Innovations in the health care and construction industries in light of new global interaction patterns and local dependencies

Abstract

This paper is about innovation in two industries where there at the same time are very strong local and global networks. The health care and the construction industries are both featured by the existence of these two types of networks and, as a consequence, a special interface between them. One interesting effect of this interface is that it creates specific innovation challenges and patterns. Global innovations have the problem that they tend to create complex ambiguities and controversies in diverse but tightly interacted, productive local networks. Local innovations may fit perfectly into the local network where it emerged, but typically do not have the resources behind them required to expand into other local networks, due to the frictions their introduction typically cause in those other production networks. As a consequence, local innovations in order to expand must typically be adopted and supported by some global network. In this work in progress paper we try to describe and discuss the differences and the antecedents of these differences between the local and the global networks in the two industries. We also give a couple of examples of innovation processes fighting with these problems.

Key words: Construction, health care, local, global, networks, innovations

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INTRODUCTION

Certain industries have for quite some time been highly globalized in terms of their activity structures. This is particularly pertinent for all kinds of industrial commodities and technologies such as for instance the telecom and the car industries. These are highly integrated and their activities are globally clustered and interacted in tightly coordinated supply chains and infrastructures to reach consumers wherever they are. Contrary to these, huge industries like health care, construction, but also education, agriculture and - of course – retailing, maintain a considerable dependency on local resources, activities and political contexts while to an increasing extent also being part of a variety of expanding global interaction systems and patterns. Thus, they include two parallel networking processes. One networking process where local activities and resources of involved units are systematically related to each other. The other networking process is relating activities and resources of globally specialized units to each other. Furthermore, these two processes interact.

In this paper we will discuss some of the specific challenges to these industries that result from their diverse local and global oriented dependencies created by these networking processes, with a particular emphasis on the health care and construction industries. As different as these two may appear, we also see interesting similarities and particular differences that offers opportunities for illuminating comparative analysis.

The fundamental question here concerns the effects of the different networking processes on some key characteristics of the involved units. These networking processes will, according to Håkansson et al 2009 and other industrial network descriptions, have effects on the emerging structures in dimensions such as efficiency, power distribution and knowledge. Those being affected by “the local” processes will in this way be influenced in one way - and quite differently from those being part of “the global” networking. But at the same time the emerging network structures have to be connected (or interacted), i.e. some of the units will be part of both processes. The local networks must have some kind of interface with the global ones and vice versa. Some key questions are: How do the local units take advantage of the expanding globalized systems and patterns? What are the implications of these expansions on to the local activities and resources? What can and should the local units do, to contribute to a reasonable economizing ambition as represented by their polities?

These questions are particularly relevant to the discussion of innovation policies within these industries. Because there is this substantial dependency on local activities and resources, these industries are important to their national political contexts – especially perhaps in the smaller

nations. They are therefore also being targeted as particularly interesting for national political initiatives to enhance their effectiveness, efficiencies and capacities to deliver increased output at higher quality, at higher speed and at lower costs. These are often structured as major reforms or as innovation policy initiatives. We will discuss the potential conflicting forces between the politically and/or locally initiated initiatives to resolve major challenges, to restructure or to innovate within these sectors on the one hand, and the increasing influences of global and local networking processes with specific effects on efficiency, power distribution and knowledge in the emerging networks .

ANALYTICAL APPROACH

Business networks have important time- and place-related characteristics (Håkansson et al 2009). In relation to time the interactions between companies result in particular patterns of activity specialization, in the creation of specific technological paths which exploit certain resources and builds on important co-evolutions across the related actors. In a similar way interaction processes have important place-related characteristics. One is the consequential creation of specific interdependencies between activities performed by different actors that are exploiting heterogeneous resources together. (Håkansson et al 2009 p41-45).

Both the time and the place dimension are actively exploited by the involved actors in rather complex/advanced ways (Bakken et al 2012). Here we will focus on one interesting aspect – the extendedness of the place dimension of network interactions. Every node in a network can be opened up and seen as a micro-network in itself. Each node in such a micro-network can also be opened up and seen as network too. Similarly, every network can be simplified so as to represent a single node that is part of a more extended macro-network. And this extended network can again be simplified into a node in an even more extended network – and so forth ad infinitum. Networks can accordingly be seen as having a variable space dimension that depends on our analytical focus on the objects of investigation. Such an approach permits for a focused investigation of how a local network may be included into a more extended network; the particular conflicts, alignments and mutual demands that demonstrate themselves in the interaction processes. Similarly, it permits for studying how something extended (global) may be simplified so as to be included as a functional node in the less extended (local), a process in which much of what is represented by the global network is “baked into” what is being included into the local – thereby forcing particular network effects.

Interaction will in this way develop different place related networks that at the same time can and are related to each other. Basically, this also permits us to allow for the possibility that it is up to the way interaction is being done if the network is extended or not in relation to a specific location.

As a consequence every business network will have a special configuration in relation to place. It will be more or less developed in different place related dimensions. This will in turn affect the involved actors as they will face problems related to the specific configuration. It will make some interaction harder and more difficult to handle in an efficient way.

Development is a change process that is embedded into related interaction processes. This includes both development of new knowledge and development of its application to practical use. It includes the kind of process where individuals develop their own knowledge and the processes by which they systematically relate to and align with the knowledge of others (teaching and learning). A central aspect is the creation of shared knowledge. Knowledge is

due to the interaction processes also embedded into products and technologies, facilities and business processes as output of the lengthy and complex development and interaction processes through which they were created, produced and brought to use. Knowledge in these many ways are absolutely core to the efficiency and productivity of any given business network. The more knowledge created and brought to use, the more extensive are its resource ties, activity links and actor bonds.

To frame our approach, we need to investigate a system of interaction and mutual influencing where local network interactions and global network interactions are seen as two kinds of distinct analytical processes with particular internal characteristics. Secondly we need to come up with a framework for analyzing how these processes interact with and influence one another – either directly or indirectly through some intermediate unit (international construction firms?, University hospitals?). To analyze this, we need to be able to see this from the perspective of the local on to the global and vise versa, by the use of the same analytical constructs.

We furthermore need to address how new knowledge (innovations) analytically can be seen as being produced, enforced and moved from one network into another, and how this process impacts the acting as well as the receiving networks.

In the next section we will try to apply the network approach to a discussion of the problems of applying globally developed innovations within locally interacted networks.

LOCALLY INTERACTED NETWORKS AND THEIR INNOVATION PROBLEM

In industries like healthcare and construction, very substantial shares of the resources, activities and actors involved are local and specific with respect to location. These locations represent a variety of complex circumstances within which the given local activity is organized, interacted and conducted in order to provide health care services or construct buildings, infrastructures, etc. The way things actually work in each of these locations, is the outcome of lengthy interaction processes through which the particular resources, activities and actors that have been there, have mobilized efforts to connect to one another in certain ways and to establish a particular form of material, social and economic order. In these industries, these many and variable interaction patterns carry substantial weight as opposed to industries where the local parts of the operation is much simpler and standardized.

To effectively and efficiently deliver output over time necessitates stabilization of production systems, interaction patterns and procedures across multiple dimensions of the operation. Things have to be routinized and behaviors turned highly predictable, which can only be achieved when conflicts over alternative ways to do things are somehow resolved, when interfaces have been aligned and when a number of power constructs have been put in place, like contracts of various kinds, rules and systems to measure and control outputs. There need to be some systemic order, some system of power and some appropriate and precise governance and control system to ensure productive behaviors and outputs. Most local economic activities are dominated by this foundational rationality.

If a different way of doing things – such as represented by a major technological innovation - is introduced to such a system, it typically generates disturbances which in the short run will cause productivity and quality to fall. It will force a process of destabilization of the existing rationality and order, before a new order may emerge. Interfaces are no longer aligned. Highly

trained expert practices have to be altered. Established power-structures change and new power-games are opened up as alternative ways to re-establish productive order are being thrown into the local process. The frictions and conflicts that emerge represent what we typically see as opposition to change, opposition that quite often prevents introduction of new inventions. Many inventions and even simple improvements are never implemented because "they do not fit into the particular local context of operation".

In the national perspective, a common criticism of these kinds of local industries is that they are not sufficiently innovative. Their productivity as well as the quality of their output – it is said - could potentially be enhanced if they would only become more innovative. However, when observing these industries, there is something else which seems to represent a much more immediate and powerful phenomenon, and that is the roles and influences of expanding global supply networks in relation to these industries.

Over the last decades many of the local suppliers to these industries have been absorbed into global business operations that are orchestrating supplies of technologies, commodities and other inputs to these industries across continents. This has led to a dramatic standardization and scaling of supply operations as well as to much more concentrated and resource dependent innovation processes within these global networks. From these huge "innovation and supply" engines new substances, materials, technologies, integrated modules, etc. are being created and offered to local operations across the world in the form of highly formatted, standardized or interacted complex offerings with well argued benefits suggested and marketed to the local operations and their customers/users.

These are the kinds of innovations that the local networks typically have to deal with on a daily basis. Through these innovations, some of the local work is taken over by the global suppliers as particular functions are being commoditized or baked into new technologies. Or they force shifts in the local distribution of work – for instance across professions. Elements are being premade in factories rather than made or even put together on site. The entire way of conducting a local operation may be entirely changed by what has been developed on the outside of overview and control of the "local". In these ways the global supply chains are expanding into and altering the local operations with substantial force and in different forms. However, the local operations of these industries also have strong resistances to these forces which fundamentally result from their own unique substances, location and complex interactions associated with the operations they perform every day. Thus, the innovations and the proposed redistribution of operations that comes along with them, typically confront one another in rather dramatic ways.

In order for new products, modules or technologies to become extensively used, there must be a sufficient destabilization of the established local order. Someone must force new alliances, demand different interfaces, create new routines, put different power systems into place, negotiate different contracts, develop appropriate governance and control systems, establish new links to external partners etc. The global supply network has to adapt to all of these demands by building sufficiently powerful and complex capacities to actually break into and influence the many diverse and resisting local operations, essentially by going through rather similar change processes itself. And the local operations have to do it on their side - in order to actually exploit the perceived new improvement opportunities being offered to them.

We will argue that the interactions of these activities in between the global innovation and supply networks and the diverse set of rather powerful local operations represent the major share of the change, adaptation and improvement oriented activities within these industries. The role of creative local innovations in this setting is fundamentally minor in kind and for

the most part related to the need for creative ways to adopt and adapt or to exploit what is coming from the global suppliers. Genuine local commercial innovations will typically not be easily adopted by other local contexts because they lack the kind of complex and substantial powers to influence diverse and resistant local operations such as do the global innovation and supply networks. So, what we would expect to observe is that such local commercial innovations will aim at being part of global innovation and supply networks rather then being directly targeting the local operations. Hence, local commercial innovations may not be particularly useful to their nearby local operations, and they are unlikely to create solutions to the kind of problems that local operations are generally facing.

In this perspective it is easy to understand that the local operations in these industries are challenging and that they are seen as conservative, resistant to change and as having substantial problems stabilizing their qualities as well as demonstrating productivity improvements over time. We will argue that this is not because they do not innovate, but because the flow if innovations and the force and complexity by which they are being pushed into "destabilization – reordering" processes within diverse local operations, have intensified as a result of the building of more integrated and powerful global innovation and supply networks. Hence, we will observe more turbulence, more quality problems and more complex challenges in making sense of their relative improvement processes.

We will now introduce two illustrations – the health care and the construction industry.

HEALTH CARE INDUSTRY

The existence of the two networking processes in health care is very much related to the existence of two very different knowledge creating processes. One is closely connected to scientific research which in turn is highly dependent on the existence of some very knowledge intensive resources. In this process there is need for extremely advanced activities as well as resources in order to develop this knowledge further – there is need of a global specialization. And there is a general agreement in the world that more such knowledge is highly needed and valued.

The other important knowledge creating process deals with the application of the health care activities. This knowledge is very situation specific and is created through an interaction between the patient and the local network of actors. There is need for an adapted local knowledge to format and conduct the activities. They are directed toward human beings who themselves are highly complicated medical objects who furthermore are embedded into a social context. Together these two aspects require that many of the activities have to be adapted and adjusted in a multidimensional way.

These two knowledge creating processes are so basically different that they need very different network settings. The knowledge development in the medical resources is driven by highly specialized units that need contact with other highly specialized units. This specialization is therefore taking place in a global scale. The knowledge in the "treatment and care activities" includes the patient and all those units close to the patient. The local network includes social organizations besides the medical ones. There is usually a local chain of "treatments" as well as a chain of "administrative activities". The process is labor intensive and deals with taking care of the whole patient. Here we have local adaptations and individual specific treatment. However, most activities are also structured and conducted on the basis of technologies, standards and routine systems produced by the globally specialized networks.

Thus, health care is featured by existing in an interface between two very different types of knowledge driven development forces - one being very local and the other one being global. All care is done locally and it is substantially influenced by local conditions. Most activated resources are local, most activities are performed locally and the actors are mainly local. The basic reason is that all patients are locally anchored in their local context. This local context is also becoming more important the more the elderly people become the primary patient group. Here we have multidimensional problems and they have to be seen and treated as a totality. However, in order to handle these local problems in a more efficient or better way the local activities are very much dependent on the global.

Large actors are dominating the knowledge development in the global part of the network. There are scientific units as well as large multinational companies. The pharmaceutical networks are some, the information technology networks and the medical technology networks are others on these scene. In every case the ambition is to explore and create standard solutions to well specified “problems”. In order to be able to standardize the solution, the problem has to be clearly specified and detached from any particular local context. The research/development is extremely costly and large investments are needed to find new “standardized” solutions. In order to develop these standardized solutions there is need for many local inputs. The local knowledge is an important input into the development of the standardized solutions.

Table 1: Health care

	Actors	*Activities*	*Resources*
Local networks	Hospitals	Primary care	Expertise - doctors
	Social units	Social services	Equipment
	Doctors	Some special care	Relatives
	Local political units	Documentation	Rooms, beds
Global network	Pharmaceutical comp	Research	Scientific researchers
	Scientific units	Testing	Specialized labs
	University hospitals	Teaching	Specialized equipment
	Med tech comp	Product development	

The two sub-networks are interdependent; they are parts of one total network. Output from one is input in the other and vice versa. But it is a problematic interdependence. There are large difficulties to bridge them. Every activity, resource and actor has important interfaces both to the local totality and to the global one. The dilemma is in both cases that every resource, activity and actor can be tied, linked or bonded in both directions and that these ties, links and bonds often can be contradictory due to their different logics.

The actors, activities or resources that have strong connections in both directions will have more problems than those others. One example is the university hospitals. Such a unit will strive for having close connections in the global part at the same time that it has to have important functions in relation to local areas. They will have problems both in terms of financing as well as controlling its activities and resources.

Efficiency in one local activity is directly related to how it is linked to other related local activities but also how it is linked to some of the global activities. If we want to increase the local efficiency the activity will be linked harder or in a new way with the other local activities. This will change the activity and it will probably change its possibilities to link to the global activities.

An example: Technology development within health care is generally perceived of as moving faster than ever, and according to some researchers around 80% of all kinds of treatments offered today, were not available in 2005 (Grund, 2006). ICT has been a core ingredient in almost all of this – at any node in the healthcare system in between the highly specialized and long term research activities – and the day to day health care activities interacting with the individual patients at any location.

One typical example of such a development may for instance be observed within the area of heart surgery, where the wave of new technologies have opened up for a range of new opportunities for both treatment of patients, simplified diagnosis procedures and organizing of the health care services. Minimal-invasive techniques are radically changing the way heart surgery is mostly being done, and are based on a range of new high-tech equipments, video-

assisted operations (cardiovascular interventions, angiography) and establishing of hybrid heart-surgery labs with numerous screens, sensors, control/manipulation/surveillance instruments, CT scanners etc. This set-up also permits for fast transfer of patients to different techniques/operations when needed.

This kind of highly advanced new treatment techniques are typically first introduced in the most advanced and specialized university hospitals, before they may be distributed also to regional hospitals – often based on substantial support and collaboration with the university hospital – for instance through tele-medical assistance, lab-services, education support etc. All of these new technologies and procedures have radically changed the way heart-surgery is being done. It has also transformed the relationships between the various highly specialized professions involved and has increased demand for new kinds of expertise. Traditionally, heart surgery was conducted only by heart surgeons. With the new procedures radiologists and cardiologists have moved in to do a lot more, thereby challenging both the hierarchical ordering of the professions and the control over the procedures. The labs are being re-organized. These changes typically lead to serious new conflicts across professional borders concerning who holds competence to what, before new relationships and new alliances eventually may settle. Then, the surgeons have to start training themselves in using the new machines, following the new procedures, experiencing new problems, etc, to build new expertise, as will also the various other professions. In particular, expertise based on interactions with or through ICT equipments has become a lot more critical as opposed to the direct physical interaction based treatments where a lot of the embodied expertise of surgeons connected through the sensibility of their hands in contact with the patient's body.

Because these situations are full of conflicts and include a number of novelties to the local activities, there are numerous uncertainties with respect to what actually are the most appropriate methods, equipments, procedures, work arrangements etc. The outcomes are accordingly the results of complex negotiations, power-games and creative local solutions that include some mix of standardized technologies and procedures entering from the outside and the uniqueness of the local resources, activities and actors and their interactions. The successful adaptations of these innovations are never secured in advance. Neither is it obvious that a successful implementation at the university hospital will make implementations of similar technologies easy or even possible in surrounding regional hospitals, as the particular circumstances are very different and as there are multiple options regarding how to structure and organize the division of work between these institutions.

With the increasing pace by which new technologies and new treatments are being offered to the healthcare sector, the innovation challenge essentially has to do with these many adaptation and re-organizing processes that are triggered by the new opportunities that are being supplied by global medical technology and pharmaceutical companies. And because the local contextual areas of activity are so powerful, complex and interconnected, the costs of adaptation and change are substantial as well.

CONSTRUCTION INDUSTRY

In the construction sector there are two very different types of specialization processes. One has to do with the production process – how it is designed and executed - and the other with the construction object in terms of design and use of materials and components. The production process is very much influenced by the fact that most constructions are done where there already is a lot of earlier constructions and where there are other construction

processes at the same time. Therefore, most construction processes has to be related to an already existing activity structure which becomes one critical context for the project.

Table 2: Construction

	Actors	*Activities*	*Resources*
Local network	Investors/owners	Construction	Land, buildings
	Sub-contractors	Planning	Input materials
	Contractors	Financing	Distribution/transports
	Users	Maintenance	
Global network	Global constructors	Technology develop	Advanced dev groups
	Technology providers	Production	Equipment/large scale
	Specialized sub-contr		
	Global users		

The issues may regard ownership, financing, architecture, use of local subcontractors and distributors, etc. There is obviously a need to design a production process that is embedded into the local conditions – through interaction the goal must be to utilize the local specialization as much as possible. Most constructions have in this way a unique touch due to the fact that the local place has some specific features. It is a specific place both when it is produced - such as the existence of transportation and storing possibilities – and even more when it is used and maintained. Knowledge about all these factors has to be included and activated. Due to the existence of all these specific local features there are reasons to develop a specialized local activity structure where all local knowledge is activated including highly local actors with important locally situated resources.

However, the construction object in itself is a complex object. The construction has important functions which in turn is dependent on the design but also on the use of materials, components and different technical systems. Most of the materials, products and technologies used as inputs in the constructions are developed and produced in a very different setting – far from the single construction project. Each of the different products and materials has its own development and production context – its own network setting. Much of the knowledge embedded into these is in turn dependent on equipment and materials developed by the producers in question in cooperation with different types of sub-suppliers. Thus, we have a number of highly specialized suppliers that have at least a national and sometimes also an international context/base. They are members of highly specialized more or less global activity patterns – global networks.

The major challenge in every construction project is to utilize and combine these two types of knowledge providers. Due to the characteristics of the construction project there are differences in their relative importance and also in the difficulties to combine them. One special problem is to utilize the globally oriented activities in an active way in the

construction processes. One effect is that relationships with customers are perceived to be central for increasing the renewal activities while the suppliers – despite being resourceful and knowledgeable – are not at all perceived to be important in the same way (Håkansson & Ingemansson 2011). The time restricted projects have problems to establish the kind of long term oriented interaction needed for creating and applying innovative new materials or products.

An example: In an earlier study the adoption of a new timber solution in the building of houses higher than two stores in Sweden were studied. (Bengtsson & Håkansson 2008). Due to city-fires in the 1900-century, the use of timber for frames in such houses was forbidden by law until 1990. EU-regulations forced Sweden and the other Nordic countries to change this law and to change to functional requirements. During these 100 years timber had been used in the US and had proven to be an economically interesting solution in many cases. The international Swedish construction company – Skanska – had experience of the American construction industry and wanted to take advantage of the new rules. The company saw a quite substantial economic potential in using timber. Economic comparisons with US suggested that it could be as much as 20-30% lower production costs compared with the established concrete alternative. The projects started did not turn out in such a positive way. The main reason was that the reduced costs in the US alternative was not just related to the material in the frames but was due to all other components and activities having interfaces with the frame that had been adapted over time. In Sweden, where concrete was the alternative, all these related actors had adapted activities as well as resources (including product features and production activities) to the use of concrete in the frames. It will take a long time and a lot of projects until all these related actors have changed and adapted to the use of timber-frames. Thus, the existing local network had developed over 100 years and this has resulted in a lot of local solutions in terms of adapted interfaces. Activities performed by different actors have been changed and related to each other in the same way as the used resources have been adapted to each other. Over time all actors have tried to find ways to make all interfaces more efficient – to perform the activities and to use resources in the best ways possible. All resources and activities have in this way more or less adapted to all other resources and activities. They have co-evolved.

In the same way the timber solutions in the US had developed over the same time period in close “interaction” with other materials and components used in the construction projects and developed efficient interfaces. In this way it was to move a resource from one local (even if it was a much larger) network to another. It is in this way not a perfect example of the global/local interface but it illustrates what can happen also in the latter case. It demonstrates that the network interfaces are very much influenced by the earlier interactions and that it takes time and efforts to relate something “new” in relation to all established ones.

Conclusions

The existence of strong local and global networking processes has in this paper been described for two very different industries – the health care and the construction industry. In both cases we have been able to formulate important problems related to how the global and local networking processes could be combined. One special area is the effects on knowledge and the use of innovations. As the knowledge in all cases are embedded into the networks there are problems to move something specific – such as a new product (or earlier not used product) from one to the other part of the network or between networks. The problems can be defined as knowledge related problems but they can not just be solved by “learning” or

"increased information". There is need for changes in the items where the knowledge has been embedded – such as other resources and/or activities. There is in all networks a natural resistant towards changes that breaks the earlier solution which in turn is based on the used knowledge. These knowledge problems make these areas difficult from a local and national innovation policy point of view. As there are strong local networks, national policies are both powerful and relevant but also usually part of the local network. There are always reasons to develop the local network and both industries are so important for the local society so it has to act. At the same time one of the important means exist in the global part of the networks where the local or national policy units have no influence. At the same time this global part of the network and its innovation pattern is creating risks and constraints for any local solution. Any local solution might easily be overrun by a global solution. But on the other side if too little is done locally then the local network might become irrelevant in the global perspective.

Another consequence of this interface between the local and the global is that all innovation processes, whether they start in the local or in the global part of the network, will take time and will have to go through a highly complex process as the two examples showed.

The existence of the interface will also give some special actors a central role. One such example are the large university hospitals that has to be highly involved both in the local as well as the global part of the health care network. It gives special opportunities but it can also become a burden as it has to develop routines and an organization that must handle both.

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