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From user–producer relations to the learning economy

Björn Johnson

This paper deals with three issues. First, the conceptual and theoretical development in Lundvall's writing from user–producer relations to the learning economy is discussed with a focus on his main contributions to innovation theory. Second, Lundvall's description of the learning economy is extended in that it is argued that it is driven by its *internal contradictions*, and by the *institutional responses* to these contradictions. This approach is not in conflict with Lundvall's views, but he has not pursued it and it may give new insights into the dynamics of the learning economy. Finally the learning economy is placed as a central concept in the quest for a general theory of innovation, which for many years has characterized Lundvall's writings.

IN THE FIRST HALF OF THE 1970s the international economy was hit by a crisis. It ended a long period of unprecedented economic growth and high levels of employment in large parts of the industrialized world. The crisis lasted well into the 1980s and was characterized by widespread balance-of-payments disequilibria, low growth rates and high rates of unemployment and inflation. This particular combination of macroeconomic problems puzzled mainstream economists. The inability to convincingly explain the crisis and show a way out of it provoked considerable reactions in economic theory.

For example, it became evident that to understand international competition and the differences in economic performance between countries it was necessary to draw technological innovation into the picture. On the macroeconomic level, mainstream growth theory was reformulated to include technical change as an endogenous phenomenon. On a less aggregated level, the relations between structural and technical change were increasingly taken on board to explain competitiveness and growth. Schumpeter was rediscovered and interest for innovation theory surged.

To analyze technical innovation as one of the main factors determining the international competitiveness of a country, Lundvall (1985, 1988) introduced the notion of 'user–producer relationships'. This was a reaction to the tendency among politicians as well as economists in some countries, including Denmark,[1] to blame deteriorating international competitiveness on excessive wage increases. The crude form of this argument concentrated on nominal wages and tended to disregard productivity growth. For many economists this made it obvious that technical change had to be taken more seriously in the discussion.

The notion of a user–producer relationship also meant a move away from the idea of a marketplace with rational actors connected by anonymous, arm's-length relations interacting only with price- and quantity-signals. In such a model it is difficult to fit in innovations. Since innovations are known to be ubiquitous in the real world, this pointed to a need to develop theories which focus on this. The user–producer relationship represented a move towards the notion of an 'organized market' in which durable and multi-sided relationships support interactive learning and innovation. It became a building block in the development of the broad, 'Aalborg version' of the concepts of 'national systems of innovation' and the 'learning economy'.

This paper deals with three issues. First, the conceptual and theoretical development in Lundvall's writing from user–producer relations to the learning economy is discussed with a focus on his main contributions to innovation theory. Second, Lundvall's description of the learning economy is extended in

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that it is argued that the learning economy is driven by its *internal contradictions*, and by the *institutional responses* to these contradictions. This approach is not in conflict with Lundvall's views, but he has not pursued it very much and it may give new insights into the dynamics of the learning economy. Finally, briefly, the learning economy is situated as a central concept in the quest for a general theory of innovation, which for many years has characterized Lundvall's writings.

2. The user–producer relationship

Lundvall (1985, 1988) observed that, in a 'pure market economy' (i.e. with rational, anonymous actors at arm's-length distance from each other and with perfect information and perfect competition), product innovation would be rare and difficult to explain. If users and producers of products didn't communicate in other ways than by sending price signals to each other, it would be difficult for producers to discover new user needs, and it would be difficult for users to get qualitative information about new products.[2]

The recognition of the need for users and producers to communicate about product innovation led to the idea of the organized market. If users and producers don't integrate vertically to solve the innovation problem, as might be predicted from a transaction costs perspective, they need to find other channels for durable and selective communication, interaction and cooperation. Over time different institutions that support this emerge. The market becomes 'organized'. This is an important part of the explanation of why some economies become more innovative than others; their markets are organized in different ways. It represents a shift in perspective on the market from transaction costs to learning benefits, that is, to a more dynamic perspective.

In Lundvall's writings the organized market became a significant methodological statement with connections to evolutionary economics. In evolutionary theory it is decisive to focus on the diversity of elements in a population (e.g. a population of firms, which are differently organized and connected in different ways) rather than on ideal, pure types of elements and relations. Furthermore, it is important to recognize the evolutionary value of flaws and deviations from the normal. This is different from the traditional method in economics to define a standard household or firm, assume some basic institutional rules like private property rights, utility and profit maximization, etc. and deduce market results from this. Such 'essentialism', in which you abstract from diversity and the context-dependence of economic categories, is common in social science. It can be tracked back to Plato and, according to Dawkins (2009), it is about as methodologically far from evolutionary theory as one can get.

The user–producer relationship is only one of several relationships which affect innovation in a modern economy.[3] But it is a central part of the micro-foundations of innovation theory since it is a cornerstone in the concept of the organized market, which in turn is a basic part of the notions of national systems of innovation and the learning economy.

3. Ubiquitous, interactive innovation and national systems of innovation

If a country does not want to compete internationally by low wages it has to be innovative. It needs to be able to introduce, diffuse and utilize new knowledge at least as fast and efficiently as its main competitors. For a small country with an open economy and limited research capacities this primarily means that it has to be able to absorb, adapt and develop knowledge, which comes from other countries. It seems obvious that the main focus should not necessarily be on radical, science-based innovation in high-technology areas. It might be fruitful to take experience-based, incremental innovation in low- and medium-technology areas on board as well.

Especially in a country like Denmark, which does not have much science-based production and only few big firms but, still, enjoys relatively high income, it is important to have a broad innovation concept. Good economic performance in a period of increasing international competition might be rooted in steady, broadly based, incremental innovation. This became a working hypothesis in the research on innovation in Aalborg. Innovation was no longer seen as isolated rare acts of creativity unaffected by the routines of everyday production. Instead they became parts of the normal economic activity. They were less dramatic than science-based or radical innovations, but just as decisive for economic well-being in the long run. The concepts of user–producer relations and organized markets were constructed to analyze ubiquitous and interactive innovation. They co-evolved with the formulation of a central research question: *Which traits of the organized market form the relationships and interactions that feed different kinds of innovation?*

During efforts to understand a Danish 'productivity mystery'[4] it became clear that the organization of the

market had to be complemented with the organization of the firm in order to understand the contribution of technical innovation to economic growth. Investments in new information technologies didn't increase productivity (rather the contrary, it seemed) until firms learnt how to use them by adapting their organization.

The perspective of ongoing innovation in every part of the economy, rooted in different kinds of 'learning relationships' between users and producers, between people with different type of competences, between different departments in the firms, and so on, invoked a vision of ongoing processes of *interactive learning* in the economy. It became more and more clear that learning was a crucially important process in a competitive economy and that learning is always is some sense interactive.

The notion of a 'national system of innovation' became a way to get hold of and keep together the ideas of ubiquitous, interactive innovation affecting the international competitiveness of high-income countries. It was used in two complementary ways. First, it is a practical tool for both researchers and policy-makers. It helps them to form a systematic overview and description of the actors and processes of innovation and the means and ends of innovation policy at the country level. Lundvall's conceptualization of national systems of innovation was broad in order to cover many types of innovation and avoid the S&T bias of especially the US-based innovation research.

> The broad definition … includes all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring. (Lundvall, 1992)

Second, the national system of innovation may also be used as a heuristic concept and focusing device. In this case it is situated within a specific (evolutionary) theoretical approach used to study modern market economies, with a shift of attention away from resource allocation towards resource creation through learning and innovation. This draws attention to the existence of different types of knowledge, experience-based as well as science-based, and the different forms of learning, which creates and implements them.

Used in this way, both as a practical tool and as a focusing device, the (national) systems of innovation has proved to be a remarkably useful notion. It has been helpful both for understanding economic growth and for the more normative endeavor to formulate innovation policies without becoming a victim of an S&T bias. The broad usefulness of the concept is illustrated by the fact that, even if it was first only intended to be used in the context of the North, it is now increasingly applied to the South as well. Building and supporting innovation systems is increasingly discussed as important elements of development strategies in many countries.[5]

Living in the learning economy we should study different types of knowledge and how different kinds of learning combine to shape the capabilities and competences which determine our wealth individually as well as socially

Furthermore, it has served as an instrument for developing ideas about the 'learning economy' — a concept for pinpointing the fundamental processes of change in the development of capitalism today. It underlines the need to give stronger emphasis to the analysis of learning capabilities at all levels of society.

4. The learning economy: a phase in capitalist development

The notion of a learning economy (like the notion of a system of innovation) has at least two different but related meanings. On the one hand it is a heuristic device, which implies a focus on the roles of learning and knowledge in the modern economy. Living in the learning economy we should study the character and role of different types of knowledge and how different kinds of learning (consumer learning, technical learning, organizational learning, institutional learning, policy learning) combine to shape the capabilities and competences which determine our wealth individually as well as socially. On the other hand the learning economy also denotes the latest phase in the development of capitalism. The economy is described as relentlessly changing and the driving forces behind this are different kinds of learning and innovation.

In the following we concentrate on the learning economy as the latest phase of capitalist development and discuss some of its central drivers of change. Scholars studying literature, architecture, music and other arts have often found it natural to divide the development of their subjects into periods with distinctively different characteristics. Economists do not usually do that and the notion of 'phases of capitalist development' has never been important in the mainstream of economic theory. There are, however, theories in the border areas of the discipline of economics in which regions in both space and time are important. Economic history, evolutionary economics, institutional economics, regional economics and economic geography are obvious examples. Terms like pre-industrial, industrial and post-industrial capitalism, the first, the second

and the third industrial revolution (Bruland and Mowery, 2005), long waves or Kondratieff cycles (Kondratieff, 1926), long swings in growth rates (Kuznets, 1971) and techno-economic paradigms (Freeman, 1992) have been used to identify periods with different structural characteristics and different modes of development.

The present phase of capitalist development has been given different names, but it has become more and more common to focus on an alleged increasing importance in the economy of information, knowledge, competence, etc. and terms like the 'information economy' and the 'knowledge (-based) economy' dominate the discourse. Knowledge is regarded as the most important resource and the basic development factor. This idea is not new. Marx (1859) made the development of the forces of production the main source of social and economic change, and Marshall (1890) stated that:

> knowledge is the most powerful engine of production; it enables us to subdue nature and satisfy our wants.

In a way it is trivial to say that we live in a knowledge economy today since we have always done that. The stone-age economy was also knowledge-based. It evidently required enormous amounts of mainly experience-based and tacit knowledge to survive in a harsh environment without the help of advanced tools. But it is less trivial to say that we live in a learning economy. Every economy is a knowledge economy but every economy is not a learning economy. In the present phase of capitalist development, the success of individuals, firms, regions and economies reflects the capacity to learn. The learning economy is an economy where change is fast and where old abilities become obsolete and new abilities come into demand at a high rate (Lundvall and Johnson, 1994; Lundvall, 2002).

To characterize the present phase of capitalist development as a learning economy doesn't imply that learning was not important also in earlier phases. In fact scholars have described learning as a deeply ingrained human need. Veblen (1918) thought that human beings are endowed by nature with instincts and propensities. There are, for example, the instincts of 'workmanship' and 'idle curiosity', which compel individuals to be industrious and creative and strive for improvements. These instincts place learning at the centre of economic evolution.

According to Scitovsky (1976) both the need for comfort (shelter, food and other basics) and the need for stimulation (closely related to learning and including experiencing new things, situations, processes, ideas, competencies, etc.) are based in our genes. Economic growth will lead to an increase in the relative importance of stimulation as compared to comfort, because it is much easier to saturate the need for comfort than the need for stimulation. In fact, the human need for stimulation seems to be unlimited. To reallocate resources towards stimulation, which requires learning, is an integrated part of development.

Even if individual learning may be to some extent genetically based, the main argument is that in the learning economy the incentives and possibilities of learning are determined by economic, social and political relationships. Learning is anchored in the institutions and structures of society. The combination of information and communication technology (ICT) and knowledge management and the use of innovation as a main instrument of competition implies that societies are 'learning to learn', accelerating the speed of technological and economic change. Society has, to quote Dawkins (2009), 'evolved its evolvability'.

The development of the institutions of the learning economy has taken a long time. An important enabling background factor was the consolidation of an international economy consisting of independent nation-states in economic and political competition with each other during the 18th and 19th centuries. A growing social and political acceptance of change and the development of morally and socially restricted economic greed as a basic value in society may also be mentioned in this context. The birth of the technical university and the in-house R&D department were without doubt very important, and so was an increasing government responsibility for the knowledge infrastructure. Other major 'institutional events' were: the reinvention of cross-disciplinary science; the development of new forms of learning, for instance problem-based learning in higher education; and learning to combine different (e.g. experience- and science-based) modes of innovation in firms. A gradual discovering of the importance of people with open minds and national borders open for goods, people and ideas may also been regarded as crucial institutional changes in the evolution of the learning economy.

5. Contradictions in the learning economy

The notion of knowledge as the most important resource is much less loaded with conflict than the traditional notions of capital and labor as basic factors of production. The term 'the learning economy' seems to imply social harmony with no resistance to increasing use of knowledge. But knowledge is a contradictory entity and learning is often marked by conflict. Contradictions, conflicts, tensions, and unfulfilled possibilities in the economy provoke change. This is a neglected aspect of learning- and innovation-driven economic growth and development.

It is a classic analytical method to start with contradictions and conflicts in the economy to analyze growth and development. Marx regarded the contradiction between development of the 'forces of production' (i.e. technological change in a broad sense) on the one hand, and the capitalist 'relations of production' (i.e. the institutional set-up) on the other

hand, and the conflict about the distribution of income between profits and wages as basic structural characteristics of the capitalist society. The reactions of capitalists, workers and the state to these conflicts explained the development of capitalism.

The notion of successive techno-economic paradigms developed by Freeman and Perez is a modern example of the idea of contradictions between technical and institutional change.[6] Also within the equilibrium framework of mainstream economics it is sometimes observed that tensions provokes technical change. For example, Erik Lundberg (1961) invoked the picture of 'productive out of equilibrium positions' in his analysis of productivity growth.

The learning economy can be characterized by its contradictions and its conflicts. In the following some of these will be described. This apposes describing the learning economy in harmonious terms. Competing by learning and innovation change the built-in conflicts of society.

5. 1 Inherent contradictions of knowledge

Knowledge is in itself contradictory. Some of its contradictions are related to incomplete tendencies to transform knowledge into commodities. Firms want to have free access to new knowledge created in other parts of the economy but at the same time they want to be able to charge for the knowledge they create themselves. This leads to an accelerating process of 'commodification' through the creation of intellectual property rights. It also produces contradictions. To a large extent knowledge is socially produced in networks and, since buying and selling knowledge may introduce rivalry and concealment, transforming knowledge into commodities may damage these networks. In addition to this, to patent an idea is not only costly, but also provokes objections from persons and organizations, which are excluded from utilizing what was earlier free. Knowledge is not an ordinary but rather a 'fictitious commodity', embedded in social relations (Polanyi, 1944).

Some types of knowledge have public goods characteristics and are difficult to transform into private goods. It may be expensive to produce new knowledge but once it exists the marginal costs of using it are often quite low. Knowledge can be used over and over again without being diminished and sometimes it may even grow as a result of learning by doing. Furthermore, from the point of view of society as a whole, it may not be a good idea to privatize a public good. Every time a good is not used, because the requested payment is bigger than the marginal cost of supplying it, there is an unsolved efficiency problem.

5.2 Learning and forgetting and the distribution of wealth and power

New knowledge may be incompatible with and sometimes destroy old knowledge. The different theories about the 'basic elements' — earth, water, air and fire — could not survive scientific advances in chemistry. Theories about spontaneous generation of life were crushed by 'germ theories'. Many skills related to arts and handicrafts have been destroyed by industrial manufacturing. Transfer of modern knowledge from the North crowds out systems of indigenous knowledge in the South. The examples are so frequent that every idea about generally additive knowledge should raise suspicion.

When new knowledge and competences are introduced into the economy, the specialization pattern changes. As a consequence the structure of employment and the distribution of income and wealth also change. Knowledge and power are interrelated and when firms reorganize to take advantage of new technical possibilities it affects the distribution of power and income. Structural changes create conflicts between different groups of people. In the learning economy, firms are actively managing knowledge. They buy, recruit, produce, recombine and adapt knowledge. The benefits and costs of these types of change are likely to be unevenly distributed. Interactive learning is a game with winners as well as losers, which changes the structure of conflicts in society.

Since learning is fundamentally interactive, it requires a degree of social cohesion and trust to thrive (Lundvall, 2002). If conflicts about the distribution of income and power and about access to information and knowledge become too uncompromising, trust between people decreases, social cohesion is reduced and learning is hampered. This may turn out to be a main contradiction in the learning economy.

5.3 Knowledge fragmentation

Increasing diversification of knowledge in the learning economy sustains interactive learning, but also leads to fragmentation of knowledge, which destroys learning possibilities. Specialists tend to prefer communicating with close colleagues, rather than with specialists from other fields. Even within such a narrow scientific area as economics, there is limited communication between, for example, theoretical macroeconomists, institutional economists and industrial economists. ICT has made more specialized knowledge communities possible and speeded up communication within these communities. Communication between the communities, however, becomes increasingly difficult. Interactive learning and innovation presupposes that people with different types of knowledge and competence can and do communicate with each other. A very fragmented knowledge base may block many potential paths of learning.

Furthermore, rapid changes in hardware and software can destroy electronically stored information. It is inevitable that the learning economy is challenged by massive losses of knowledge. As with the 'angry

orphans' described by David (1986), some of this loss is quite unwanted.[7]

5.4 Fast finance versus slow knowledge

The escalating importance of international financial capital and institutional investors has led to an increasing importance of short-term rather than long-term decisions. The process of decision-making behind capital movements accelerates and leads to a specific form of the basic contradiction between technical change and capitalist control.

The learning economy speeds up technical change. Still, since learning is interactive and knowledge socially produced, there are limits to how much the rate of change can be increased. There is a contradiction between fast, short-term, speculative movements of financial capital, on the one hand, and the need for long-term planning and conduct of learning and innovation in the context of knowledge-based competition, on the other. Different kinds of Internet taxes (bit taxes, bandwidth taxes, email taxes, etc.) have been proposed to address this, but this has not affected the situation very much.

5.5 Indigenous and foreign knowledge

The contradiction between the power of international financial capital and the requirements of learning-based competition illustrates the globalizing character of the learning economy. Contradictions between different knowledge systems in different countries are parts of this development.

This is accentuated in the case of indigenous knowledge vs. foreign knowledge in developing countries. Most development strategies in the South involve knowledge-sharing and knowledge transfer from the North. A relatively neglected question in this context is to what extent it is possible to combine indigenous and foreign knowledge. In many developing countries there are rich sources of indigenous knowledge and there is an increasing interest in the possibility of utilizing them for development (World Bank, 2004). A large number of cases from many countries in the South demonstrate that indigenous knowledge has the potential to contribute much more to development than it does today; and in many countries there are now genuine efforts to mobilize indigenous knowledge for development in, for example, local resource management, agricultural production, health care, primary education and local conflict management.

Indigenous knowledge is often unique to local cultural contexts. It is mostly preserved through oral traditions and depends on demonstration rather than documentation. Often it is commonly rather than individually owned. It is embedded in community practices, habits, rituals and relationships. It is tacit rather than codified. These characteristics of indigenous knowledge make it vulnerable when threatened by the disappearance of local practices, traditions, cultures and languages in the globalizing economy.

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Since the characteristics of indigenous knowledge are so different from those of scientific knowledge it may seem very difficult to combine these two bodies of knowledge in fruitful ways. It is well known that, for example, medical science has utilized indigenous knowledge about healing attributes of plants in the development of medicines. But this is done on the premise of science; for example, indigenous people find the plants while pharmaceutical companies in the North develop the medicines. More 'equal' new combinations of indigenous and scientific knowledge are hard to find.

However, since many firms in high-income countries do in fact successfully combine tacit and scientific knowledge as well as very different types of competences in their innovation strategies, there is no strong reason to exclude the possibility of overcoming the tensions and fruitfully combining indigenous knowledge and S&T-based knowledge in developing countries. Sibisi (2004) observes that, in some instances (agricultural pest control, plant selection, weather forecasting, etc.), indigenous knowledge has evolved into a kind of science and technology of its own with practitioners and communities making observations, drawing conclusions and taking actions over long periods of time and accumulating impressive bodies of knowledge.

5.5.1 Tensions and contradictions in the innovation process of firms The examples discussed so far have illustrated the contradictory character of the globalizing learning economy on the over-all macro level. In this section it is demonstrated that contradictions are also present on the micro level.

The innovation process itself is characterized by contradictions. Jensen *et al*. (2007) documented the existence of two different modes of innovation in Danish firms. One, the DUI (doing, using and interacting) mode, is based on informal processes of learning and experience-based know-how. The other, the STI (science, technology and innovation) mode, is based on the production and use of codified scientific or technical knowledge. These two modes are very different and there are tensions between them. Nevertheless, it was shown that firms that were able to combine these two modes (usually DUI firms that introduced elements of STI, or STI firms that introduced elements of DUI) were more

innovative then firms that relied on only one of the two modes.

There are several explanations of this. One explanation hinges on the expansion of ICT and the acceleration of change. On the one hand, codified knowledge processed by information technology and sometimes taking the form of scientific information becomes increasingly important for all kinds of business (including 'low-tech' businesses). This requires STI-competence and learning. On the other hand, this development together with globalization speeds up the rate of change and increases the need to learn and the ability to rapidly implement new ideas. This requires strong organizational DUI-competence and learning. Therefore firms that combine the two will be relatively able both to capture and develop new ideas and to implement them.

Another more general explanation takes departure in the innovation effects of combining different bodies of knowledge. Every body of knowledge has some basic concepts and some internal structure. Every mode of learning develops rules, standard procedures and ideas of best practice. This is inevitable and normally also quite productive. But this inherent myopia — following from the habits of thought, which characterize every body of knowledge — also opens up new perspectives when different bodies of knowledge, like DUI and STI competences, collide and feed upon each other. This can happen without clear prior intentions, as when a DUI-firm has to relate to codified knowledge of which it has little previous experience. But it can also be encouraged by organizational change supporting mixed strategies including different bodies of knowledge.

To mix different types of knowledge is not easy and sometimes not even possible. They are often in contradiction with each other and knowledge management cannot be compared to the ease with which one blends the different ingredients when baking a cake or mixing a drink. Only when the contradictions and tensions are tackled can new fruitful perspectives and options be opened up and the innovation process supported. This is an essential determinant of success in the learning economy.

6. Institutional responses

The learning economy with its ongoing rapid technical change develops through institutional reactions to its own contradictions. Some of these reactions are on the micro level. Firms take steps to improve their innovation capabilities by making organizational changes — for example, when developing the ability to combine science-based and experience-based modes of innovation. They may also enter or participate in the building of networks and partnerships with other firms, universities, government organizations, and so on.

Other institutional responses occur on the macro level, as when property rights and modes of public governance change. A central question in this connection is the extent to which government policies can induce institutional changes when economic growth is challenged by contradictions in the learning economy. To do this, policy-making itself has to become a process of learning, where policy-makers engage in dialogues with other major actors and the means and ends evolve in interaction over time.

Policy learning needs to address institutional change at all levels. It may support the development of the overall learning economy by forming the visions and value premises of innovation policy. Policy learning also needs to address the development of new concepts, data, and theories of innovation and the role of innovation in growth and development. To move the focus in economic policy away from a preoccupation with short-term allocation of given resources and stabilization of the economy towards long-term processes of learning and innovation would be an important improvement of the policy agenda in the learning economy.

Some of the deepest contradictions in the learning economy have to do with conflicts over the distribution of income and power and the erosion of trust, which come about with rapid structural change. To build meeting-places for dialogue between the stakeholders in the learning economy in order to detect and discuss its contradictions and conflicts before they escalate should be a priority. To develop new forms of democratic participation and new forms of dialogue between employees, unions, researchers, and governments might be helpful in this context. Marginalization of slow learners, increasing crime rates and weak integration of immigrant groups are examples of problems, which may be connected to rapid structural change. To tackle such problems may also require institutionalized dialogue.

Good access to learning, competence-building and training at the workplace for employees is important since it makes broad participation in processes of technical and organizational change possible. Not only individuals but also firms may need policy support to improve as learning organizations and become better innovators. Policy programs may focus on organizational change, for example, to induce firms to combine STI and DUI modes of innovation. This requires that policy-makers abolish the present STI-bias and take on board a broader range of policies including support for networking in the private sector and partnerships between firms and public agencies.

To break the STI-bias, including a predilection for the linear model of innovation, it may be necessary to reconsider who is responsible for the policy. Traditionally, the minister of finance dominates all the most important kinds of economic policy. This implies a risk of letting the relatively short and narrow time horizon of monetary and fiscal policy dominate and compromise the necessarily more long-term views of policies for learning and innovation.

Furthermore, it is necessary to improve and develop a broad set of institutions, which influence interactive learning and cooperation. This set includes institutions affecting the system of education, the distribution of income, job security, participation at the workplace, access to on-the-job training, social security, trust, etc. It should be an important part of policy learning to develop a new kind of institution for shared political responsibility and policy coordination. Such an institution would be responsible for creating a common vision for coping with the contradictions and conflicts of the learning economy.

7. Concluding remarks: toward a general theory of innovation

With the user–producer relation, Lundvall broke with mainstream ways of thinking about technical change and, in retrospect, it is clear that he started a quest for an evolutionary inspired general theory of innovation. Or put more precisely, a general theory of innovation within the confines of the learning economy looked upon as the latest phase in capitalist development.

The notions of different broad systems of innovation, which are so important in Lundvall's thinking about innovation, are situated in the changing division of labor of the learning economy. Going all the way back to Adam Smith the very division of labor in a market economy has often been thought to contain an inherent kind of dynamics: division of labor increases productivity, which reduces costs and leads to an increase in the size of the market. This, in turn, makes further division of labor possible, leading to more cost reduction, increasing markets, and so on.

This description of the basic dynamics of a market economy can be found already in book 1 of the *Wealth of Nations* in connection with the famous example of the pin factory. Here Smith derives the division of labor from a certain propensity in human nature: 'the propensity to truck, barter and exchange one thing for another'. He also explains that the productivity gains associated with increased division of labor have three different sources. First, an 'improvement of the dexterity of the workman' as he repeats his operations over and over again. Second, 'the advantage which is gained by saving the time in passing from one sort of work to another'. Finally, labor is facilitated 'by the application of proper machinery'.

Smiths's argumentation is rich in detail and substance. Still, it gives both a biased and a limited picture of the dynamics of a market economy. It is biased because it doesn't leave much room for product innovation. Increasing division of labor in the pin factory may lead to cheaper pins but hardly to new types of pins. It is limited because it doesn't tell us very much about *how* increasing division of labor leads to productivity growth. Marglin (1974) has pointed out that the division of labor in the pin factory could not lead to much learning. Furthermore, it was not intended to do so. Division of labor in early capitalism was an instrument for control and discipline.

In spite of these weaknesses, Smith's analysis can be made more dynamic and contribute to a general theory of interactive learning and innovation. This is a crucial aspect of Lundvall's search for a general theory of learning and innovation. A broader spectrum of learning possibilities connected to interactions within a diversity of competences has to be taken on board. Increasing division of labor opens up new interfaces for communication and interaction. The organization of work within the firm affects both the quantity and quality of interactions between different skills and competences. Furthermore, the learning possibilities of the 'workman' depend on his qualifications and on the characteristics of his work tasks. Increasing or changing division of labor between firms and other organizations in the private and government sectors also changes the patterns of interaction in the economy.

The quantitatively and qualitatively changing patterns of interactions, within as well as between firms, open up new innovation possibilities. To the extent that these are realized, by adequate demand and investment, the division of labor is again changed and new learning interfaces are shaped. A broader and more dynamic version of Smith's cumulative interaction between the division of labor and the size of the market is at work. User–producer relations, both between and within organizations, play crucial roles in this, but other types of durable interaction are important as well. It is evident that a general theory of interactive innovation specifically must include important aspects of both organization theory and labor market theory. Generally it becomes essential to understand and analyze the innovative qualities of the interactions in the learning and how they are both facilitated and hindered by political, social and cultural factors.

The broad version of the notion of national systems of innovation placed within the context of the globalizing learning economy is a powerful framework for thinking about innovation. To a very large extent it has been developed by Bengt-Åke Lundvall. It has helped to move innovation theory away from the essentialism of pure markets in the direction of an evolutionary understanding with a diversity of flawed and organized markets in the centre.

Notes

1. Lundvall has been based at Aalborg University in Denmark most of the time since 1972.
2. In the same period as Lundvall developed his ideas about user–producer relationships and innovation, mainstream economics also started to deal with product innovation to explain international trade and productivity difference between countries

(Krugman, 1979; Grossman and Helpman, 1989). Mainstream authors also wrote about R&D collaboration between firms (D'Aspremont and Jacquemin, 1988; Kamien *et al*., 1992). The present author acknowledges this, which was pointed out by an anonymous referee. However, in this paper I want to concentrate on Lundvall's specific contributions to innovation theory, which both were early and have proved to have exceptionally rich generic qualities.

3. Other examples are network relations, partnership relations, R&D collaboration, long-term relations between firms and financial institutes, long-term relations between firms and universities, etc.
4. The labour productivity in Danish manufacturing industry decreased in 1984–1986 in spite of increasing production, investment and employment (Gjerding *et al*., 1990).
5. See <www.globelics.org>. See also Cassiolato *et al*. (2003), Muchie *et al*. (2003) and Johnson and Segura (2010).
6. See e.g. chapters 8 and 10 in Freeman (1992).
7. When a technology changes to a new standard some users would prefer to stick to the old one. However, if they cannot retain a critical mass they are left behind as angry orphans.

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