The Learning Organisation and National Systems of Competence Building and Innovation

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INTRODUCTION

There is a growing understanding that knowledge is at the core of economic development. This is reflected in OECD-publications referring to the *knowledge-based economy* (OECD 1996a; OECD 1996b; Foray and Lundvall, 1997). Here we prefer to define the present stage as a 'learning economy'. Knowledge has always been at the core of economic development and it is not obvious that there has been a radical change in 'the amount of economically useful knowledge'. The useful stock of knowledge is not the sum of all knowledge that was ever created in the history of mankind. A lot of knowledge has been lost in a process of creative destruction.

The last decades have been characterised by an acceleration of both knowledge creation and knowledge destruction (EIRMA 1993; Carter 1994). Information and communication technology has made a lot of information more easily accessible to a lot of people, but it also has made many skills and competencies obsolete. What is really new is the high rate of change and, as we will discuss below, this acceleration of the rate of change is perhaps the most important impact of the wide use of information technology. What constitutes success in the current market economy for individuals, firms, regions and national economies is rapid learning and forgetting (because old ways of doing things often get in the way of learning new ways).

In this new context the learning capability of firms located in the domestic economy becomes a major concern for national governments and, vice versa, the national infrastructure supporting knowledge creation, diffusion and use becomes a concern for management and employees. To get the two to match and support each other becomes a prerequisite for economic success for firms as well as for the national economy. The new economy gives new responsibilities to both business and governments. One of the major objectives of this paper is to demonstrate that societal institutions, which may exist at the national or regional levels, shape the types of organisational learning predominating at the level of the firm.

The analysis presented in this paper illustrates the logic of institutionalised variation in patterns of learning and innovation. It also discusses how such variation may enable, or constrain regions or countries to create organisational forms needed for generating the types of innovation associated with different technologies or industrial sectors. The paper argues that tacit knowledge, which is difficult to create and transfer in the absence of social interaction and labour mobility, constitutes a most important source of learning and sustainable competitive advantage in an increasingly globalised knowledge-based economy. Learning builds on trust and social capital. Institutions that are able to imbue these elements into firms and markets encourage interactive learning and are more likely to produce strong innovative capabilities.

TOWARDS A LEARNING BASED THEORY OF THE FIRM

There is a gap between the normative, management-oriented literature on learning organisations on the one hand and theoretical contributions regarding the theory of the firm on the other. In the first category we find strong recommendations to focus on the management of knowledge but these recommendations are sometimes based on a rather limited perspective. They reflect correctly that firms need to give more attention to their capacity to learn and to manage knowledge, but in order to promote

their ideas, they tend to abstract from the wider set of activities and functions related to good performance. In theories of the firm, considerations of knowledge and learning are either absent or integrated in a somewhat static way. It might be worthwhile to consider how this gap could be narrowed in order to make the management literature more comprehensive and the theories of the firm more relevant.

In what follows we will indicate how the original contribution by Penrose (1959) on the resource based theory of the growth of the firm can be developed into a learning based theory of the firm. The fact that firms and management teams search and learn is taken into account by Penrose (1959, pp. 76-80 et passim)[1]. In her model it is the competence of management and the human resources it controls that set the limits for growth. It is implicit in the analysis that it is more time-consuming and costly to develop this core of knowledge than it is to acquire other types of (tangible) resources.

If we bring this analysis to its logical conclusion we end up with *a learning based theory of the firm*. If it is correct that the limits to growth (Penrose assumes that in practical terms the objectives of growth and profit are inseparable, 1959, p. 30) are set by the competence of the management team and the costs of extending this team, the *increase in competencies* becomes the most important strategic objective. Or, as formulated by Senge (1990), "the only enduring source of competitive advantage is the ability to learn."

It is interesting to note that recent contributions by Penrose (1959; 1995) and Richardson (1996; 1997) also indicate the need for such a more dynamic (learning-based) theory of the firm. In the new foreword to her classical text, where she brings together and comments upon what seem to be the most important new developments since she published here own work, Penrose points to the contribution by Loasby (1991) and his emphasis on how management construct 'research programmes' that make it possible for individuals to learn without threatening the coherence of the firm. The most recent contributions by Richardson (1996 and 1997) have typically presented theoretical and empirical analysis of processes of knowledge-creation in highly dynamic sectors.

Three basic functions of the firm

It is useful to specify the basic functions of the firm into three categories:

- Allocating scarce resources (statics)
- Exploiting underutilized resources by entering into new activities (first order dynamics)

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[1] Her discussion of knowledge is quite advanced and worth a much deeper analysis. Penrose defines knowledge as encompassing both information (know-what) and skills (know-how). She introduces 'learning by doing' as well as 'learning by searching'. And, finally, she insists on the fact that economists interested in industrial dynamics cannot allow themselves to neglect the systematic analysis of this 'slippery' subject.

- Speeding-up learning and creating new competencies (second order dynamics)

The three functions are at the focus of three different theories of the firm – neo-classical, resource-based and learning-based theories of the firm. But real firms have to take all the three functions into account. The firm will re-allocate its resources if there is a (substantial) change in relative factor prices. To exploit underutilized resources and to use the existing knowledge base, in connection with the introduction of new products, is also an important part of the strategy of firms. But, in the long run, the success and growth of the firm will depend on its capability to build new competencies.

It is also important to note that there are trade offs between the three functions. A strictly 'optimal' use of all resources (with no x-inefficiency) will leave too little slack for flexible adaptation and for growth endeavours. A growth pattern characterized by a 'harmonious' combination of 'similar' activities may hamper the learning capability by reducing the diversity on which learning processes thrive (see below on this point).

The three functions may take on different weight in different parts of the economy. In those parts of the economy that are stable in terms of technological opportunities and user needs, we might find firms that successfully focus on the static allocation function. In other parts where the rate of change is dramatic, the third function becomes the central concern of management.[2]

One aspect of the learning economy is that there is a general movement within firms that gives stronger emphasis to the third function and this is why there is a demand for the management literature on how to implement learning organisations and knowledge management. But, of course, knowledge management strategies have to take into account the other two functions as well. Firms still have to be concerned about their allocation of existing resources and about growth on the basis of its existing competencies.

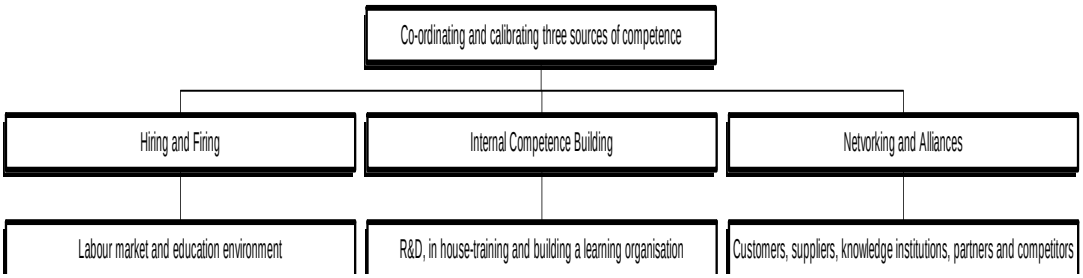
Building learning organisations and integrating strategies of competence building at the level of the firm

The theoretical considerations discussed above have their correspondence in management considerations. Management is constantly in a situation where it has to consider alternative ways of creating and using competence emanating from different sources. These choices have to do both with human resource development and with the degree of vertical integration of tasks. The competence of the work force will reflect a combination of hiring/firing decisions and investment in internal training and learning. Take-overs and mergers is one way to get access to individual and collective knowledge pools while a positioning in networks or in strategic alliances is another. Knowledge management needs to have an integrated and coherent approach to the use

[2] Below we shall present four different types of organisations that differ when it comes to their basic style of knowledge management. Three of them may correspond to the three functions referred to here: Machine bureaucracy – resource allocation, J-form organisation – capability based growth, Operating Adhocracy – high speed learning

of these different sources. An *integrated competence building strategy* is needed and such a strategy should take into account how to combine the three different major sources of competence building: Internal competence building, hiring and firing and network positioning (see the diagram below).

Diagram: Knowledge Management in the Learning Organisation



Firms differ in how strongly they emphasise each of these elements both between and within national innovation systems. Japanese firms have emphasised internal competence building while most hi-tech firms in Silicon Valley depend on learning through high inter-firm mobility of employees within the industrial district. In Denmark the institutional set-up of the training system and the labour market supports networking firms and high mobility in the labour market, making it attractive for firms to locate in 'industrial districts'. Below we will develop a taxonomy of organisational strategies and national systems that bring such differences into focus.

As we shall see there is no single optimal strategy in this respect. What is a good practice will depend on sectoral and regional contexts. Under all circumstances, the diagram gives a first hint that there is a connection between the knowledge management style of the firm and education and labour market institutions. It is important when designing public training and labour market reforms to be aware of the behaviour of firms in this respect and to balance the needs of the firms to social needs. The aim of reform should be to shape framework conditions in such a way that firms get strong incentives to contribute to competence building without undermining social cohesion in society at large.

The generic trends toward learning organisations

An extensive literature shows that there is a strong synergy between the introduction of *new forms of organisation* and the performance and innovative capacity of the firm (Gjerding 1996; Lund and Gjerding 1996; Lundvall 1999; Lundvall and Nielsen 1999). Establishing the firm as a learning organisation characterised by decentralised responsibility, team work, circulation of employees between departments and

investment in training has a positive impact on a series of performance variables. Flexible firms are characterised by higher productivity, by higher rates of growth and stability in terms of employment and they are more innovative in terms of new products. Research also shows that success in terms of innovation is even greater when such a strategy is combined with active networking in relation to customers, suppliers and knowledge institutions.

While there are generic tendencies reflecting the movement toward a learning economy, different types of organisations learn and manage knowledge differently. During the past decade, a large literature has discussed new organizational models and concepts designed to support organizational learning and innovation (see, Lam 2004). These models include 'high performance work systems' or 'lean production' (Womack et al 1990), pioneered by Japanese firms in the automobile industry; and the 'N-form corporation' (Hedlund 1994) and 'hypertext organization' (Nonaka and Takeuchi 1995). More recently, concepts such as 'cellular forms' (Miles et al 1997); 'modular forms' (Galunic and Eisenhardt 2001) and 'project-based networks' (DeFillippi 2002) reflect the growth of flexible and adaptive forms of organization with a strategic focus on entrepreneurship and radical innovation in knowledge-intensive sectors of the economy. These studies highlight the different ways in which firms seek to create learning organizations capable of continuous problem solving and innovation. Very few studies explain the nature of the learning processes underpinning these structural forms, the types of innovative competences generated and the wider institutional context within which this organizational learning is embedded.

One of the major points in this paper is to demonstrate how the national (or regional) context shapes the forms of organisational learning predominating at the level of the firm. In the next section we will start from the now widely diffused concept ‘the national system of innovation’ and discuss how it can be both extended and deepened by putting competence building of people and organisations at the centre of the analysis.

TOWARDS A CONCEPT OF NATIONAL SYSTEMS OF COMPETENCE BUILDING AND INNOVATION

The concept of ‘national systems of innovation’ goes back to Friedrich List (List 1841). The analysis of national systems developed by List took into account a wide set of national institutions including those engaged in education and training as well as infrastructures such as networks for transportation of people and commodities (Freeman 1995). The modern revival of the concept some 12-15 years ago gave rise to different more or less broad (often implicit) definitions of innovation systems.

The US-approach (Nelson 1988; 1993) linked the concept mainly to high-technology industries and put the interaction between firms, the university system and national technology policy at the centre of the analysis. Freeman (1987), in his analysis of Japan, introduced a broader perspective that took into account national specificities in the organisation of firms – he emphasised for instance how Japanese firms increasingly used ‘the factory as a laboratory'. The Aalborg approach (Lundvall 1985; Andersen and Lundvall 1988) also took the broader view: it looked at national systems of innovation as rooted in the production system and it also emphasised the

institutional dimension, where institutions were defined theoretically as norms and rules (Johnson 1992). Porter (1990) brought in regimes of competition as important dimensions of national systems.

But none of these approaches gave education, training and labour markets the central role that they deserve. The education systems and labour markets are nationally constituted and it is obvious that they play a key role in competence building and thereby in shaping the foundation for innovation processes. There are national specificities in the formation of skills and in the national labour dynamics as well as economic and cultural barriers to the free movement of labour across national borders. There are important changes taking place that increase the international mobility of highly skilled labour but there is little doubt that 'human capital' and labour remains the least mobile of the resources used in the production process.

There have been some broader approaches that give more attention to the role of labour markets and training in national systems. Starting from a different tradition that, historically, has put less emphasis on technical innovation and more on macro-economic dynamics, regulation school economists have been among the first to introduce the human resource dimension when pursuing comparative analyses of national systems (Amable, Barré and Boyer 1997).

Also, in the parallel work on 'national business systems' pursued by Whitley (1996) and others there is some emphasis on national specificities in human resource development systems and labour markets (referred to as the 'labour system' by Whitley).

Innovation systems – three alternative perspectives

We can thus identify at least three different ways of delimiting the innovation system. The first is the innovation system as *rooted in the R&D-system*, the second is the innovation system as *rooted in the production system* and the third is the innovation system as *rooted in the production and human resource development system*. There are several reasons why the last perspective is to be preferred.

Several OECD-countries that are characterised by a low-tech specialisation in production and exports are among the countries in the world with the highest GNP per capita. To focus on the rather small part of the economy engaged in formal R&D-activities would give very limited insights regarding the growth potential for these countries. This is true for most small OECD-countries and for developing countries. It may be argued that the 'made in America' study (Dertoutzos et al, 1989) and the made in France study (Taddei and Coriat 1993) indirectly have demonstrated that this wider perspective has relevance even for the big OECD-countries.

A second reason has to do with the fact that empirical studies especially at the regional level (see, Gelsing 1992 and Jensen 1992) only partially support the original hypothesis in Lundvall (1985) about innovations systems as primarily constituted by inter-firm, user-producer relationships. It is an obvious alternative to broaden the perspective on regional and national systems and to see them as constituted also by a common knowledge base embedded in local institutions and embodied in people living and working in the region.

The final and perhaps the most important reason for taking the broader view has to do with the basic assumption presented above about the present era as dominated by a 'learning economy'. This hypothesis points to the need to give stronger emphasis to the analysis of the development of human and organisational capabilities. In the national education systems people learn specific ways to learn. In labour markets they experience nation-specific incentive systems and norms about what kinds of knowledge are the most valuable. Again this will have an impact on how they learn. This is a theme that is addressed in the next section.

KNOWLEDGE, ORGANISATION AND SOCIETAL INSTITUTIONS

The knowledge creation and learning capabilities of firms cannot be separated from specific organisational forms and societal institutions (Lam 1997; 2000a). Here, we develop a typological framework linking the micro- and macro-level analysis to explain the links between learning patterns, organisational forms and societal institutions. It highlights the importance of education and training systems, and types of labour markets as the key societal institutions shaping organisational forms and the learning capabilities of firms.

Education and training shape the social constitution of 'knowledge', and thus provide the basis of qualification, work status and job boundaries. As such, they influence the relative status and importance of different types of knowledge, and the nature of their interaction. The types of labour market determine the locus of learning, the incentives for developing different types of knowledge, and define the boundaries and social framework within which individual learning interacts with collective learning. These institutional features interact with organizational structures and processes to generate different types of knowledge, patterns of learning and innovation.

The analysis seeks to link together the literature on knowledge and learning with that on organisational forms and national systems of innovation. In order to cover these fields, normally treated separately, a number of simplifying assumptions have to be made. However, we believe that this integrated approach has great heuristic value both for theoreticians who tend to be locked in into more narrow fields of analysis and for practitioners who may also tend to focus too myopically either on the organisational or at the societal level.

Characterising knowledge

The knowledge of the firm can be analysed along two dimensions: the epistemological and ontological. The former concerns the modes of expression of knowledge, namely, Polanyi's (1962; 1966) distinction between explicit and tacit knowledge. The latter relates to the locus of knowledge which can reside at the individual or collective levels. These two dimensions give rise to four different forms of organizational knowledge: 'embrained', 'embodied', 'encoded' and 'embedded' knowledge (see table 2):

Table 2: Knowledge types

	Individual	Collective
Explicit	Embrained knowledge	Encoded knowledge
Tacit	Embodied knowledge	Embedded Knowledge

Embrained knowledge (individual and explicit) is dependent on the individual's conceptual skills and cognitive abilities. It is formal, abstract or theoretical knowledge. It is typically learnt through reading books and in formal education. Embrained knowledge enjoys a privileged social status within Western culture. The high occupational status of science compared with engineering reflects this.

Embodied knowledge (individual and tacit) is action oriented; it is the practical, individual types of knowledge on which Polanyi (1962; 1966) focused. It is learnt through experience and in training based on apprenticeship relations. Embodied knowledge is also context specific; it is 'particular knowledge' which becomes relevant in light of the practical problem solving experience (Barley 1996).

Encoded knowledge (collective and explicit) is shared within organisations through formal information systems – any member of the organisation who knows the code can easily get access to relevant data bases through the use of information technology. Encoded knowledge is formed in making explicit as much as possible of tacit knowledge. This is well-illustrated by the principles of Scientific Management which attempt to codify worker experiences and skills into objective scientific knowledge.

Embedded knowledge (collective and tacit) is built into routines, habits and norms that cannot easily be transformed into information systems. Embedded knowledge is produced in an interaction among different members of the organisation and it may be supported by story-telling and processes aiming at making members of the organisation share its cultural norms. Embedded knowledge is relation-specific, contextual and dispersed. It is an emergent form of knowledge capable of supporting complex patterns of interaction in the absence of written rules.

Characterising organisations

All organisations potentially contain a mixture of knowledge types, but their relative importance differs. Organisations may be dominated by one type of knowledge rather than another. To each of the knowledge forms there corresponds an ideal type organisation. We distinguish four ideal typical organisational forms, using two dimensions: the degree of standardisation of knowledge and work, and the dominant knowledge agent (individual or organisation) (see table 3). These different organisational configurations vary in their ability to mobilise tacit knowledge, resulting in different dynamics of learning and innovation.

Table 3: Organisational types

	Individual	Organisation
Standardized work	Professional bureaucracy (embrained knowledge)	Machine Bureaucracy (encoded knowledge)
Non-standardized work	Operating Adhocracy (embodied knowledge)	J-form Organisation (embedded knowledge)

Professional bureaucracy and embrained knowledge

Professional bureaucracy (based upon individual and standardised knowledge) refers to a hierarchical complex organisation where individual experts are highly specialised and where they operate within narrowly defined fields of knowledge. Such organisations may be especially efficient when the environment is stable and the need for high degree of professional precision is necessary to avoid big negative risks. However, its learning focus tends to be narrow and constrained within the boundary of formal specialist knowledge. Tacit knowledge is circumscribed and contained; it plays a limited role in a professional bureaucracy. Professional bureaucracies are not innovative and they will get into serious crisis when faced with radical change in the environment.

Machine bureaucracy and encoded knowledge

Machine Bureaucracy (with a knowledge base that is collective and standardised) refers to an organisation where the dominating principles are specialisation, standardisation and control. This is an organisational form that is well suited for mass production in a stable environment. It may be said to be the ideal type of Fordist production where principles of Taylorist management are predominating. There is a clear dichotomy between the 'execution' and 'conception' of knowledge. The managers are the key agents responsible for translating individual knowledge into rules and procedures and for filtering information up and down the organisational hierarchy. A large part of tacit knowledge is naturally lost in the translation and aggregation process. It is a structure designed to deal with routine problems but is unable to cope with novelty or change.

'Operating Adhocracy' and 'Embodied Knowledge'

Operating Adhocracy (the knowledge base is individual and non-standardised) is a highly organic form of organisation with little standardisation of knowledge or work process. It relies not only on the formal knowledge of its members, but draws its capability from the diverse know-how and practical problem solving skills embodied in the individual experts. It has a strong capacity for generating tacit knowledge through experimentation and interactive problem solving. Organisations engaged in providing non-standard, creative and problem solving services directly to the clients, such as professional partnerships, software engineering firms and management consultancies, are typical examples. In these organisations, formal professional knowledge may play only a limited role; a large part of the problem solving activities has very little to do with the

application of narrow standardised expertise and more to do with the experience and capacity to adapt to new situations. Tacit knowledge is generated through interaction, trial-and-error and experimentation. It is a very flexible and innovative form of organisation. Its weakness has to do with the problems of reproducing what has been learnt into an organizational memory and with a high degree of vulnerability when it comes to individuals leaving the organisation.

J-form organisation and embedded knowledge

The J-form organisation (with a knowledge base that is collective and non-standardised) derives its capability from knowledge that is 'embedded' in its operating routines, team relationships and shared culture. Its archetypal features are best illustrated by some of the big knowledge-intensive Japanese firms (Nonaka and Takeuchi 1995; Aoki 1988). It combines the stability and efficiency of a bureaucracy with the flexibility and team dynamics of an adhocracy. One fundamental characteristic is that it allows an organic, non-hierarchical team structure to operate in parallel with its formal hierarchical managerial structure. Shared values and organisational culture form the environment where interaction across functions and divisions take place in a systematic manner. This is an adaptive and innovative form of organisation. It has a strong capacity to generate, diffuse and accumulate tacit knowledge continuously through 'learning-by-doing' and interaction. It is good at generating incremental and continuous innovation. However, learning in the J-form organization is also potentially conservative. Its stable social structure and shared knowledge base may block radical innovation.

Characterising national systems of competence building and innovation

The relative dominance of different knowledge types, and the ability of an organization to mobilise tacit knowledge as a source of learning are powerfully influenced by the wider societal and institutional factors. Here, we focus on education and training systems, and labour market organisations as key institutional features shaping the knowledge and learning pattern of firms. Our implicit argument is that these institutional aspects and patterns of learning within firms are inter-dependent and they constitute a sub-system within the wider national system. There is a process of mutual adaptation between knowledge types, organisations and institutions. Other national institutions such as the capital market also affect learning within firms but in a less direct way, and the process of mutual adaptation is less obvious.

Education and training systems: narrow 'professional-oriented' vs. broad 'competence-based'

On the education and training dimension, national systems can vary according to the relative importance they attach to different types of knowledge (e.g formal academic knowledge vs. practical skills), the level of formal professional control over the nature and content of high-level expertise, and the distribution of competence among the entire workforce. A narrow 'professional-oriented' system is characterised by the dominance of formal academic knowledge, a high degree of professional control over training programmes and an uneven two-tier distribution of competence: a well-developed higher education system for the professional elites while the majority of the workforce is poorly trained. Such a system gives rise to a narrow conception of

knowledge, and the expertise acquired tends to be highly specialized and distant from problem-solving practices. For example, the system in the UK and USA can be described as narrow 'professional-oriented'. It displays a strong bias towards academic education and attaches little social status and economic credibility to practical skills which acts as a disincentive for investment in this area. As a result, there is a widespread lack of formal intermediate skills and qualifications among the general workforce in these two countries (Buechtemann and Verdier 1998). Such a system creates a bias in the use of human capital and labour market polarisation. It is associated with a bureaucratic form of work organisation. The wide disparity in the educational backgrounds and skill levels between the different categories of the workforce generates knowledge discontinuities and social distance within firms. It reinforces the domination of formal knowledge over tacit skills.

In contrast, a broad 'competence-based' education and training system recognises the value of both academic education and vocational training. It is characterised by a widespread and rigorous general and vocational education for a wide spectrum of the workforce. Such a system is more conducive to a decentralised mode of work organisation. A more even distribution of competence among the workforce provides a better basis for interactive learning and the cultivation of tacit knowledge as a source of organisational capability. The cases of Germany, Japan and also Denmark are illustrative (Soskice 1997; Koike 1995; Kristensen 1996). The systems in these countries accord relatively high social status to ‘practical experience’, and recognise it as a source of competence and qualification. This encourages investment in vocational training which has resulted in a good supply of intermediate skills. This enables firms to organise work in a more cooperative and decentralised manner, conducive to the transmission and mobilisation of tacit knowledge.

Labour markets and careers: occupational vs. internal labour markets

Labour market institutions constitute another important dimension of national systems of competence building. They influence the knowledge base and learning capabilities of the firm in three main ways. First, these determine the extent to which expertise is developed outside or within the firm, and hence the relative importance of formal education and training institutions vis-a-vis employers in defining the knowledge base of the firm. Second, they determine career mobility and incentives for individual workers and the capability of the firm in acquiring and accumulating different types of knowledge. And third, they shape the individual’s career and social identity and define the boundaries of learning. A broad distinction can be drawn between systems where careers take place through job shifts in an occupational labour market (OLM) and where the typical career is connected to a firm-based internal labour market (ILM). The former implies a higher degree of market control over skills and competence criteria and hence a stronger tendency towards formalisation and codification of knowledge across firms. In contrast, the latter allows a greater degree of individual firm control over the definition of expertise, leading to a lower level of standardisation of expertise around formal knowledge.

Occupational labour market (OLM)

An occupational labour market (OLM) offers a relatively high scope for job mobility. Knowledge and learning are embedded in an inter-firm career. Formal education and training play a much greater role in generating directly relevant occupational competence. The type of qualifications generated can be highly task-specific based on standardised, advanced 'packaging' of knowledge and skills (e.g. craft-oriented training or professional education). Alternatively, it can be a broad-based general education that can be adapted and applied across a wide variety of work settings and tasks. The former approach assumes that the task environment is relatively stable and the knowledge required can be codified and pre-packaged in initial training programmes. The latter, in contrast, rests on the notion that the task environment is uncertain and the knowledge required is fluid and emergent. It cannot be easily bundled into occupations or codified in advance, and hence requires a broad-based initial qualification to enable individuals to pursue a more varied and flexible approach to continuous learning.

In an OLM, knowledge and skills are owned by and embodied in the individuals; they are personal property for career advancement. The transparency and transferability of the knowledge acquired is of paramount importance for inter-firm career mobility. Such career mobility relies on effective signals: dependable information about the type and quality of skills and knowledge that individuals have. This can be based either on public certification (institutional signals), or peer group recognition (information signals). The former approach works well provided that the knowledge and skills required can be easily identified and codified, i.e. bundled into specific occupations with a distinctive set of tasks or problems to which these skills and knowledge are applied . In situations where the tasks are highly fluid and unpredictable, and the knowledge used constitutes a large tacit component, institutional signals become insufficient and unreliable. This is because tacit skills cannot be easily codified; they can only be revealed through practice and work performance. Their transfer will have to rely heavily on social and professional networks based on shared industrial or occupational norms. In other words, the efficient transfer and accumulation of tacit knowledge in an OLM requires the support of a 'containing social structure', for example, the formation of a community-based OLM based on localised firm networks and industry clusters (Saxenian 1996). Social networks facilitate the 'marketability' of cumulative personal tacit skills.

Learning within an OLM tends to be person-centred and market-oriented. It is rooted in the individual's professional and career strategy, and characterised by a greater degree of autonomy and latitude in the boundary and domains of learning. This can potentially enlarge the knowledge base of the firm and stimulate radical innovation. Moreover, firms operating in an OLM are able to reconstitute their knowledge base through hiring and firing. This allows them to respond flexibly to shifting market requirements and technological changes.

Internal Labour Market (ILM)

Internal labour markets are characterised by long-term stable employment with a single employer and career progression through a series of interconnected jobs within a hierarchy. Knowledge and learning are embedded in an intra-firm career; a large part of the knowledge and work-related skills is generated through firm-specific on-the-job training (OJT). Formal knowledge acquired through education serves only as an entry qualification and provides the basis upon which work-related skills are built within the firm. The nature of the work organisation and careers determines the

quality and boundaries of learning through OJT. Where jobs are narrowly defined and careers are organised around hierarchies of jobs with tiered boundaries based on formal entry qualifications as in the case of a machine bureaucracy, OJT will tend to be narrow and job-specific. In contrast, an ILM can also be organised around broadly defined jobs and a continuous career hierarchy based on a common ranking system (e.g. the case of Japan). Progression to upper level positions is achieved, in this case, through accumulation of a wide range of skills and organizational experience. Formal knowledge plays only a limited role in defining competence criteria and entry to senior positions; the key emphasis is on the long-term accumulation of firm-specific skills and practical experience. OJT is broad-based and linked systemically with career progression. This increases the variety of experience and facilitates the generation of tacit knowledge. Job rotation also serves an important socialization function and helps to reduce social distance between different categories of the workforce. The close integration of OJT with career progression also gives individuals a strong incentive to accumulate knowledge through practical experience. The career hierarchy becomes a device for tacit knowledge creation and learning.

Learning within an ILM tends to be organisation-oriented and self-reinforcing. It evolves along the internal requirements of the firm, and is rooted in a firm-based career and organisational identity. The stability of personnel within an ILM facilitates the retention and accumulation of knowledge. Firms may display a strong capacity for incremental innovation and focus on developing a distinctive core competence.

Four contrasting societal models of competence building systems

The education and labour market dimensions are inextricably linked and there is an institutional logic defining their specific configurations. The interaction between these institutions give rise to four contrasting 'societal models' of competence building systems (see table 4). The term 'societal' requires some qualification. It is used in a broad sense to point out the effect of institutional environments on ways of organising knowledge and learning, rather than simply to emphasise national distinctiveness. The institutional environment may exist at the national, regional or sector levels.

Table 4: Societal models of competence building systems and their innovative potentials

	Occupational labour market (OLM)	Internal labour market (ILM)
Narrow 'professional - oriented' education and training	**Professional model** (professional bureaucracy, embrained knowledge) Narrow learning inhibits innovation	**Bureaucratic model** (machine bureaucracy, encoded knowledge) Slow learning, limited innovation
Broad 'competence-based' education and training	**Occupational community model** (operating adhocracy, embodied knowledge) Dynamical learning, radical innovation	**Organisational community model** (J-form organisation, embedded knowledge) Cumulative learning, incremental innovation

The *professional model* refers to an economy where the education and training is governed by professions and education institutions and where the typical career is one of moving between different employers. It is one where practical experience has a low status while codified and scientific knowledge is regarded as very important. Broad segments of the population have insufficient training. In this context there will be a predominance of hierarchical forms of organisations. Learning will be narrow and take place mainly among those who have already a strong formal education background. The professional model is most likely to be found in Anglo-American countries where the norms of 'professional specialisation' and 'elitism' remain deeply rooted.

The *bureaucratic model* is one where careers take place inside firms but where hierarchies are stable and connected with formal training and access to codified knowledge. It seeks to control and eliminate tacit knowledge and its capacity to innovate is very limited. The bureaucratic model prevails in economies or firms which seek to sustain competitive advantage through standardisation and price-based competition.

The *occupational community model* is one where there is high inter-firm mobility in the context of a region. Inter-firm mobility fosters social and professional networks. Education and training institutions may be well connected with professional networks and with firms in the region. Italian industrial districts and Silicon Valley are examples of this kind of model. This kind of context is highly flexible and promotes continuous innovation as well as radical innovation. The occupational community is an institutional prerequisite for fostering and sustaining the innovative capability of the 'operating adhocracy'. In a 'boundaryless' open labour market, the operating adhocracy will be under pressure to bureaucratise because of the difficulties in accumulating and transferring tacit knowledge. The tacit knowledge creating capability of the operating adhocracy can only be sustained if it operates as a member of localised firm network. Such networks of social relationships provide the 'social capital' and 'information signals' needed to ensure the efficient transfer of tacit knowledge in an inter-firm career framework (Saxenian 1996).

The *organisational community* model is characterised by a broad based egalitarian education system and with careers that take place inside the firm. Training takes place inside firms or in activities organised by the firm. This kind of context is well suited to promote permanent incremental innovation but it might be difficult to start up completely new activities in such an environment. It might be combined with financial systems that give priority to existing firms. Japan represents a typical example of this model.

Of course, what has been presented is a set of ideal types and in reality none of the categories are pure. The typology is a heuristic tool. It helps us to understand how institutionalised variation in learning and innovation may allow, or constrain firms to create different organisational forms and related innovation trajectories. It also suggests that there are alternative models for generating different types of innovation which may lead to societal comparative advantage in different industrial sectors.

LOOKING FOR GOOD PRACTICES OF LEARNING ORGANIZATIONS: ALTERNATIVE SOCIETAL MODELS

One fundamental characteristic of the learning economy is the rapid pace of change and acceleration of knowledge creation. Although the use of information technology enhances the incentives and possibility to codify knowledge, the rapid pace of knowledge advancement has also created immense barriers to codification. The limit of codification is especially obvious in skills and knowledge transmission in labour markets.

In the high-skills sector, knowledge is now moving too rapidly to be encoded and institutionalised into a stable set of occupations. Traditional institutional signals, for example, occupational qualifications have severe limits in providing dependable information about the quality and contents of skills (Lam 2000b). Codification is indeed too slow a process for the transmission of rapidly evolving knowledge. The high rate of change and growing complexity of knowledge required for innovation has reinforced the importance of tacit knowledge and collective learning in the knowledge economy.

The above analysis suggests that both the 'organisational' and 'occupational community' models are favourable to the creation and transmission of tacit knowledge. However, the different labour market structures generate some significant contrasts in their learning and innovation patterns. The occupational community model operates within a more open and fluid labour market which permits extensive hiring and firing, risk taking and the development of human resources in a 'competency destroying' environment. In other words, it facilitates the diffusion of tacit knowledge within a broader boundary and varied contexts. It encourages experimentation and entrepreneurial behaviour and has the potential to achieve radical innovation.

In contrast, the 'organisational community' model derives its competitive strength from the cultivation of firm-specific core competence. It allows the accumulation of tacit knowledge within the boundary of the firm, and the continuous combination and recombination of firm-specific product and process technology with industry technology. Firms within the organisational community may develop a strong orientation to pursuing an incremental innovation strategy and do well in established technological fields. The strong emphasis on 'competence preservation' within organisations, however, inhibits the creation of active labour markets, and thus makes it difficult for firms to renew their knowledge base and compete successfully in rapidly developing new fields.

The sections that follow examine three concrete examples to illustrate the theoretical argument developed in this paper. The divergent innovation trajectories pursued by Japanese and US firms in the high-technology sectors give the most vivid illustration of the contrasts between the 'organisational' and 'occupational' community model of learning and innovation. The example of Denmark provides another interesting example of an innovation system with characteristics of the occupational community model that differs from the high-technology clusters discussed in the context of the Anglo-Saxon economies.

The Japanese 'organisational community model'

The Japanese competence building and innovation system exhibits some of the most quintessential features of the organisational community model. The economy is characterised by a high level of cooperation and organisational integration (Lazonick and West 1998). This occurs through extensive long-term collaboration between firms in business groups and networks. Additionally, integration within large firms is particularly strong. Japanese social institutions and employment practices foster the close involvement of shop-floor workers in the development of organisational capability.

The successful state education system and large company driven networks equip the majority of workers with a high level of skills that employers respect and so can rely on them to contribute usefully to innovation activities. The internal labour market system is characterised not only by long-term attachment but also by well-organised training and job rotation schemes. These practices promote continuous skills formation through learning-by-doing and systematic career progression. Hence, a strong organisational capacity to accumulate knowledge and learn incrementally. Moreover, the approach to engineering skills formation fosters strong cross-functional teams and extensive human networks in product development (Lam 1996; 1997).

Japan has historically placed a high value on the importance of developing the practical skills of their engineers in the workplace. This is due, in part, to the fact that industrial development in Japan was historically based on imported technology, and Japanese engineers have played an important role in translating theoretical knowledge into concrete operational details for shop-floor workers (Morikawa 1991). Japanese firms have always placed a strong emphasis on developing the on-site practical knowledge of their graduate engineers in order to facilitate knowledge transfer. Formal university education is less important than practical learning in the workplace. The university degree in Japan is far more general and broad-based than that in the US or Britain. Young graduate engineers normally spend their initial years in a wide range of peripheral technical tasks and gradually accumulate their knowledge and expertise through assignment to a wider range of more complex tasks. The type of knowledge transmitted tends to be judgemental, informal and tacit.

Over the past three decades, Japanese firms have gained international competitive advantage in those industries such as transport equipment, office machines, consumer electronics, electronic components for computing equipment and telecommunication hardware. The strength of Japan in these sectors stems from the capability of firms to develop highly flexible production systems through the close integration of shop-floor skills and experience, the tight linkages between R&D, production and marketing, and a unique innovation strategy based on continual modification and upgrading of existing components and products (Womack et al 1991). The Japanese organisational community approach to learning has enabled firms to thrive in 'flexible mass production' characterised by constant variation and improvement of basically standardised products. The capacity of the organisation to create new knowledge through synthesis and combination of the existing knowledge has enabled firms to gain competitive advantage in relatively 'mature' technological fields characterised by rich possibilities of combinations and incremental improvements of existing components and products.

Conversely, organisation-specific and path-dependent learning have constrained Japan's success in a number of leading-edge technological fields. Japan finds it harder to excel in sectors which do not exclusively rely on incremental upgrading of system components (e.g. aerospace; supercomputers) and those in which fast-paced radical innovation are crucial for success (e.g. pharmaceuticals and biotechnology). The human-network-based interaction and internal tacit knowledge transfer appear to be less effective in coordinating systems involving complex interactions among components. The insular nature of the Japanese human resource development system, and the absence of an active labour market for experienced scientific and managerial staff have constrained the boundary of explorative learning of firms. They also reduce the incentives for firms and individuals to engage in risky new projects. The organisational community model of learning limits the development of highly specialised scientific expertise, and makes it difficult to adopt radically new skills and knowledge needed for radical learning. The disappointing performance of Japanese firms in such fields as software and biotechnology during the 1990s may constitute evidence of the difficulties faced by Japanese firms in entering and innovating in rapidly developing new technological fields.

'Occupational community models': high-technology clusters in the US and UK

While the dominant institutions of the Anglo-Saxon economies have less capacity to foster the organisation-oriented type of collective learning observed in Japanese firms, they have the potential to accommodate a more market-based and individually-driven form of collective learning and to compete successfully in the highest-skill sectors. Some of the world's most innovative and prosperous high-technology clusters can be found in the USA and also in the UK. California's Silicon Valley and the high-technology clusters surrounding Cambridge in the UK are two of the most famous success stories. These high-technology clusters provide good examples that illustrate the processes of knowledge creation and dynamics of innovation underpinning the occupational community model of competence building. They also highlight the importance for the 'adhocracy' of supportive local labour markets and other external institutions typically included in analyses of national, sectoral and regional innovation systems.

Silicon Valley has been an enormously successful and dynamic region characterised by rapid innovation and commercialisation in the fast growing technological fields. The core industries of the region include microelectronics, semiconductors, computer networking, both hardware and software, and more recently biotechnology. Firms operating in these industries undergo frequent reconfiguration and realignment in order to survive in a constantly changing environment marked by incessant innovation. The availability of a large pool of professional experts with known reputations in particular fields enables firms to quickly reconstitute their knowledge and skill base in the course of their innovative endeavours. The rapid creation of new start-up firms focusing on novel innovative projects, and the ease with which project-based firms are able to assemble and reassemble their teams of highly-skilled scientists and engineers to engage in new innovative activities are central to the technological and organisational dynamism of the region. The high rate of labour mobility and extensive hiring and firing creates a permissive environment for entrepreneurial start-ups and flexible reconfiguration of project teams and knowledge sources (Saxenian 1996; Bahrami and Evans 2000; Angels 2000). Labour mobility within the context of a region plays a critical role in the generation of professional networks and facilities the rapid transmission of evolving new knowledge, a large part of which may be tacit. Such a regionally based occupational labour market provides a stable social context and shared industrial culture needed to ensure the efficient transfer of tacit knowledge in an inter-firm career framework. The shared context and industry-specific values within the regional community ensure that tacit knowledge will not be wasted when one changes employers, and this gives the individual a positive incentive to engage in tacit 'know-how' learning (DeFillipi and Arthur 1996). A regionally-based labour market and networks of firms create a stable social structure to sustain collective learning and knowledge creation within and across firm boundaries. The creation of a wider social learning system amplifies the learning and innovative capability of the individual firms locating within the system.

The 'Cambridge phenomenon' (Segal Quince Wicksteed 2000) - a clustering of small, but successful high-technology firms around Cambridge University in the UK - has been likened to Silicon Valley. Many of the new companies in the area started as university spin-offs by Cambridge graduates and academic staff. The process has been continuing since the 1960s and has led to the area being dubbed as 'Silicon Fen'. Similar to Silicon Valley, the success of the Cambridge cluster has been helped by having a world class research university, a highly networked community, a dynamic

labour market and an entrepreneurial business culture. The area is marked by the existence of a dynamic high-tech labour market which has grown rapidly and become spatially more extensive over the years. The success of the high-tech cluster has continued to work as a 'pull' factor attracting many qualified scientists and engineers from outside to work in the area. The workforce in the area is highly skilled and is dominated by qualified scientists and engineers. The technology consultancies have played an especially important role in attracting experienced consultants and researchers from outside the area. The inflow and mobility of people have contributed to the diversity of the workforce and dynamism of the region.

Empirical studies also suggest that there is an active process of inter-firm mobility in the region, involving the movement of entrepreneurs, consultants and researchers (Lawson et al 1997; Segal Quince Wicksteed 2000). This takes place primarily between consultancy and clients, and between a consultancy and its spin-outs. Labour mobility and the personal and professional networks formed as a result of shared experiences in the region are important factors contributing to knowledge transfer and a growing capacity of the region for technological innovation.

It is clear from these accounts that what underlies the innovative capability of the world's most dynamic technological regions is the processes of knowledge creation and collective learning sustained by a community-based social and professional network. Labour mobility plays a critical role in the generation of these networks and facilitates the transmission of rapidly evolving knowledge, a large part of which may be tacit. There is a strong link between tacit knowledge and regional competitive advantage (Lawson and Lorenz 1999). The analysis also suggests that the processes of developing the capabilities of the individuals and organisational knowledge in the most dynamic technological sectors may be best served by an open labour market rooted in an occupational community.

Finegold (1999) argues that in the turbulent, high-skill environments, the responsibility for skills formation and career development shifted from the firm to the individual and regional cluster itself. This is because for the engineers and scientists, who are the key drivers of knowledge creation in the region, company-based formal training is often not the main vehicle for learning. Instead, these people enter the labour market with a high level specialised qualification. They then continue to learn through project-based work and solving cutting-edge technical problems. Their wider personal and professional networks are another important source of learning. Inter-firm career mobility promotes learning and knowledge transfer. The willingness of the individuals to change firms, on which the collective learning process depends, is made possible by the guarantee of job opportunities elsewhere within the region.

Denmark as another example of an 'occupational community model'

Denmark represents another example of a national innovation and competence building system that displays many of the characteristic features of the occupational community model. And yet, the country has developed a pattern of industrial specialisation that deviates sharply from that of the high-tech large economies. Denmark is one of the smallest OECD countries with a population of just over five million. It has one of the highest levels of GDP per capita in the world. The country is especially successful in the production and export of low- or medium-technology goods.

The main industries include meat, fish, diary products, wooden furniture and related machinery. Maskell et al (1998) argue that the economic success of Denmark, and also of other Nordic countries, demonstrates the possibilities for economies to generate a high level of prosperity while retaining a low-tech industrial specialisation. The main reason behind the competitive advantage of these small countries, according to the authors, lies in the capabilities of the social institutions to promote shared trust and interactive learning resulting in a set of 'localised capabilities' which are tacit and difficult to imitate for outsiders. But it is also important to note that the social and institutional context favours a rapid and wide diffusion of advance process technologies in the so-called low tech-sectors.

Denmark is characterised as a 'village economy' with a strong tradition for consensus-building deeply rooted in egalitarian values (Maskell et al 1998). It is one of the most equitable societies in the world and rich in social capital. The business community has developed strong social networks and trade associations enabling intense interaction and information sharing between manufacturers and suppliers. Many Danish firms have also adopted a flexible form of organisation with a strong emphasis on cross-functional collaboration. Denmark has a well-developed state-funded vocational system resulting in a good supply of skilled workers. The flexible work system is highly dependent on the competence and contribution of these workers. These institutional features have enabled many small Danish manufacturers to develop a superior ability to create and accumulate knowledge internally and between firms through 'learning-by-doing' and 'learning-by-interacting'. The success of the Danish furniture industry is a case in point (Maskell et al 1998).

Danish firms are responsive to changes and have been able to combine technological changes with organisational innovation. Such responsive capacity is facilitated by an active labour market. It is suggested that inter-firm labour mobility in Denmark is as high, or possibly even higher than in the US but by a more limited geographical spread (Lundvall and Christensen 1999). The willingness of Danish workers to change jobs is buffered by a good social security net which reduces the costs and risks of job changes. Such social protection also contributes to the positive attitudes among the workers and trade unions to technical and organisational changes. In addition, Denmark has developed an extensive and highly regarded public system for continuous training for adults. All these institutional factors have made it possible to combine a fluid and open labour market with a high level of trust and cooperation which promote the development of learning organisations.

Although Denmark is especially successful in the relatively low- and medium-technology sectors, it also has some successful niche products in the high-technology sectors such as mobile telecommunications and also in pharmaceuticals. However, the dominant strategy has been to absorb and use technologies from abroad and the approach to innovation is incremental. This can be partly attributed to the fact that Denmark does not have a strong science base and the interaction between the private sector and universities is not well developed. Moreover, the majority of the academically trained workforce has historically opted for employment in the public sector. On the whole, the Danish system of innovation and competence building is geared towards competence-intensive low- and medium-tech sectors. It is less well developed for the large-scale science-based industries.

The Danish 'occupational community model' of competence building generates a learning pattern that is more similar to that found in Japan rather than in the high-technology clusters in the US or UK. The strong ability of Danish firms to learn collectively is rooted in the shared culture and 'village like' institutions of a small country. Such pre-existing social solidarity has shaped the formal social and economic institutions leading to a high level of cooperation and trust in the society as a whole. The whole country can be considered as a region like the industrial districts in the larger economies.

However, an important characteristic feature of 'village-like' institutions is the exclusion of outsiders, as in the case of the corporate community in Japan. The Danish labour market is not open to immigrant workers. This is in stark contrast to the high technology community in Silicon Valley which builds on an extremely open and diverse labour market with a truly international character. Cohen and Fields (1999: 126) describe the foreign workforce as 'a vital transmission belt, diffusing technology and market knowledge, sometimes establishing offshore facilities that seed new districts and serve as connectors into the Valley'. The Silicon Valley labour market is local but borderless. This, arguably, is one of the region's most valuable assets and the main source of dynamism. In contrast, the localised learning capability of Danish firms is embedded in a truly local labour market with less scope for radical renewal.

CONCLUSIONS

This paper is based on a hypothesis that we have entered a specific phase of economic development (which we refer to as 'the learning economy') where knowledge and learning have become more important than in any earlier historical period. In the learning economy, individuals, firms and even national economies will create wealth and get access to wealth in proportion to their capability to learn. This will be true regardless of their present level of development and competence. We will propose an even more far-reaching hypothesis stating that there is no alternative way to become permanently better off besides the one putting learning and knowledge-creation at the center of the strategy.

We have seen how different national systems have different pre-conditions when it comes to cope with the learning economy. The learning capability of Japanese firms is rooted in strong organisational integration and employee commitment based on stable employment relationships. Social capital is built on long-term obligational relationships within and between firms. In Denmark, the networked learning organisations are supported by a strong sense of communal trust and social solidarity that has become institutionalised in formal mechanisms for collective decision-making. In the Anglo-American economies characterised by liberal market institutions and professional individualism, the creation of regional clusters appears to be critical for promoting collective learning rooted in professional and inter-firm innovation networks.

There is a variety of approaches to promoting learning and innovation. Societies with different institutional arrangements develop different types of learning organisations and innovative competencies that appear to generate and reproduce distinctive regional or national patterns of technological specialisation. The Japanese

'organisational community' model continues to orient major Japanese firms towards adopting high-quality incremental innovation strategies and sustaining competitiveness in mature technological fields. Japan may find it difficult to develop a 'societal strategic advantage' (Biggart and Orru 1997) in areas characterised by rapid and disruptive changes. The R&D globalisation strategies adopted by Japanese firms in the science-based sectors appear to have limited effect in altering the established learning patterns and innovative trajectories (Lam 2003).

In contrast to Japan, the Anglo-Saxon 'occupational community' model can better accommodate a science-driven, entrepreneurial approach to innovation and perform well in sectors in which radical learning is important. A major underlying structural weakness of this model, however, is the marked segmentation between professional and production workers, and the bias of the competence building system in favour of the interests of high-technology firms (Angles 2000). Denmark, on the other hand, has developed a specialisation pattern in low- and medium-technology sectors with a focus on an incremental innovation strategy. The Danish case also suggests that an innovation-driven redeployment of competencies can be organised more collectively by public agency action and an emphasis on workforce vocational training and lifelong learning. The so-called 'new economy' configuration as observed in Silicon Valley based upon de-regulated labour markets and excellence in scientific personnel is not necessarily the benchmark for fostering innovation and economic growth.

It is also important to emphasize that learning is an activity going on in all parts of the economy, including so-called low-tech and traditional sectors. As a matter of fact, learning taking place in traditional and low-tech sectors may be more important for economic development than learning taking place in a small number of insulated high-tech firms. The learning potential (technological opportunities) may differ between sectors and technologies but in most broadly defined sectors there will be niches where the potential for learning is high. This is important in a period where knowledge policy tends to be equated with science policy and with support to science-based firms.

Finally, it should be noted that all kinds of labor have skills and a capability to learn, including what misleadingly is called 'unskilled workers'. These specifications are made in order to avoid that the learning economy-hypothesis leads to a neglect of the developmental potential of parts of the economy less intensive in their use of formally acquired knowledge.

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