; they are analytical concepts or models, representing attempts to endogenise 'ordinary' determinants of learning and innovation. As such they are a way of giving name to the resultant framework of social interactions underpinning innovation activities.

The reader will notice that we have dropped the adjective 'national' of innovation systems. Lundvall and collaborators (Lundvall 1992a) have argued that innovation systems have strong national dimensions. However, from the perspective of economic dynamics, there are no a priori reasons that compel us to give preferred status to geographical space. In keeping with the generality of the innovation system approach, we acknowledge that innovation systems reside in[7]

- geographical dimensions, through economic interactions, and through the geographical extent of institutional structures,
- technological dimensions, relating to areas and criteria of technologies and capabilities,
- predominantly economic dimensions, spanning industrial and economic subspaces,
- as well as other social dimensions, f.i. relating to social networks and roles and non-economic objectives of innovating firms.

The 'innovation hypersurface' within this multi-dimensional space is far from homogenous and isotropic; this space abound with non-trivial topologies. Its structures and loci are continuously changing. An approach to innovation systems

over this informational environment during the next few years was vital to continued company existence.

[7] There is a kinship in considerations behind the NIS-approach and several other approaches that refer back to the Swedish economist Erik Dahmen's suggestion of 'development blocks' shaping industrial development as an inspiration. In a general sense all these may be denoted innovation system approaches. Focussing specific intervals along the dimensions, the concept of technological systems (Carlsson 1995) is a variant of the innovation system approach.

would be to identify substructures of this hypersurface with some persistency in structure, outwards linkages and extension. Such substructures may be denoted innovation systems. However, we will never be able to map the global topology and geometry of this hypersurface; that would entail the existence of an omnipotent grand unified theory of innovation, or technological determinacy. All we can ever attain is to outline local characteristics, connectedness and geometries and 'stylised' or general features of innovation systems on the basis of inductive approaches to studies of small regions of the hypersurface.

Today's 'systems' literatures is a return, albeit in a new form, to a concern that was central to classical political economy; the identification of the dynamic equations of motion governing economic systems. With the insights about systemic innovation as a dynamic principle of the evolution of market economies, the innovation system is the necessary extension of the capitalist economic system that concerned classical economists. Just as with their economic system, it is difficult to determine the extension of and limits to innovation systems[8]. There is a close relation between the evolution of innovation systems and economic development. But in contrast to classical approaches we now know that the search for the ultimate boundary of these systems is futile. We can find a general, or 'stylised' answer to the question raised in the title of this chapter in this relation, but no ultimate solution.

Services and economic development

A casual reading of the flourishing literature on modern economic growth suggests a quiet consensus of the manufacturing industrial enterprise as the engine of growth. Economic growth concerns productivity change in manufacturing industries. Services are left with a few passages, describing changes in aggregate sectoral composition of employment or output in the post-war period[9]. To the extent that

[8] The economic system ended where labour and consumption shifted from being productive to unproductive. The use of the pair is at its most pronounced in Mill's synthesis of classical political economy, Mill 1868.

[9] See f.i. three books all published during 1996, Crafts and Toniolo 1996, Mayes 1996, and Landau, Taylor and Wright 1996. One laudable exception is the discussion of financial innovations in the last of these, Scholes 1996.

service activities contribute to productivity growth the verdict seems to be allotting them a status of peripheral productivity laggards.

It is evident that this is a gross misrepresentation of the role of services in economic systems. The residual of economic activities that we conventionally denote services encompasses integral parts of the history of industrial capitalism. Distributive and financial services played a constitutive role in the industrial revolution (see f.i. Mitchie 1994). Neither are the activities of knowledge intensive business services new. It goes even deeper. Chris Freeman maintained in 1982 that the "whole apparatus of economic thought, as well as our whole system of statistical indicators, are still largely geared to the 'tangible' goods and services approach" (Freeman 1982, see also Freeman and Soete 1997), an assessment that still rings true. Essential aspects of the role of various services in economic development and in innovation processes, is still little understood, just as the understanding of economic aspects of several services themselves[10]. With analytical instruments biased towards a material economy, it severely limits our abilities to understand modern economies.

Tracing antecedents of present-day sectors gives valuable insight into the processes that have shaped our present economic systems. Even though these insights yield only partial understanding of present-day economic systems, one observation can be made; economic history is richer in its consequences than a story of the 'use of scarce material resources for alternative ends' would suggest. This suggests that a simple dichotomy between manufacturing and services will not give fundamental insight into the dynamics underlying innovation and economic growth, just as the quest for a fundamental engine is ill-posed. It also suggests that the question in the title of this paper is missing the point. We will still argue that the question is worth posing. It is meaningful within a framework of 'middle-range' theorising, where activities that are included under the umbrella of services may be identified as activities and sectors in interaction with other economic activities. They are contemporary expressions of a historically contingent division of labour. Secondly, it is worth posing as a correction to a material mindset. Lastly, due to our inability to

[10] There is a definite need of developing a new taxonomy for service activities, the concept mixes together kinds of activities that have nothing more in common than this umbrella label. Here we will use 'services' in the traditional loose sense, of a ragbag of activities that are neither extractive 'primary', nor manufacturing 'secondary' activities. Our frame of reference will be 'market services'; service activities produced with commercial objectives. Hence we explicitly exclude public services.

answer consistently fundamental questions about economic and social development, an appreciative approach may contribute to develop more apt concepts and insights to guide future efforts towards answering these questions.

Though the literatures on the highly aggregated topic of economic evolution or structural change and those on the 'complex' world of firm-based competitiveness may seem universes apart, they are intimately linked. Understanding and bridging this 'micro-macro' chasm is still one of the fundamental challenges for social sciences. Our proposition is that the explanation of the emergence of a complex 'service', 'information', 'knowledge' ... economy[11] resides in the answer to this challenge. So, here lies also the answer to the question in the title. Innovation is regarded as furnishing at least the framework of this bridge; it is the accepted mode of describing both aggregate economic development and formation of national and firm-level competitiveness. Innovation is acknowledged as a phenomenon underlying both economic growth, industrial organisation and firm behaviour. That innovation *is* important, is doubtless. But it is only part of the story, innovation is powerful because of its dual, cumulative integration with another social process, what is commonly called 'division of labour'. Even though important, division of labour is much more than sophisticated technical divisions of labour in manufacturing production.

Our assertion is that the weakness of the 'micro-macro' bridge has implications for our understanding of the evolution of modern economies. In particular this has hit our understanding of what services are (not) and what role they play in modern economic systems. The role of services in innovation systems is ultimately a question about the role of various services in economic development. This approach to services in innovation systems raises several issues, a thorough discussion of which would bring us far beyond the purposes of this chapter. However, let us state the main idea underpinning our approach to innovation systems. The economic system is embedded into the wider social framework in a dynamic sense, i.e. the evolution of the economic system is permeated with social relations, beyond 'pure' economic

[11] Pick your favourite term. A Norwegian proverb has it that "A dear child has many names".

ones.[12] Crudely speaking, it is possible to 'disembed' economic systems qua economic production and exchange systems in short time spans only; comparing economic systems widely separated in time entails comparing *different* economic systems.

Focussing on the introduction of (ready-made) innovations as economic entities into the economic system is still treating the system as separable, but we may argue that we are at least pinching a few holes in the membrane surrounding it. Endogenising innovation *processes* necessitates pinching many holes, even dissolving, the membrane; innovation systems extends the social realm of the traditional economic system. But innovation, the development and implementation of new implements and new ways of doing things, is not enough to generate structural change in economic systems of the kinds that economic history witnesses. To understand this it is necessary to distinguish innovation and social and technical divisions of labour.

Division of labour

In spite of the role Adam Smith gave technical divisions of labour[13] in advances in industrial production, division of labour has played a rather muted part in economic thought. Under the disguise of increasing returns the topic was picked up by Young in 1928, and later by Stigler 1951. The extensions of markets that determine industrial or technical divisions of labour feed back to enhanced productivity growth and specialisation in 'roundabout' methods of production, feeding back to new extensions of markets. Thus "division of labour depends in large part upon the division of labour", a circular, cumulative causation that implies that economic development is "continually defeating the forces which make for economic equilibrium [being] more pervasive and more deeply rooted in the constitution of the modern economic system than we commonly realise" (Young 1928). Thus the process of externalisation of indirect functions and methods is intimately linked to

[12] The 'embeddedness' of economic development is a central topic in the literature on economic sociology, see f.i. the articles in Smelser and Swedberg 1994, and to its critiques of 'undersocialised' descriptions of economic action in standard economics (Granovetter 1985).

[13] The first three chapters of Wealth of Nations (Smith [1776] 1986) contain a theory of cumulative causation, based on division of labour, innovation and market growth.

industrial growth, to industrial evolution (Stigler 1951).[14] This is one of the main starting points of Lundvall's approach to national innovation systems (Lundvall 1992b).

But division of labour is a phenomenon with wider impacts than evolving economic divisions of labour. Durkheim placed division of labour centre-stage in social development, "higher societies can maintain themselves … only if labor is divided", division of labour is the foundation of social order (Durkheim [1893] 1933). Durkheim started from the apparent paradox that individuality and social unity or solidarity grow in tandem, as individuality grows so does the individual's dependence on social order. He invented the term *organic solidarity* to express the mutual interdependencies, and the associated social order, that increases as individuals become more unequal. A circular causation is also at work in the wider social framework, again division of labour is a function of division of labour.

The two cumulations of divisions of labour are highly interdependent. They do not only interact in processes of sophistication of production processes, with positive economies tied to learning and specialisation. Through the wider repercussions on society they also create opportunities for learning consumers, with changes in social roles, expectations and wants. The linkage between the two circles of causation is what characterises the French Regulation school (Petit 1986). Similarly recent reappraisals of Marxist economics emphasises the maltreatment of division of labour as a social force, "the most serious outstanding problems of radical political economy lie in its treatment of division of labour" (Sayer 1995).

From a different vantage point Veblen stated that to explain capitalist development, one must explain innovation as a cumulative, path-dependent process. The cumulative causation that must be explained "is the sequence of change in the methods of doing things - the methods of dealing with the material means of life". It is not innovation *per se* that matters; "changes ... in the mechanical contrivances are an expression of changes in the human factor. *It is in the human material that the*

[14] This is a much more satisfying framework to consider functional externalisation and internalisation than the 'make or buy' decision of a transaction cost framework. Even at the micro-level, the latter framework "is not an able guide to the multi-dimensional problem of [the associated] integration because it collapses all elements into only two terms: costs of exchange and economies of scope" (Walker 1992)

continuity is to be looked for" (Veblen 1898, our emphasis). Veblen's starting point is that human behaviour is intentional, going a long way towards identifying the property of intentionality of human behaviour as the seed of economic evolution. But specific intentionalities, forming the basis of economic and social action, is an 'acquired characteristic' of human agents, an effect of the individual's former life, the cultural heritage from former generations, etc. As the individual objectives and intentions evolve over time, actions and wants change.[15] Obviously the impacts of social division of labour form a significant part of these 'acquired characteristics'. Learning has a central role in shaping divisions of labour, and learning is in itself shaped by social divisions of labour.

From this broad-brushed presentation we may identify at least two distinct explanations of the growth of 'market services'. Firstly, the 'Engel's law' argument in a generalised form[16], with 'static' income effects and dynamic learning effects, affecting consumer services. Secondly, it points to 'techno-structuralist' arguments, on the role of key services in determining competitive advantages. Pivoting on issues of strategic importance of technological knowledge and core competencies, they may be argued to emerge from a Young/Stigler mechanism. Even though we do not have a full understanding of these issues, an argument that growth in 'intermediate' services and market extensions are interrelated phenomena, is highly compelling.[17]

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15 Thus Veblen may be interpreted as the first to point to the fundamental role of learning and its path-dependent imprint on economic evolution.

16 The size of individual income elasticities is, however, an empirical question, as is possible enhancements of substitutability between service and manufactured consumption goods. It seems that there is no reason *ex ante* to say that consumers prefer service goods to manufactured ones or vice versa.

17 It is of course to be expected that other factors enter the equation, simple mechanistic explanations are not of any help. Let us suggest different trends that probably play significant and contingent roles. We have already indicated that 'market extension', through income growth etc., suggests a generalised 'division of consumption', a gradual process of differentiation of demand structures. Equally changes in educational and work opportunities and background is a source of changing social roles and wants.

That the IT-revolution plays a role should be fairly evident, but maybe not just in the simple way of IT as a generic technology, rather the perceptions of IT may be more important. This leads to a shift of focus towards embryonic possibilities of scientific knowledge, technological change, and the formation of these, increasing efforts to develop these technologies and implement them in new environments.

This suggests a third factor, *perceptions* of the business environment are the basis for initiatives and strategies, not the characteristics of the business environment itself. To the extent that the former is not a direct representation of the latter, these perceptions may constitute an independent impact on the business environment. In particular, if the environment is perceived as complex and turbulent,

Innovation in economic systems

As seen innovation is an act undertaken to accomplish commercial objectives. Innovations are initiatives at the level of the individual firms, of exploiting opportunities and meeting challenges in the business environment. Hence it should in principle be possible to explain innovative undertakings as endogenous phenomena. Systemic innovation highlights interdependencies between actors, and thus the importance of uncertainty, information and knowledge. There will be innovation in every nook and corner of the economy, but its orientation, intensity and structure will vary according to characteristics of the activity in which it happens, the competitive environment of the activity, as well as idiosyncratic choices of innovators.

Schumpeter was first to argue systematically the central role of innovation in economic development (Schumpeter [1934] 1961, [1939] 1964, [1950] 1986). The Schumpeterian capitalist system integrates two complementary roles; the capitalist firm and the entrepreneur. The entrepreneur is introducing innovations - "any 'doing things differently' in the realm of economic life" (Schumpeter [1939] 1964). The interaction between the disequilibrating function of the entrepreneur and the equilibrating processes of capitalist firms is what capitalism is all about; the "process of Creative Destruction is the essential fact about capitalism" (Schumpeter [1950] 1987).

The technological competition, the 'gales of creative destruction' "strikes not at the margins of the profits and the outputs of the existing firms *but at their foundations and their very lives*" (Schumpeter [1950] 1987). The decisive element of Schumpeterian competition is not the competition with *what-is*, with existing technologies, products, and forms of organisation. Rather the competition that counts is from *what-could-become*, from the new product, the new supply etc. The decisive competition is not any longer a competition among incumbents doing the same things, but the competition from entrepreneurs, from new entrants, introducing new ways of doing things. The awareness among incumbent producers of the vulnerability to such competition, fundamentally changes the competitive environment. The new competition creates needs for new and extensive forms of

enforced by f.i. business literatures, this would imprint on firm behaviour. We leave outlining implications of this to the reader.

information, information allows identification of and tells about the efficacy of 'new ways of doing (new and old) things'. The associated exchange of information allows firms to identify and learn of innovations, to assess their characteristics and to decide on adaptation and implementation.

This adaptation process is time-consuming, costly and prolonged. Learning of new ways involves not just acquisition of available information, it also requires building up capabilities to observe, adapt and implement innovations. Rarely are innovations characterised by clear-cut and complete economic and technological desiderata. Innovations involve significant trade-offs between technological and economic considerations. Adaptation to and of user needs narrows down the options that are opened by technological considerations, increasing the determinateness of technological trajectories. Economic criteria act "as selectors [defining] more and more precisely the *actual* paths followed inside a much bigger set of possible ones" (Dosi 1982).

Innovation systems - between innovation and division of labour

Opening up for such technological or functional indeterminateness thus leads to a richer competition. It is neither just a competition on the market between clearcut alternatives, nor just a patent race with a given innovation at stake. It becomes a competition of how innovations, *qua* economic acts, are 'economically defined'. This technological competition opens up for an endogenous and extended selection process, nurtured by this 'techno-economic' variety.[18] The economic capabilities built through user-producer linkages is evidently a significant part of the capabilities for the process of economic definition of innovations.[19]

The innovation literatures are overwhelmingly focusing *technological* innovation. And it does so for a very simple reason. Focusing production as successive material

[18] This selection process shifts the attention from firms (as embodiments of resp. old and new ways of doing things) to the level of alternative 'new ways of doing things'.

[19] That user-producer linkages is an important, if not *the* most important, dimension to firms' innovation environment should be quite evident; interpretation of 'market signals', of 'what our customers want', is necessarily a crucial part of firms' responses to the competitive environment. Hence it is not surprising that a 'stylised fact' from the many innovation surveys that have been performed in various countries, is the importance of these linkages as sources of information for innovation.

transformations, places technology, as productive knowledge, know-how, routines, heuristics and artefacts, centre-stage. Technology is then knowledge enabling material transformations, and the means to do such transformations. Evidently we may generalise this concept of technology to other forms of functional or productive capabilities, to generalised forms of 'technology'. Secondly, 'user-related' capabilities do not exhaust the relevant dimensions of these 'techno-economic' competencies. Though user-producer linkages are important, it is necessary to introduce other dimensions of economic competencies.

With capability formation at the core of such innovation activities, the range of networks or links between agents in an innovation environment, or 'system', may in principle be characterised by a correlation length of impact on capability formation across the network: an innovation, or change in firm characteristics at one point in the network has an impact on the behaviour of other firms in the network as the innovation changes their environment. This impact would be expected to fall off with what may be characterised in a general way as techno-economic distance, spanning the four categories of dimensions suggested above. With some measure of firm behaviour we may characterise this interaction by a correlation length.[20] Outlining such correlation lengths affords an inductive measure of the topological structure of innovation systems as suggested above. The structures these correlation lengths measure is evidently closely related to the French idea of filière structures. A filière is a cluster of strongly interlinked sectors or functions, providing a "structure of diffusion, transmission and amplification of microeconomic impulses and dynamic feedbacks" (Dosi and Orsenigo 1988).

To get an idea of the nature of these interactions and what these correlation lengths mean, we need an idea of what shapes relevant firm behaviour. More specifically, we want to characterise the nature of *change* in typical firm behaviour. If we turn to Schumpeter and neo-Schumpeterian literature, three factors are usually identified as the central determinants of these changes,

- the existence of and ability to utilise *technological opportunities*,

[20] A correlation length may be defined as the inverse rate (per distance measured on some scale), at which the correlation between the behaviour of a pair of firms falls off as the interfirm distance increases. As such the correlation length is a measure of the range of inter-firm interactions.

- *market conditions and opportunities*, as well as
- the *appropriability conditions* for categories of innovations, contingent on technological, market and governance conditions.

The perceptions of these conditions and opportunities and changes in them are regarded as determining factors of industrial development through the firm's utilisation of and adaptation to these conditions, by changing its behaviour, its 'ways of doing things'. With a resource-based perspective on the firm (see Penrose [1959] 1995, Fransman 1995), these conditions shape innovation through shaping firms' learning processes and subsequent capabilities. Adapting Carlsson and Eliasson's scheme for classifying such techno-economic competencies (Carlsson and Eliasson 1995; economic competencies in their terminology), we may distinguish five dimensions to these competencies or capabilities.

Techno-economic competencies would be expected to be multi-dimensional, and to have many-faceted impacts on innovative efforts. By extending Lundvall's argument to a wider conceptualisation of economic competencies on the basis of user-producer linkages, it thus seems possible to further enrich the idea of innovation systems, and also to account for processes that contribute to an understanding of the growth of certain service sectors.

But to what extent are commercial and functional, or technological, capabilities distinct entities? These competencies and capabilities form the basis for 'economic action', towards innovation and towards business conduct. The basic observable is the action, the behaviour of firms, through the decisions that are made and the implementation of these, affecting the relations between firms and other organisations, as mediated through the product markets of the firm. Evidently we cannot make a principal distinction between 'commercial' and 'functional' actions, they are complementary aspects of an integrated phenomenon of 'economic action'. However, it is equally evident that we may distinguish commercial and functional foci of economic capabilities.

In describing such techno-economic capabilities as the ability to generate, identify, expand and exploit business opportunities, we identify five types of capabilities,

- selective or *strategic* capabilities,

- *organisational* or integrative and co-ordinating capabilities,
- technical or *functional* capabilities,
- capabilities and understanding of *market* and *demand* characteristics, and
- the ability to *learn*, to absorb, transform and reflect on acquired information and experiences, integrating and cutting through all of these.

We have added a separate category of market and demand capabilities to Carlsson and Eliasson's original list, since we regard these competencies as distinct from the selective or strategic capabilities in which these competencies seem to be included in the original scheme. An illustrative example of market competencies is Thomas Levitt's reflection that quarter-inch drill bits are sold in millions, "not because people want quarter-inch drill bits, but because they want quarter-inch holes. People don't buy products, they buy expectations of future benefits" (Levitt 1969, as cited in Quinn 1992). A crucial dimension to these market competencies is the knowledge of their benefits, i.e., the services rendered by the products, the identification of the services that are decisive in determining demand and how demand patterns are changed by shifting emphasis on existing and new benefits.[21]

In addition knowledge of regulatory frameworks, socio-cultural attitudes, as well as the wider structure of governance may have a formative role on innovations. Knowledge about such conditions and of their likely future changes may be vital for successful innovation. Furthermore, if this is correct, capabilities to influence these conditions will be important.[22]

These areas of capabilities differ in character and in intra-organisational distribution, and have often been focused selectively in different approaches to competencies. While the innovation literatures mainly focus functional capabilities, management literatures have a stronger focus towards organisational and strategic capabilities. Nevertheless, our contention is that all these types are complementary, it is the integration between these that forms the basis for 'economic action' and the changes

[21] Foster 1986 forcefully describes the importance of functional, organisational and market capabilities and their distinctive and complementary relations.

[22] In the 1992 evaluation of publicly funded oil and gas related R&D in Norway (Smith and Wicken 1992), a high-level representative of the state-owned oil company Statoil was asked about the nature of critical knowledge bases that was required to run offshore activities competitively. The representative answered promptly "seismology and politics"! (Keith Smith, private communication)

in these we identify as innovations. What all these capabilities[23] have in common is the centrality of

- the interaction between internal and external repositories of competencies,
- these capabilities (see f.i. Cohen et al 1996) being constituted partly in routines, heuristics and skills, and
- that they have tacit dimensions.

This gives the learning abilities and processes important roles as mechanisms of integration of the circles of causation. Integrating the two cumulative causations, allows a qualitative understanding of the dynamics of innovation systems. These two interconnected cycles are illustrated in figure 1. Towards the lower left we have outlined features that are related to Smith, Young and Stigler's arguments on technical divisions of labour, while the upper right part of the figure is an attempt to schematise Durkheim's theory of organic solidarity. With the indicated integration of these cumulative cycles, a third sub-loop appears, which we have suggested correspond to Veblen's argument of learning agents.

[23] As part of the OECD/CSTP project on national innovation systems led by the TIP working group, a set of six groups of 'innovative capacities' of innovative firms has been identified on the basis of surveys of recent innovation literatures. With each group comprising a set of more specific capacities, the Phase 1 report of the Innovative firm focus group (Arthur D Little 1998) groups innovation capacities in

- managing the competency base
- vision and strategy
- creativity and idea management
- intelligence
- organisation and process
- culture and climate

Figure 1: Cumulative causations of economic and social change

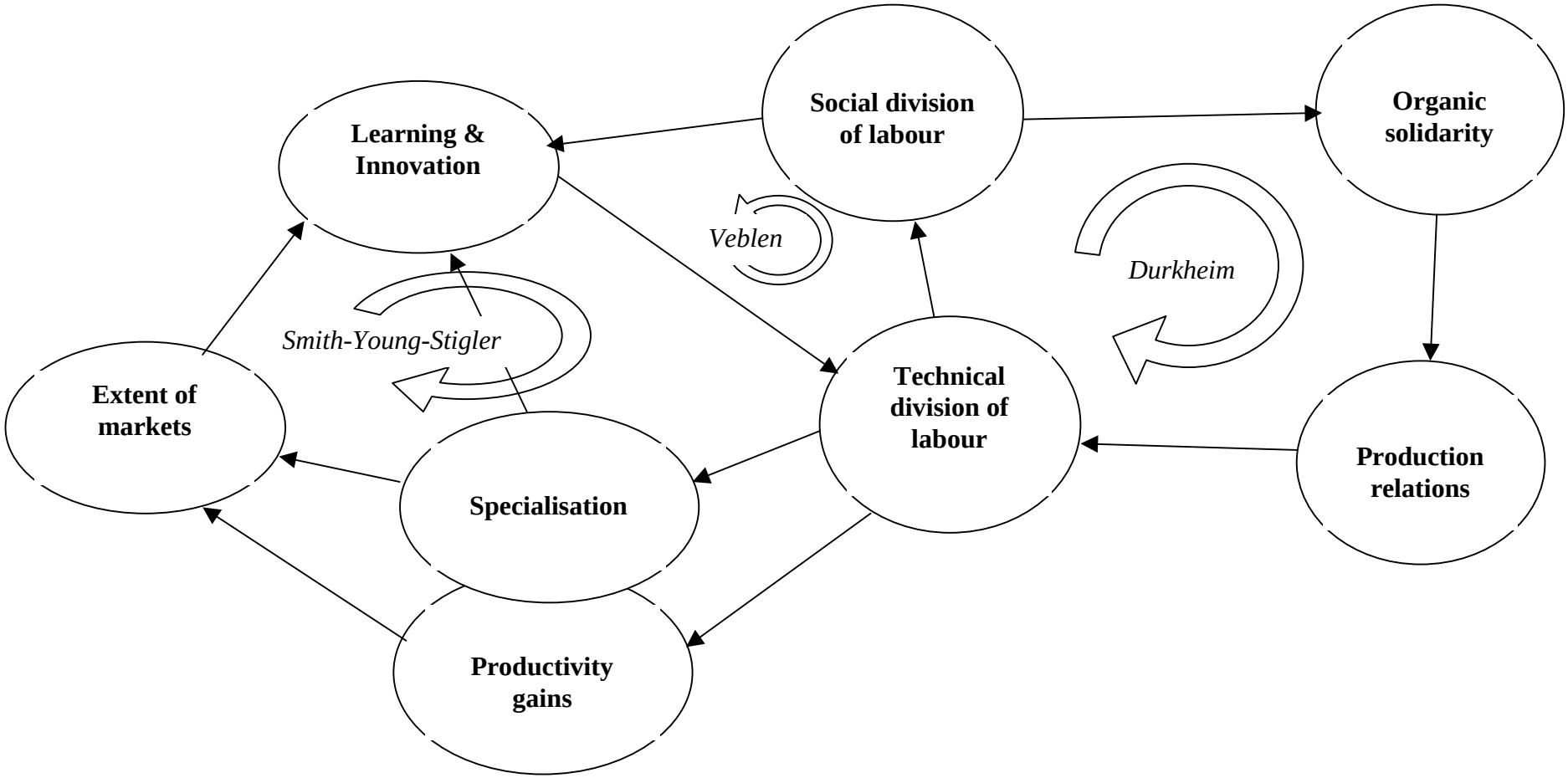
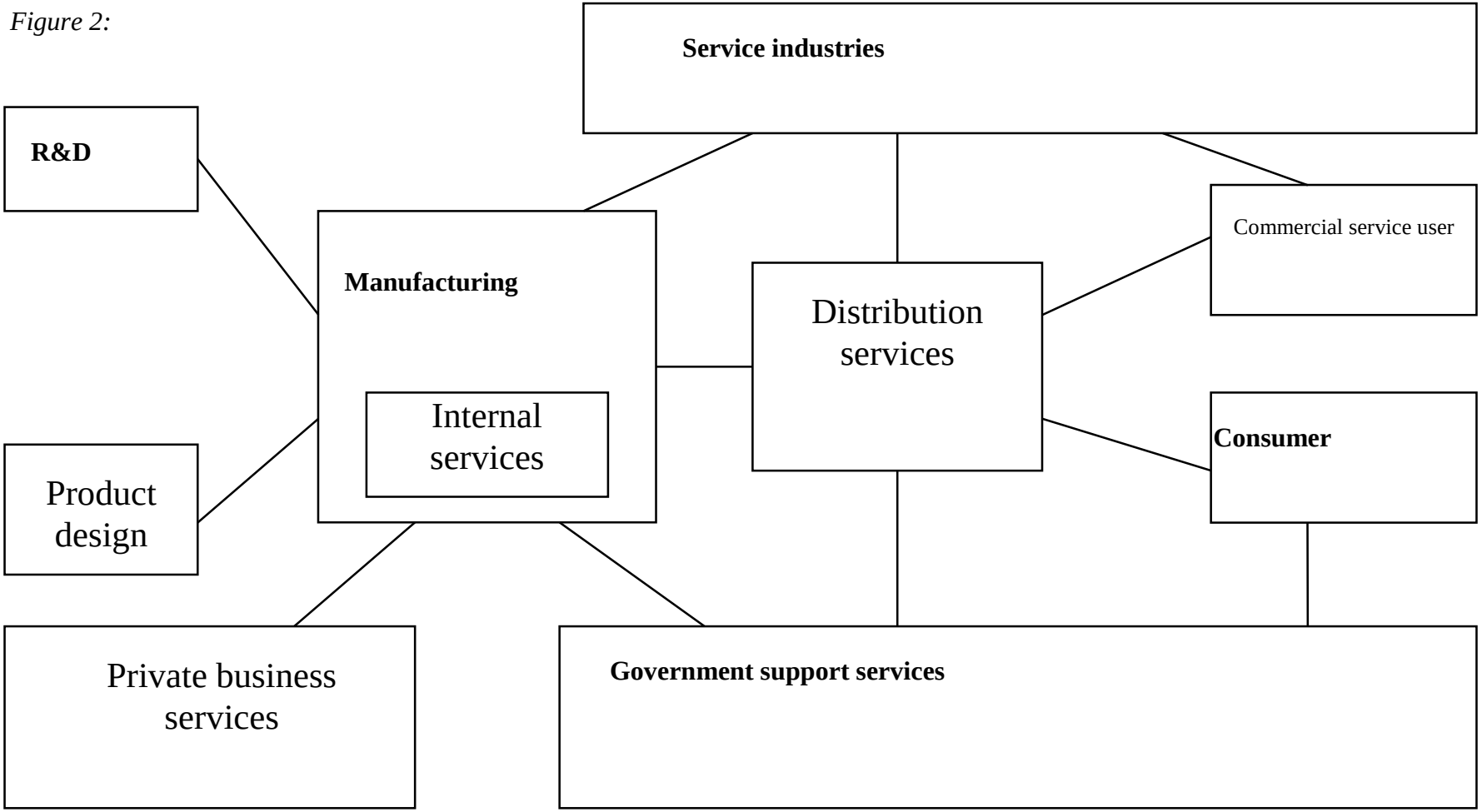


Figure 2:


Service industries
R&D
Manufacturing
Internal services
Distribution services
Commercial service user
Consumer
Product design
Private business services
Government support services

Innovation systems emerge from this with two roles, as the social locus of learning and development of economic and technological capabilities, and as the arena of technological competition. Thus the concept promises a unifying framework for two main characteristics of evolutionary approaches to economic development (Nelson and Winter 1982, Nelson 1995), cumulative variety generation and an extended selection mechanism. This ties together micro- and macro-levels, innovation as micro-level phenomena have repercussions at 'higher' levels, social divisions of labour is a macro-structure having impacts 'downwards'. Similarly cumulative causations of the kind suggested by Smith, Young and Stigler relate to technical divisions of labour, a micro-structure, and 'market extensions', a collective phenomenon.

Services in innovation systems

In this last section we will briefly outline some dimensions of services roles in economic systems. Since attempts to define services as one class of economic activities will fail, we need a much better grip on the economic character of different services, a character that evidently also covers their roles in an innovation system. Services are usually conceptualised as parts of a 'structured environment', or as parts of a value chain, centring around a core of implicitly assumed manufacturing activities. Figure 2, redrawn from Quinn 1992, is a typical example of what in management literatures is often referred to as resource-based perspective on firm development. Services are strategically important, even to the extent of appeals to reconceptualise the manufacturing firm's business as service provision. Services provide strategic value-added, on the basis of an underlying core of activities.

These descriptions are evidently catching important dimensions of the strong integration between several service and manufacturing functions. The problem is the extension to an assumption of autonomy of material 'wealth creation', while service functions are reduced to 'add-ons'. The world is evidently more complex than this. But many aspects of these interactions are still weakly understood. That 75% of costs in manufacturing production and some similar share of employment is accounted for by service provision may be correct in a accountancy-based presentation of manufacturing production, but the use of such numbers do not reflect the reality of

such production[24]. Rather than catch the strong complementarities between these functions, the concepts may create a false dichotomy between 'manufacturing' and 'services'.

A significant feature of such approaches is that there is no qualitative distinction being made between service functions and service sectors. The question of externalisation appears as a rather simple question of (dynamic) transaction costs, often presented as a dichotomous 'make-or-buy' decision. But pointing to such simple, idiosyncratic decision making does not answer the fundamental question; what, if the basic approach is correct, lies behind a tremendous aggregate shift towards externalised business services in the OECD area over the last few decades? Even though there is very little hard evidence, it is obvious that the process is not simply a process of externalisation of constant amounts of business services.

These complementarities have direct implications for how we should think of service activities in innovation systems. To develop a terminology that captures this properly, would go far beyond the scope of the present chapter. Instead we will take a more naïve approach to market services in industrialised countries. This restriction does not imply that other services, as public services, are un-important. However, while market services are more likely to conform with the dynamics outlined in this chapter, public or social services also involve quite different dynamics.

Any taxonomy of services must take the economic role of various services as a starting point. The failure of monolithic approaches to services is due to their failure to describe the fundamental heterogeneities of the economic role of different service functions. It is only in a wider approach encompassing all productive activities that a unified approach is possible. Thus it is in this wider framework that the general questions of how 'service innovation' evolves and how service functions impact on innovation in other sectors of the economy may find their answer.

Starting from the standard interpretation of (market) service sectors, as a sector with economic activity being any economic activity but primary, extractive or secondary production, we will briefly outline the economic roles of some service functions. We

[24] It is impossible to envisage manufacturing production totally void of an immaterial or service content, just as it is impossible to envisage service production without a material or manufactured

will concentrate on four kinds of productive activities or functions that are included under the residual heading of services,

- distribution services, trade and transport industries, as 'market-enabling' activities strongly complementary to manufacturing production,
- financial services providing a 'shadow' infrastructure of the economic system, facilitating exchanges, allocating resources and mitigating risk,
- a range of business services, corresponding to activities related primarily to organisation, co-ordination and development of production activities,
- services traditionally characterised as consumer or personal services.

Various service functions may have important common features, an immediate example is 'information intensive' services, services where administration and processing of routine information is a central part of the production chain; financial and several social services provide examples.[25] Other service sectors again have multiple economic roles; both communication, financial and transport services also include considerable consumer service, as well as producer service aspects.

These commonalties and multiplicities will be neglected here. We will focus one central economic role of these service functions to the neglect of others, with an intention to describe what we perceive as main constitutive elements of these sectors' present functionalities and roles in economic systems. Thus we cannot expect more than account for limited aspects of the sectors as they appear in national economies today. In outlining some forms of impacts of these services on innovation activities, we will emphasise the functional integration of these services in economic production.

Rather than focus a dichotomous distinction of immaterial and material production, or services and manufacturing, we are then lead to consider filières or clusters of economic production that span any division between the two. The salient point of a filière approach is the emphasis of functional complementarities, of functional divisions of labour and the interrelations between the divisions. Hence with a filière

content.

[25] Such service functions have been termed quarternary services to distinguish large scale production of routine information from tertiary functions providing tangible services as transport and trade, and quinary functions involving non-routine information production and decision making, Abler and Adams 1977.

approach we are led to stress the *sine qua non* character of individual functions and that 'sector accounts' as indicated above leaves out the features that essentially constitutes economic production. With clusters or filières as such multi-functional complements the main context of innovation will be the filière itself, with interactive innovation being contingent on the complementary divisions of labour.

In broad terms we may distinguish three types of linkages between economic functions in a filière;

- forward linkages, corresponding to what objectives and wants the service product are to satisfy. This would primarily be related to the role and impact of the service functions downstream, corresponding to user-producer linkages as considered by Lundvall 1992c,
- backward linkages, corresponding to the acquisition of the means of production of service products, hence relating substantially to service producers' use of capital and intermediate goods,
- horizontal linkages, of various service products and production to related functions, substitutable factors, 'spillovers', etc.

In all these cases it is possible to distinguish between direct and indirect links and impacts on f.i. innovation performance. While direct impacts may be thought of in terms of simple and direct interaction between two functional parts of a filière involving mutual deliberate action by agents, indirect impacts emerges in more diffuse forms as the result of indirect interaction, mediated as unintended or unilaterally initiated interaction. Note that a distinction between direct and indirect relations is contingent on institutional arrangement of the relation. While f.i. intra-firm horizontal links related to co-ordination of service support functions according to this is a direct link, as there exists a contractual or institutionalised arrangement regulating the relations between them, an emerging co-ordination of similar service functions in a market-based structure of provision is indirect.

Monitoring innovativity and innovation trends of whole filières individual functions or participating sectors in a filière must then be based on an understanding of impacts of complementary divisions of labour on innovation patterns. Though this is relatively easily stated, it is much harder to do in practice than a 'traditional' sector based approach of innovation measurement. A filière context dependent analysis of innovativity and optimality of innovation levels or integration of individual (service)

functions can be done, but in the cases where something like this has been performed it has required resource intensive analysis. Examples of such studies are Michael Porters cluster analysis, Porter 1990, and Bo Carlsson and his collaborators' analyses of technological systems, see f.i. the contributions in Carlsson 1995.

Rather than entering a full-fledged description of such interactions, a theme that is the topic of several of the ensuing chapters, we will give a rather simple outline of some immediate roles played by prominent service functions in today's economic systems and in their historical development. Some services may have an immediate forward functional impact that directly affects innovation activities or selection of innovation projects. Typically such services involve learning, or capability formation, in the client organisation with the learning process to involve a process of transformation of the service product. Depending on the circumstances of demand for such services, they may be characterised as awareness enhancing, problem solving or solution providing services. In general these services are characterised among knowledge intensive (business) services, or KIBS, they are knowledge intensive in the sense of requiring often complex, transformation capabilities on the side of the user, as well as being produced by professional organisations (see f.i. Tordoir 1993). Other have functional impacts on innovation processes that are considerably more indirect. It is to the latter we turn first.

Distribution services

The economic role of wholesale and retail trade and logistic and transport activities is rather immediate. Their role as considered here is to bridge a temporal and spatial gap between production and exchange. A specification of commodities as economic objects requires a description of their functional characteristics, as well as date and place for their availability; a commodity is a dated and located economic object. The textbook version of this may be illustrated as follows. The value of a bread supplied in Lille to a consumer in Manchester is nil, similarly a bottle of beer supplied in Utrecht 19 March 1998 is of no value to a consumer in Utrecht demanding a glass of beer 10 March the same year. As such these functions are integral parts of production processes, transforming functional, temporal and spatial coordinates of commodities.

The role of distribution services in economic development is particularly elaborated in literatures on the industrial revolution. Adam Smith's theorem suggests that the commercial revolution of his days was a prerequisite for the ensuing industrial revolution.[26] The development of trade and transportation increased reliability of distribution, improved time lags and reduced costs of arbitrage and distribution. The interaction of traders and customers enabled traders not only to exploit information on location of demand for existing commodities, but also on how improved qualities of goods would satisfy related demands. The increased trading enabled by more efficient transportation and commercial systems had direct effects. By facilitating learning, the extension of markets reduced search costs, brought new options to producer's attention and increased the potential returns that could be appropriated from innovation. In addition several indirect effects have been discussed in the literatures, such as spill-over mechanisms related to engineering skills formation and to backward linkages, i.e. to sophistication of intermediate demands, from transport sectors. Evidently, the growth of commercial trade and transportation is a *sine qua non* for the economic development over the last centuries. But claiming this does not amount to much more than stating the integrated character of the capitalist enterprise. Causality is still an open question, whether the commercial development played an autonomous role or just reflected responses to changing demand for distribution services (see f.i. Kindleberger 1975).

During these last 150 years several factors have contributed to a phenomenal increase in productivity in transportation, as

- progress in ship designs and propulsion,
- development of channels and railways,
- hydro carbon based propulsion of automobiles.

Developments as these have increased scope of transport services, allowed faster transport, as well as lead to a substantial reduction in costs of distribution services, being one important ingredient in present globalisation trends. For all these, development of physical infrastructures were indispensable for realising productivity

[26] In Wealth of Nations Adam Smith emphasises the continuity of economic development over the centuries preceding its publication; he is more concerned with his contemporary commercial revolution than the industrial revolution that ensued over the following decades.

growth potentials. Questions of causalities of the development of transport functions, systems and technologies are difficult to answer. What we may describe is forward and backward linkages and spill-over effects associated with these transport systems, whereas a general answer to the question about drivers for the development of these systems is unattainable.

Even though individual drivers or originators may be identified in specific instances; if the role of technological fascination is evident in the early history of aircrafts, the development was quickly modulated by anticipations of commercial opportunities of aeroplanes. The characteristics of the aircraft Douglas DC 3, developed just 30 years after Kitty Hawk, cannot be understood if these anticipations are neglected.

The productivity growth in transportation industries has depended on technological development outside the sector itself; transportation needs have not 'created' aircrafts and automobiles. But this does not mean that these activities have been without influence in shaping these technologies[27]. The process of diffusion, adaptation and further development is an interactive process, with decisions about related infrastructures as additional prerequisites for this process to evolve. It is in the processes of continual adoption, adaptation and redefinition of inventions or technologies that their economic effects are generated.[28] The history of aircrafts shows this again and again, on large and small scale. On the large scale "it almost has to be said of the airplane that everything of economic significance is attributable to subsequent improvements since 1903" (Nelson and Rosenberg 1992). With the launch of the Douglas DC 2 and the initiative of American Airlines for a version allowing sleeping berths, the DC 3 was born, and the commercial history of aircrafts took off. Jet propulsion first became economically viable with the Boeing 707, Douglas DC 8 and the French Caravelle Jet in 1957-58. The contemporary version of

[27] There are however also examples of innovation in transportation that originated in the sector; "one of the most significant productivity improvements in the transport sector since World War II has derived from … containerization" (Kline and Rosenberg 1986).

[28] The classic reference to this is the study of the implementation of new processes in the petroleum refining industry by John Enos (Enos 1962, see also Freeman and Soete 1997). Enos distinguishes two phases in the implementation of these processes, an alpha phase of first introduction and a beta phase of the improvements of these processes that followed during the diffusion and adaptation process. The process innovations incurred annual cost reductions of 1,5% during the alpha phase, and 4,5% in the beta phase. The economic effect of these innovations were considerably larger in the beta phase; the cost benefits of the innovations stems mostly from the beta phase.

the jumbo jet Boeing 747, the 747-400, has little in common with the 747-100 that was put in service 27 years ago.

This point is a general one, the economic significance is shaped in these 'subsequent improvements', processes that involve the network of distributors, producers, etc. In these processes the innovation systems approach is fruitful, as a conceptual framework for describing an interactive moulding of functional opportunities, market conditions and anticipations of demand patterns.

The economic organisation of trade and distribution sectors have changed dramatically since the inception of the industrial revolution. This reflects developments in the underlying manufacturing production, not the least the growth of large scale production and associated internalisation of distribution and trade, as well as functional divisions of trade, distribution and transport. Today several trends are visible (Ørstavik 1998). Vertical integration of distribution chains by manufacturers is a dominant pattern in car production. To the extent that such vertical integrations are on the increase, a relative marginalisation of extensive trade activities reflects enhanced opportunities for internalising transaction costs and positive externalities. On the other hand the growth of third party logistics may be regarded as a new division of labour, with logistic operations being outsourced to specialised producers of transport and logistic services, as scheduling, route planning, transport and real time management of transport and terminal and storage services.

A development of integrated transport systems facilitates the growth of new production modes, emphasizing flexible or just-in-time production. The integration of consumer goods production with mass marketing lead to the need of integrated and sophisticated distribution systems that allows fast and flexible distribution capacity. Large integrated distribution systems further emphasize the need of efficient large scale information processing, with increased application development in areas such as use of geographical information, tracking systems, and logistic system development. This gives additional impetus to the existence of efficient trnasport and information infrastructures, as is acknowledged in the European Commission's initiative on Trans-European Networks.

The emergence of large retail and distribution groups in consumer goods markets, as the US WalMart, the German Tengelmann, the French Carrefour and the Dutch Ahold groups integrates distribution, retail and marketing. A traditional structure based on large scale wholesalers with an independent and atomised retail system has been uprooted and is being replaced with an integrated system of actors that have challenged existing relations and distribution of critical expertise, as well as having changed buying and consumption patterns. This has been coincident with the introduction of new chain concepts and sales formats in retail sectors over the last decades. New sales formats as discount store and super- and hypermarket formats today account for a major share of sales of food products, cf. table 1.

Table 1: Sales formats in the food sector. Market shares 1994. Source EC 1996

Format	*Germany*	*France*[1]	*Italy*[1]	*Spain*[2]	*United Kingdom*[2]
Discount store	27,6	4,0	5,7	9,0	9,0
Supermarket	29,7	24,6	27,2	36,5	66,0
Hypermarket	24,3	30,5	11,4	30,5	
Sub-total	81,6	59,1	44,3	76,0	75,0
Others	18,4	40,9	55,7	24,0	25,0
Total	100,0	100,0	100,0	100,0	100,0

[1] Of total food distribution
[2] Of grocery distribution

In this section we have attempted to outline some aspects of the interactions between distribution services and other parts of the economic system, emphasising the complementarity of these services with the overall economic system. As illustrations we have focussed interactive dynamics related to backward links from distribution and its suppliers, to forward links and a restructuring of logistics services and to restructuring of trade systems that have the potential of wide-ranging effects on consumption patterns and on the relations with the underlying production and distribution system. We have pointed to the significant role of infrastructures in setting the overall efficiency of these functions and systems, as well as indicated the importance of information processing and hence of information technologies for these systems. Unfortunately our present understanding of interactive processes and developments like these is still lacking.

Financial services

Whereas distribution services is fairly easily visualised as to its economic origins and effects, the links between financial services and their origins is far more obscure. In contrast to the other kinds of service we consider here, financial services cannot be understood as an integral part of the 'goods-producing system'. Rather, by their nature they are closely linked to a 'shadow system' of the production system, the monetary system.

Financial services have probably contributed significantly to the economic development over the last two centuries. However, to what extent this is so and how it comes about is still an open question. Some analyses give financial services a key role in techno-economic tradeoffs and forward and backward economic impacts are still meagre. Hicks concludes that capital market improvements were primary causes of the industrial revolution; the onset of sustained economic growth needed the development of capital market liquidity (Hicks 1969). Other economists conclude that the role of capital markets is led by developments in the economic system, "where enterprise leads finance will follow" (Robinson 1952). Hence, the financial system is a passive reflection of changing demands for financial instruments in the economy.

To indicate how financial systems, their services and institutions are integrated into innovation systems, how financial intermediaries as providers of financial instruments and capitals interact with innovation processes, it may be worthwhile to distinguish some broad channels for such interactions between banks, venture funds, insurance companies etc. and the enterprise sector. There are essentially three channels for these interactions;

- investments, as financial institutions investments in f.i. equity shares, involving appraisals of company or project prospects,
- lending with general or specific purposes, leaving ownership to projects or firms untouched, but affecting the capital structure of the firm,
- backward linkages from financial service sectors, f.i. through use of technology in financial institutions, affecting development of 'process' technologies, and indirectly reshaping financial institutions.

For some financial institutions innovation may be part of their primary objectives, as venture funds. For other institutions, as commercial banks, their consequences for innovation may be indirect. Impacts may be the consequence of financial institutions' careful consideration of technological opportunities, or the lack of such.[29] Lastly financial institutions have become considerable consumers of intermediate goods, primarily related to their character as 'information processors'.

Just as distribution services, the role of financial services in economic development is so evident that it almost becomes invisible when focusing industrial change and innovation. First we will indicate what role financial systems play, and how this affects economic development. Then we will briefly outline how structural differences in financial systems may affect innovation. We will not discuss financial institutions as technology users here as this is considered elsewhere in this volume.[30]

Financial functions and structures

A fundamental proposition of finance states that in the absence of taxation and capital market imperfections there is no relation between performance of firms in the 'real' economy and corporate capital structure; there is no optimal capital structure of a firm[31]. This would severely limit the role of capital markets and financial intermediaries in the 'real' economy. However, capital markets are imperfect with barriers to capital mobility. A more pragmatic view of financial services and capital markets regards these as an infrastructure or lubricant of the economic system, the financial system smoothens production systems. Any improvement of the liquidity and general functioning of capital markets would improve its lubricating role of the 'real' production systems (Mayer 1987).

Imperfections of capital markets are in a sense the essence of financial systems; they explain why a financial sector exists at all. Relations between providers and users of

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29 One of the main reasons for Swiss banks' considerable losses during the 1980's on lending to the watch industry was the emergence of a new watch technology and Swiss manufacturers' reluctance to shift to the new technology (Jéquier and Hu 1989).

30 Neither will we discuss functional innovation in financial institutions. This includes innovations in financial instruments and their appraisal methods. This is evidently a significant limitation. Financial innovation, development of new financial instruments and of institutions supporting them, is a significant and dynamic aspect of the modern development of financial systems, nationally and globally. See f.i. Cavanna 1992 and Scholes 1996.

31 This is a consequence of the Modigliani-Miller theorem, see Duffie 1987

finance is beset with information asymmetries relating to risk assessment of the object to be funded, the abilities of the finance user and monitoring costs. With costs of assessing risks and uncertainties, acquiring information on abilities and monitoring performance of the lender being large, financial intermediaries appear to specialise in the role of finance providers. Financial systems facilitate resource allocation in an uncertain environment, bridging information and transaction cost barriers (Levine 1997). The systems do that by

- mobilising savings,
- allocating resources,
- facilitating risk management,
- monitoring managers and corporations,
- facilitating trade.

Levine's review surveys theoretical literatures on financial functions, as well as empirical evidence on the relations between structural characteristics of financial systems and economic growth. The functional approach adopted in the theoretical part suggests that functional relationships between capital market imperfections and economic growth may be depicted as in figure 3. The empirical evidence suggests significant relations between financial indicators and economic growth. Table 2 reproduces the result of a cross-sectional 77-country regression with four financial indicators describing structural aspects of financial systems as independent variables, on economic growth rate variables.[32] The independent variables are defined in the table. The DEPTH variable measures the size of the sector of financial intermediaries, whereas BANK describes the structure of credit allocation between commercial banks and the central bank. PRIVATE measures to what extent credit is allocated to private enterprises, while PRIVY gives the size of this credit allocation relative to the size of the economy. Behind the table there is a positive and significant relation between these structural measures and GDP per capita levels. In richer countries financial sectors are bigger, commercial banks dominate over central

[32] The regression model on the 77 country sample is $G = \alpha + \beta F + \gamma X + \varepsilon$, where G is the relevant growth rate, see table, F is a vector of the four financial indicators, X is a matrix of conditioning variables as per capita income levels, education levels, etc. Here α and ε are respectively intercept and error terms. The table gives the estimation of the four β-coefficients only.

banks in credit allocation, more credit is allocated to private sectors, boosting the relative size of claims on the private sectors.

Figure 3: Financial systems and economic growth. Adapted from Levine 1997

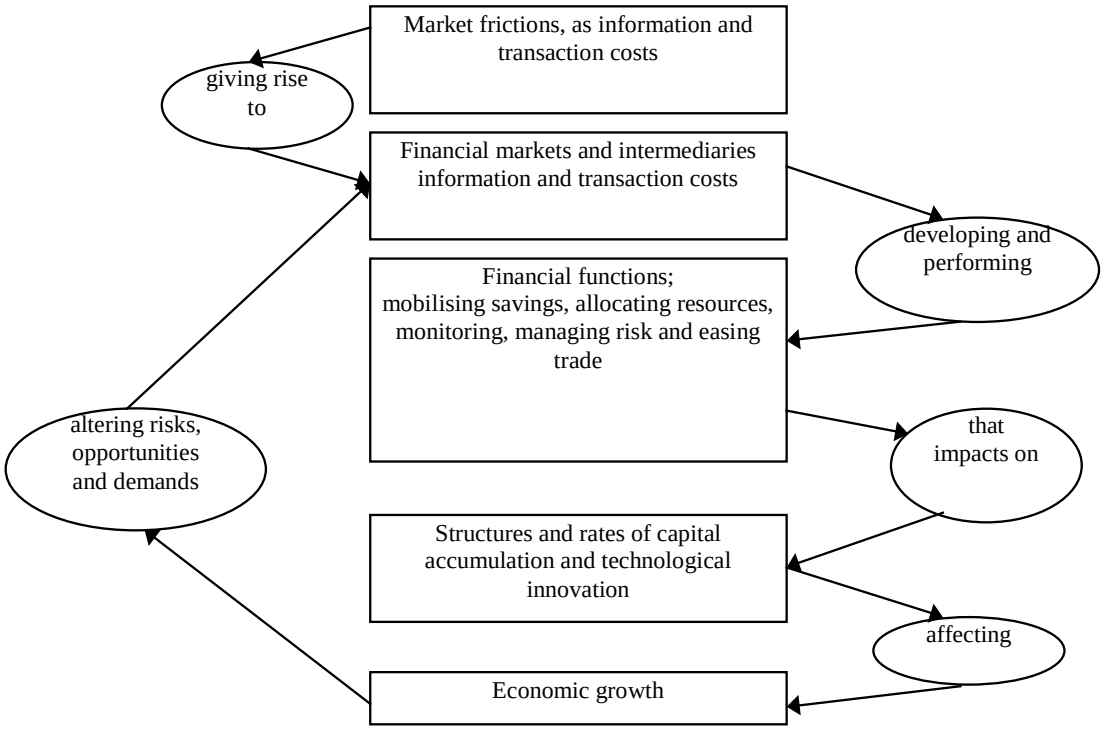


Table 2: Growth and financial indicators 1960-1989. Source Levine 1997

Dependent variable	*DEPTH*	*BANK*	*PRIVATE*	*PRIVY*
GDP per capita growth rate	0,024[1]	0,032[1]	0,034[1]	0,032[1]
R^2	0,5	0,5	0,52	0,52
Capital stock per capita growth rate	0,022[1]	0,022[5]	0,020[5]	0,025[1]
R^2	0,65	0,62	0,62	0,64
*Total factor productivity growth rate**	0,018[5]	0,026[5]	0,027[1]	0,025[1]
R^2	0,42	0,43	0,45	0,44

N = 77 countries

*TFP growth rate defined as

GDP per capita growth rate - 0,3 ∗ Capital stock per capita growth rate

[1] Significant at 1% level, 99% confidence level

[5] Significant at 5% level, 95% confidence level

Independent financial variables

DEPTH = ratio of liquid liabilities to GDP

BANK = ratio of deposit bank domestic credit to sum of deposit money bank and central bank domestic credit

PRIVATE = claims on the non-financial private sector as share of total claims (excluding credit to banks)

PRIVY = ratio of gross claims on private sector to GDP

What table 2 shows is that the level of these indicators in the period 1960-1989 is significantly correlated with three average growth rates over the same period of the 77 economies after correction for the other variables. Although the four structural indicators are crude measures of financial systems, the table shows that the size and structure of financial systems 'explain' a substantial part of the differences in economic growth. Available analytical and empirical evidence is not sufficient to conclude what causes these correlations.

The detailed interaction between financial services and economic development may in principle be approached from several complementary perspectives. How does external finance impact on innovation processes; do new financial instruments

develop as responses to new financial risks or to technological opportunities; what is the role of financial instruments towards the 'real' economy; what characterises financial intermediaries as users of intermediate inputs.

For innovation in non-financial companies, the immediate suggestion would be to map how firms use internal and external funds to finance innovation. The general conclusion of such studies is that innovation is overwhelmingly funded by internal resources, dominantly through retained earnings. This approach may be extended to analysis of corporate investment decisions. Corporate funding emphasises control relations between equity and management and financial instruments in corporate investment. The literature on 'economics of information' (see f.i. Macho-Stadler and Perez-Castrillo 1997) is concerned with incentive and contract structures under risk and asymmetric distribution of information. Goodacre and Tonks 1995 review these issues related to funding of R&D projects. Characteristically these literatures focus individual projects, portfolio management and financial instruments. To the extent that financial intermediaries feature, it is as secondary phenomena. Mayer 1987 asserts that the reason for the silence of finance literatures on 'real' effects is the "curious separation that exists in academic and policy circles between finance and the 'real' economy". Furthermore, "until recently, finance was pure technology … [of establishing] optimal portfolio decisions by investors and optimal financial practice by firms. …Within this framework there is no basis on which even to start to address … issues about different financial systems".

Financial systems

To answer questions about the impact of financial services and systems, require going beyond this 'pure technology'. It must consider organisational and institutional issues, issues on financial 'practice' and organisation and the relations between the financial system and the non-financial sectors. Unfortunately this literature is thin. Financial sectors and intermediaries are more prominent in literatures on corporate governance, the social processes that influence who makes investment decisions in corporations, what investments they make and how returns are distributed (O'Sullivan 1996). As reflected in the recent comparison of financial systems and industrial development in Germany, Japan, UK and the US (Lazonick and O'Sullivan

1997a, 1997b), it has been customary to distinguish two main forms of financial systems, Anglo-American 'market-based' systems with competitive and extensive equity and bond markets and continental European and Japanese 'bank-based' systems with closer relations between financial intermediaries and industry. Intermediaries are the predominant equity holders in 'bank-based' systems. In general terms, the structure of financial sectors are expected to look differently in this two systems, financial intermediaries in a 'market-based' system will be more specialised.

Table 3: Stylised facts of financial systems. Source Christensen 1992

Type of system	*Market-based*	*Credit-based with government influence*	*Independent credit-based*
Degree of self-financing of firms	high	low	low
Banks in external funding	small	large	very large
Ties between industry and finance	weak, anonymous, standardised	strong, known	strong, known
Influence	exit	voice	voice
Debt/Equity ratio	low	high	high
Credit and ownership concentration	low	high	very high
Cost of capital	low	high	very high

A similar tripartite classification is described by Christensen 1992 when discussing the role of finance in innovation systems[33]. Christensen splits 'bank-based' systems in two according to the traditional role of the government in regulating capital supply and prices. Scandinavian, French and Japanese systems are government influenced credit-based systems in this sense, while the German credit-based system has traditionally had a greater independence from government influence. Though the classification exaggerate the actual differences, Christensen identifies some 'stylised facts' of financial systems, reproduced in table 3. The assertions in the table are all

[33] A recent policy-motivated project at OECD discussed how national financial systems finance innovation, see OECD 1995a.

broadly confirmed by data, apart from the last one; capital costs seem to be higher in the more competitive market-based systems.[34]

The characteristics of these stylised categories, as closer ties of financial intermediaries to the corporate sector in bank-based systems, imply different advantages for these systems vis-à-vis innovation and technical change. The stability of the relations underlying the bank-based system imply an accumulation of industrial and project-related competencies, and hence of capabilities to assess projects. In slowly changing industrial and technological environments this gives bank-based systems an immediate advantage, Christensen emphasises this by denoting the bank-based mode the learning mode of financial structure. But where the bank-based system may have inertia, the market-based system promise more flexibility. Christensen points to these systems having advantages in one-off selection situations; in rapidly changing environments a market-based system would be more versatile.

The effects of these broad categories of financial systems are not definite. Part of the problem is the lack guidance from an underlying theoretical understanding (Mayer 1987). Without sufficient knowledge of the linkages between financial structure and economic growth, we cannot today say whether 'finance follows or is followed by industry'. However the conclusion of Levine 1997 that a sufficient understanding of long-run economic growth also requires an understanding of the evolution and functioning of financial systems seems warranted.

Business services

The third class of services we will consider is a heterogeneous category of business services, encompassing technical consultancy and engineering design, R&D services, a wide range of IT services and software development, as well as market related and administrative services. If services in total is a residual category, this class may be regarded as a 'residual of the residual'. We will have a subset of this residual, with

[34] This higher efficiency of German and Japanese bank-based systems compared to US and UK is confirmed by historical evidence. German universal banking was more efficient than the US financial system, in terms of costs of capital and severity of systemic problems in the period 1870-

two positive characteristics, in mind; services that are 'knowledge intensive' and that almost exclusively serve other businesses and organisations. Knowledge intensity is hard to define in an operational sense, even though it may be easy to establish consensus on the perceived knowledge intensity of particular service functions[35].

Miles et al 1995 suggests the following definition of knowledge-intensive business services,

- they rely heavily on professional knowledge,
- supplying products that are themselves sources of information and knowledge to their users or that are inputs into clients' knowledge generating and information processing activities,
- with other businesses as their main customers.

This suggests that in principle that it should be possible to identify these through a combination of two factors; a stronger reliance on formally specialised employment, and an enhanced effect on productivity of their main clients.[36]

Over the last decades the category of business services has experienced an unrivalled growth in employment over the whole OECD-area (OECD 1996). Since the early 1970's employment in these sectors has tripled, today they represent 5 - 10% of total employment. Table 4[37] shows the development of the share of employment in these sectors (including financial services and real estate) from 1980 for those large and small OECD countries where data are available in the OECD Inter-Sectoral Database (OECD 1993). The growth trend is nearly parallel across countries, comparing country shares in 1980 and 1991, the rank correlation is strong[38].

1914 (Levine 1997). The reason is probably related to reduction of information asymmetries through stable relations to clients in bank-based systems, allowing more efficient monitoring and allocation.

35 A survey-based approach to measuring industry experts' opinions on the role of knowledge intensive business services is presented in Bilderbeek and den Hertog 1997.

36 The KIBS-sectors does not correspond directly to any category of industrial activities that may be identified in industrial classification standards like ISIC or NACE. In ISIC Rev2-based statistics, international comparisons are usually based on the 'least common multiplicator' of business services, real estate, rental and business services (REBUS-services, ISIC 83), or the group financial services, real estate and business services (FIRB-services, ISIC 8).

37 As the OECD Inter-sectoral database does not allow decomposing the wider FIRB-sector of all countries, the table is based on employment in financial services and real estate in addition to business services. For more detailed data, see chapter 2 of this volume.

38 The rank correlation coefficient of 1980 and 1991 is 0,874.

Table 4: Share of total civilian employment in FIRB-sectors. Percent. Source: OECD ISDB 1993

	GER	FRA	ITA	NLD	UK	DEN	NOR	SWE	FIN	US	CAN	JAP
1980	5,8	7,5	2,6	9,2	7,3	5,7*	5,4	6,7	5,5	8,4	9,5	5,7
1985	7,2	8,2	3,5	10,7	9,6	7,7	6,5	7,5	6,4	10,3	10,1	6,8
1990	8,5	10,0	4,2	10,3	11,8	9,4	7,5	8,6	8,3	11,3	11,6	8,3
1991	8,5	10,2	4,7	10,6	12,0	9,2	7,8	9,0	8,5	11,3	11,9	8,4

* 1979

These service sectors have attracted much attention over the last years, particularly as regards technological business services' role towards technical change in manufacturing industries, see f.i. OECD 1990. Another rationale for interest in these sectors has been their potential role as economic bases for regional development, for a recent appraisal of this and other parts of the economic geography literatures, see f.i. Illeris 1996. Their potential role towards innovation processes among their clients, and characteristics of their innovation processes are discussed in several chapters in this volume, see also Gallouj 1994 and in Miles & al 1995.

Inter-industrial trade is inherently difficult to define, dependent as it is on industrial classification schemes. Table 5, based on the OECD Input-Output data set, measures the size of this trade relative to gross output for France, Germany, United Kingdom and the US. Inter-industrial trade is measured in the table as flows of goods and services between different sectors in the 35 sector classification that is used in the OECD I/O tables, hence it measures flows between relatively 'distant' sectors. These 'off-diagonal' flows correspond to some 35 - 40% of gross output in all countries. The average growth rates of these flows from the late 1970's up to 1990 are comparable to growth in gross output, but with some national variations. In particular, from this 4-country set, there seems to be no general trend of increase in the relative share of inter-industrial trade. Focusing on business services this picture changes. Reflecting the overall growth of these sectors, their share in inter-industrial trade has increased significantly over the period. A rough estimate suggests that this share has increased about 50% during the 11-13 year period. However a word of caution is in place, in the OECD tables business services are aggregated with real estate services; more detailed data are needed to determine an internationally comparable decomposition of this sector.

Table 5: Inter-industrial trade 1978-1990. Based on total flows in constant prices. Source: OECD Input-Output Database 1995

	FRA	GER	UK	US
	1977-1990	1978-1990	1979-1990	1977-1990
Inter-industrial trade*	34,0 %	37,9 %	42,6 %	34,3 %
Inter-industrial trade, annual growth rate**	2,6 %	2,9 %	4,3 %	1,8 %
Gross output, annual growth rate	2,6 %	2,6 %	2,9 %	2,4 %
REBUS in inter-industrial trade 1978***	16,1 %	11,6 %	4,8 %	10,8 %
REBUS in inter-industrial trade 1990***	16,5 %	17,7 %	12,7 %	15,7 %

* 'Off-diagonal' trade as share of gross output
** Average growth rate of total 'off-diagonal' trade in the indicated period
*** 'Off-diagonal' trade originating in real estate and business services (REBUS) as share of total 'off-diagonal' trade. Data for France 1977 include financial services, trade originating in FIRB-sectors account for 24,8% in 1990.

Nevertheless these data confirm that business service sectors account for a significant and increasing share of inter-industrial trade in these countries. The question of who uses these services, and to what end is considered in chapters 10 and 11. Data like the one we have given here are only giving lower bound estimates for the use of the associated service *functions* in national economies. These functions are both organised in separate organisations, and as functions within other companies. Hence, these data does not directly prove that the volume of use of these functions expand; the growth of these sectors may reflect increasing externalisation of previously intra-murally provided services. There are however both direct and indirect evidence that this reflects a real growth of use, such evidence is described elsewhere in this volume. As we have seen explanations of these trends, and their implications, vary, from 'neo-industrial' arguments, via 'transaction cost economising' behaviour to 'post-industrial' explanations. The interested reader is referred to the literature (see f.i. Larsen 1996, Hauknes 1996).

A present characteristic feature of many business environments seems to be turbulence; the rate of technical change is perceived as accelerating, competition is intensifying, within and between industries, through globalisation, and so on. This dimension of commercial activity is probably contributing to new industrial dynamics and the establishment of new intra- and inter-industrial structures. This process has potential consequences for the organisation of both core and peripheral activities and competencies within individual firms, for both old and new industries. These processes not only change how firms perform their activities, but also change

how firms structure their strategies and behaviour for change; their learning processes. Living in a turbulent environment with a complex division of labour and knowledge, requires higher sustainability, placing higher odds on an 'adaptable specialisation' and the ability to use such specialised functions[39]. The *know-whats*, *know-whys* and *know-hows* must be supplemented with the *know-whos*, *know-wheres* and *know-whens* (Lundvall and Johnson 1994).

The competitive environment that ensues in an innovation-dominated environment suggests that organisational effort will be directed towards measures that enable appropriation of what is perceived as important informational inputs (as well as the necessary redundancy in such inputs) and institutionalisation of information 'broker' or 'filter' functions. A substantial part of this will be efforts to internalise or control informational requirements of importance to organisational development. While other forms of 'interactive learning' may be considered a by-product of economic agency, 'learning by searching', like research, is an extensive, direct form of learning. The rise of corporate R&D (see Mowery and Rosenberg 1989), technological infrastructures, and a integration of industrial objectives into public R&D policies illustrates that learning ability is considered vital to commercial development. This focus of learning by searching extends considerably the width of the 'information horizon' that must be surveyed by the firm[40].

As a consequence of developments and trends like these, there seems to be only one option open to companies, initiate efforts to establish closer, viable networks or direct collaborative efforts towards competitors, suppliers and customers, as well as firms and institutions offering links to information or information channels. The ultimate goal of such efforts is then suggested to be partly to get ensured access to knowledge and information areas that are considered central for the company (the

[39] This evidently creates the possibility for an additional 'externalising' mechanisms. As critical competencies are scarce, they open the possibility for economically rational behaviour of the individuals and groups that have these competencies and capabilities. They may break out, whether permanently or otherwise of the organisation in which they are employed, and resell their services at a 'market price'. In some areas these situations are well-established and formalised, in other they are growing. In particular this is an increasing problem in various public services. In Norway processes like these are now becoming prominent in public health services, especially as regards specialised physicians in public hospitals. We want to suggest that this represents an important challenge for the formulation of firms' 'knowledge strategies'.

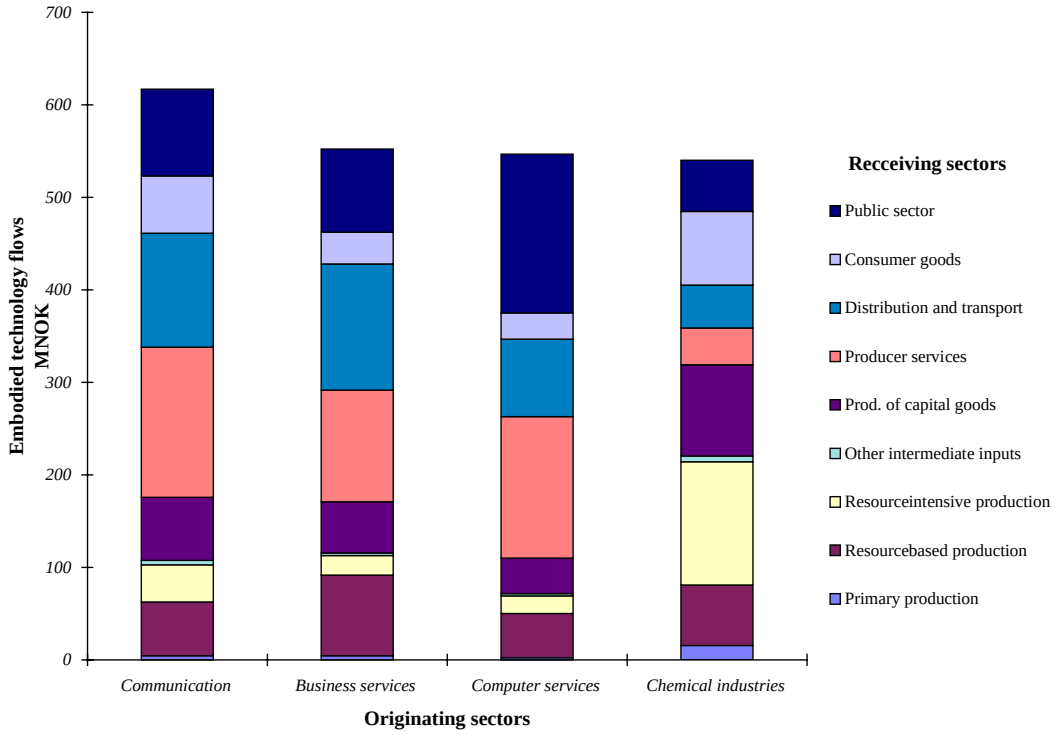
assessment of importance being done continually), to increase the local absorptive capacity of external knowledge and information, and to ensure 'thick' information flows; in short to manage an interface with a dynamic environment. Trends like these suggest that knowledge intensive business services are at the core of these developments. The restructuring of commercial activity in a turbulent environment emphasises knowledge-intensive business services' relations to client enterprises. Given the character of these services, they have an evident role to play in innovation systems; den Hertog and Bilderbeek suggests in chapter 8 that they may be considered as a 'second' knowledge infrastructure supplementing the role of the 'first' technological infrastructure .

Reflecting this potential role, consultancy services have increasingly been the subject of political interest as bridges for firms' acquisition of 'absorptive capacities' (see the chapter by Bessant and Rush). KIBS-services have been suggested to be facilitators, carriers and sources of innovation in client firms, see f.i. Bilderbeek and den Hertog 1997. These suggestions are emphasised by the fact that these sectors are significant national employers of higher educated personnel. In Norway business services employed more personnel with education level ISCED 6 or above than all manufacturing sectors together in 1994. Business services corresponding to NACE 72 and 74 employed more than 15% of the total labour stock with formal background from natural science, technology and economics or business administration. Furthermore, as coverage of national R&D surveys have improved, KIBS-services appear as significant R&D performers. To our knowledge the Norwegian R&D survey for 1995 is the first R&D survey that covered all service and manufacturing sectors in a statistically satisfactory way. Hence these data give a comprehensive description of the structure of R&D performance across all sectors. Market services account for 32% of R&D financed through the enterprise sector. The two NACE categories 72 and 74 together is a larger R&D performer than any other NACE 2-digit sector; together they account for nearly 14% of R&D in Norway. This implies that these sectors are important sources of new technology for other sectors. One measure of this is embodied technology flows. These flows are calculated through

[40] Nowhere is this clearer than in Rosenberg's argument why firms do basic research (for their own money), Rosenberg 1990, they do it to strengthen their ability to identify and capacity to interpret and absorb potentially useful knowledge, generated by the research communities.

input-output tables by augmenting intermediate flows by R&D-intensities of the originating sectors[41]. Figure 4 shows the four largest originating sectors of embodied technology flows, and the structure of their recipients in the Norwegian economy. The three largest sectors, the service sectors NACE 64, 72 and 74, account for about 1/3 of embodied flows in the Norwegian economy.

Figure 4: Embodied technology flows 1995 Norway. Four largest originating sectors



In contrast to the case of distribution and financial services, the issue of KIBS' role in innovation systems centers more directly on *functional* aspects of these services. Considering functional and organisational forward linkages and 'spillovers', there is a range of possibilities of how they interact, and how specific relations may impact on service providers' capabilities for the benefit of other customers. We will not discuss these further here other than pointing to an interaction that is specific to problem-solving relations of a kind that may characterise KIBS and their clients. Other interactions are discussed in the following chapters.

41 Technically speaking these are flows in the R&D-augmented input-output tables. For a description of the formalism, see Hauknes 1998.

KIBS-relations requires introduction of a new category of 'valorising' or induced innovations beyond the traditional five-tiered Schumpeterian scheme of product, process, organisation, market and input innovations, Gallouj 1994. These innovations are implemented in customers' organisations, but developed through or induced by the collaboration, being generated in a close problem solving relation between producer and user. They are based on service firms' accumulated stock of knowledge and experiences, and may lead to generation of new knowledge or new services that are transferable to new customers. Gallouj claims that these innovations are frequent in consultancy activities, but that they are not reflected in innovation analysis. Evidently this form of innovation concerns complementary learning processes for both the producer and the user. In that sense they seem to have a lot in common with Lundvall's concept of learning-by-interacting, and the contingent process towards organised market relations. The characteristic of consultancy-client relations is that many of the ordinary barriers to information flows between the two are voluntarily suspended or reduced, at least for a limited time,[42] implying the role played by trust. The interaction is a learning process enabling or facilitating innovation. In this, they are in accord with a larger class of potentially durable and selective user-producer relations (Lundvall 1992b). The features of induced innovation imply that bilateral 'innovation-by-interacting' are particularly relevant for circumstances where user-producer relations may be characterised as 'interactive problem-solving' as in some types of consultancies, rather than where these relations have a stronger character of sub-contracting relations, as construction of specific pre-specified components or installations.

[42] The consultancy-as-producer may be a one-off 'supplier', but there are other situations where the two are involved in longer term relations. In both cases, mutual trust is important; the consultancy will many times acquire confidential information about the client (and is required to acquire this to give adequate advice). Though we have not been able to check empirical evidence, this suggests a hypothesis of a growing share of long standing relations, and a positive relation between the clients assessment of the quality of the service, evidently measured by its effect on the clients performance, and the duration of the relation. The reason for this is simply that the development of a common 'mind set' (Phillips 1994) or communication code (Lundvall 1992b) that enable effective information exchange between the two parts is a costly process, a capital fund that is intimately tied to this relation. The vitality of trust in the relation is thus not specific to services like consulting activities, but equally apply to other producer-user relations.

Consumer services

May final consumption be decomposed into a sum of consumption of material, manufactured goods and immaterial, service goods? To what extent is a decomposition meaningful? Are there any consumer goods at all that may be called 'consumer services'?

Our focus in this last section is on consumer goods[43] where the primary object of consumption is classified as a (intangible) service. Even though the classification of consumer goods as services to some extent is a matter of convention, it excludes support or peripheral services, bundled into a tangible product or into the transaction process with the consumer.[44] We do not however take the stance of Levitt, as in his allegory of ¼ inch drill bits, which would ultimately lead to statements to the effect that 'all is services'. Such argument; being concerned with the links between formation of the consumer's actual demand structures and her underlying wants, may lead to a confusion of two (related, but not identical) service concepts; the 'service rendered' by an economic good in the process of consumption and the differentiated translation and expression of wants for such 'satisfying services' in demand for complementary bundles of economic goods, including service goods. This description of a decomposition of want-satisfying services into demand for specific goods thus leads naturally to a consideration of complementarities of demand that will extend beyond any taxonomic distinction between tangible and intangible goods.

Our consideration is with the latter 'service product' approach, with how demand patterns are expressed by the consumer with respect to service products that are available 'on the market'. By convention, consumer goods refer to goods consumed by households, restricting it from public, as well as from intermediate, consumption. In addition we may exclude consumption of service goods that are directly instrumental or supportive for operation and maintenance of specific consumer goods, including these costs in the total costs of these goods. A case at hand may be

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43 We use 'goods' or 'economic goods' in the original sense. Marshall described goods as "all desirable things, or things that satisfy human wants", with economic goods being goods that are "external to a man (sic!), belong to him … and are distinctly his; and which are directly capable of a money measure" (Marshall 1920).

44 The exclusion of 'service-wrapped' tangible goods suggests the inclusion of 'tangibly wrapped' intangible goods, as software, recorded music, as well as books. Here we enter into the

want for transport services. Partly this want is translated into a demand for scheduled, or pre-programmed, transport, expressed in demand for public transport services. However, an underlying want for flexible and consumer-specific transport services is also expressed in consumers' demand for cars.[45] The production of the latter transport services is done by the consumer, as the translation back into satisfying the underlying wants, i.e. as the consumption of the car. The cost of a car then includes operating costs that allows this consumption process, such as fuel, repair services, insurance, use of toll roads, etc.

If we turn to national accounts for an estimate of service consumption by households, more than 50% of household consumption originate in 'service sectors' outside trade sectors, see f.i. Hauknes 1996. This number is evidently of limited value, the number is evidently related to the same kind of accountancy principles that suggest that 75% of manufacturing production costs are service costs. A more direct approach is to attempt mapping consumption patterns of households. From the preceding discussion and with our choice of focus, we draw the conclusion that rather than the patterns of the consumption processes, we should map patterns of households' acquisition of the means for consumption through available product markets. Table 6 shows the contemporary structure of household's expenditures for consumption in Norway. The table is based on recent consumer surveys performed by Statistics Norway, giving the average structure of annual household consumption expenditures for the period 1993-1995.

mine-field where it is necessary to clarify whether it is a classification of products from the perspective of the consumer, a classification of production activities, etc.

[45] The emergence of household production of transport services with privately owned cars, may be regarded as an illustration of the 'self-service' pattern that has been elaborated in Gershuny 1978.

Table 6: Household expenditure in Norway 1993-1995. Source Statistics Norway 1996

Goods category	*Examples*	*Share of household expenditures*
Food	Flour and meal, meat, milk, fruits and vegetables	13,8%
Beverages and tobacco	Mineral water, beer, wine, liquors, tobacco	3,8%
Clothing and footwear	Clothing, fabrics, yarn, footwear	6,2%
Rent, fuel and power	Housing and maintenance, fuel and power	24,0%
Furniture and household equipment	Furniture, textiles, electric appliances, tableware and utensils	6,9%
Food, clothing and housing		54,7%
Domestic services	Domestic services	1,7%
Health care	Pharmaceuticals, orthopaedic articles, medical services	2,4%
Transport equipment	Purchase, operation and maintenance of transport equipment	15,9%
Public transport services	Land, water and air transport, freight charges	3,4%
Communication	PTT services	1,8%
Recreation equipment	TV-sets, audio systems, sports articles, recorded media	5,4%
Public entertainment a.o.	Cinema, theatre, lotteries	2,8%
Printed media	Books, newspapers, journals	2,1%
Education	School fees	0,9%
Personal care, jewelry a.o.	Cosmetics, hair and beauty care, toiletries, watches, jewelry etc.	2,9%
Restaurants, hotels, package/guided tours		5,5%
Other services	Financial and other services	0,5%

As we would expect the dominant share of household expenditure is for food, clothing and housing. Together these items represent nearly 55% of total expenditures for the average Norwegian household. Expenditures for purchase, operation and maintenance of large capital goods, i.e. housing facilities and transport equipment, was nearly 40% of total expenditures. These expenditures include a substantial share of service costs, but costs that are related to the wider cost concept, or to the maintenance and operation of households' capital goods. Ignoring these expenditures, trade margins and public services consumed individually, but financed through public budgets, the remaining consumption of services account for 19% of

household expenditures[46]. This covers expenditures for use of public transportation and communication, hotels, restaurants and package tours, and cultural services, as well as some other items.

Within our approach, this is what we interpret as consumer services in the limited sense. As indicated above, this approach is limited, in the sense of being based on households' direct expenditures. This implies that we exclude most of the households' expenditures on social services, primarily public education and health services, being almost exclusively financed by public funding or tax revenues. With this limited interpretation of consumer services, we note that some consumer service goods are provided through production structures that exclusively serve the household sector, like cultural services, while other production structures serve both consumer and intermediate markets. From the perspective of this chapter, in general there are two channels for 'innovation spillovers' in innovation systems from consumer services; backward linkages in the relevant service production systems, and substitution and complementarity effects of the service good towards other (manufactured) goods, mediated through the consumer market.

In some instances, as several personal services, the production may be likened to 'vertically integrated' industries[47]. However, these services also include highly disaggregated industries as some of the 'entertainment' industries, like movie and musical record production.[48] Distinguishing between service production systems with a relatively complex division of labour, and those with a weak or non-existent vertical division of labour[49], the impact on or integration into innovation systems is expected to be correlated with structure of the production system. These distinctions

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46 We ignore the households' own production of services for its own consumption, as we have no way of quantifying these activities. This is in line with the standard approach of economic statistics, as in national accounts, see f.i. Lützel 1996. But in passing, we should note that some of the most significant social innovations over the last century are related to the substitution of such production activities with consumption of household appliances.

47 An immediate example is domestic and cleaning services, as well as recreational services, but this also applies to service industries like hotels and restaurants.

48 Some industries notionally classified as services are not really different from some manufacturing industries. Consider the similarities between industries like video production and production of music discs, which were reclassified from services to manufacturing in the 1993 revision of the international standard for industrial classification ISIC, and a manufacturing industry of (book) publishing.

49 Ignoring as is usual for manufacturing production, the 'production' of capabilities necessary to produce the service good.

are not directly operational, but as illustration, both from the performing arts, we suggest film industry and theatre production as examples of the two kinds.

It is immediately clear that these industries should be considered innovative in their own right, even though attempts to identify what innovations are may prove difficult. Innovations such as the introduction of LP-records in 1948 had subsequently significant reverberations on industry structure in the 1950s, as the introduction of music CDs has in the 1990s. These are fairly unproblematic. Less immediate is how the breakthrough of rock 'n roll in the 1950's, jazz-rock in the 1970's and the present 'vintage instrument' orientation of classical music should be presented. But as the record industry abundantly show, such 'quasi-innovation' may even change the face of an established industry.

Consumer service industries may involve intensive use of manufactured capital and intermediate goods, as f.i. in the entertainment industries. The industries, being in many instances lead users, will shape the future of related industries and the development of their products. The film industry has not only been a shaper of public opinion, but has also had impacts on the development of photographic technologies and over the last decades on the emerging 'infotainment' industries. The development of public transport systems, like 'bullet trains', has also to a large extent been driven by expectations related to public transport. Activities where security and admission considerations are important have activated filières involving activities as disparate from their target activity as ticketing systems, digital keys and pattern recognition.

We have argued that consumer services make up a small share of total household consumption. From the perspective of innovations in the production systems of these goods, we are again led to consider the filière structure from which the service consumer product emerges. For some of these filières, in particular related to categories of service goods that are intensive in information processing and interpretation such as 'info-' and 'edu-tainment', electronics and information technologies represent an important extension of production structures, allowing a dramatic extension of scope of available service goods.

In addition we are led to consider the effect of demand complementarities on consumer markets in a much more fundamental way than demand relations on markets for intermediate and capital goods. These relations between different consumer goods are the effects of a 'non-specificity' of consumers' wants, giving even more richness to the Schumpeterian competition from 'new ways of doing things'.

Conclusion – A question of Concerted Action

The concept of innovation systems epitomises the importance of Schumpeterian technological competition in modern economies. We have seen that considering the systemic dimensions of innovation in a dynamic perspective, we have attained an understanding of how the integration of innovation systems into a social framework could be interpreted. By supplementing the role of innovation with evolving social and functional divisions we have argued that the dynamic interaction between the two afford insight into the structure of innovation systems and their dynamic aspects, and to economic change.

This approach has led us to emphasise economic systems in general, and innovation systems, as representation of integrated and dynamically generated economic structures. We have seen that these systems emerge as functionally dispersed systems, where the economic functionalities of what we classify as ranges of economic sectors must be understood as integral parts. This led us to emphasise the irrelevancy from a dynamic system perspective of a dichotomy between manufacturing and services. However, in a more limited, 'short-run' or myopic perspective we may still ponder the role of different sectors.

This has been our approach to the question of the role of different service sectors in innovation systems. In answering such questions, the dynamic perspectives that we outlined imposes us to consider this through the question of what these sectors economic roles are; how their functions participate in the economic system. As we have argued, the general roles that emerge are a direct consequence of the complementarities between different economic functions. The roles that emerge from this, may seem evident, and in a sense they are; the service functions we have

discussed has a ‘normal’ role to play in innovation systems, on the background of which more sophisticated interactions may be considered.

However, this ‘macro-perspective’ implies a limitation in the resolution power. To study these sophisticated interactions incurs the needs of more detailed approaches. Without higher resolution power we cannot attain an understanding of the relative importance of various services ‘on the margin’. What we have offered here, is an outline of the background and constitutive roles, on which these ‘marginal’ issues may be raised, but without which these studies would be lacking a proper foundation.

We opened this chapter by citing Schumpeter on the integrated character of social processes. Let us end with a statement on the basic constituent of economic action, that suggests the channel for social integration of economic processes,

> *“As soon as we permit time to elapse, we must permit knowledge to change, and knowledge cannot be regarded as a function of anything else”*
> Lachmann 1977

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STEP group

STEP-gruppen ble etablert i 1991 for å forsyne beslutningstakere med forskning knyttet til alle sider ved innovasjon og teknologisk endring, med særlig vekt på forholdet mellom innovasjon, økonomisk vekst og de samfunnsmessige omgivelser. Basis for gruppens arbeid er erkjennelsen av at utviklingen innen vitenskap og teknologi er fundamental for økonomisk vekst. Det gjenstår likevel mange uløste problemer omkring hvordan prosessen med vitenskapelig og teknologisk endring forløper, og hvordan denne prosessen får samfunnsmessige og økonomiske konsekvenser. Forståelse av denne prosessen er av stor betydning for utformingen og iverksettelsen av forsknings-, teknologi- og innovasjonspolitikken. Forskningen i STEP-gruppen er derfor sentrert omkring historiske, økonomiske, sosiologiske og organisatoriske spørsmål som er relevante for de brede feltene innovasjonspolitikk og økonomisk vekst.

The STEP-group was established in 1991 to support policy-makers with research on all aspects of innovation and technological change, with particular emphasis on the relationships between innovation, economic growth and the social context. The basis of the group's work is the recognition that science, technology and innovation are fundamental to economic growth; yet there remain many unresolved problems about how the processes of scientific and technological change actually occur, and about how they have social and economic impacts. Resolving such problems is central to the formation and implementation of science, technology and innovation policy. The research of the STEP group centres on historical, economic, social and organisational issues relevant for broad fields of innovation policy and economic growth.