

If you try to control networks, they die

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Abstract

In order for new knowledge to lead to growth it is necessary for this knowledge to be embedded into a user context. Among policy organisations throughout the OECD world, optimistic voices describe the societal and economic benefits that can be created through the establishments of networks around new knowledge areas. Different kinds of networks, clusters and innovation systems, among others, are seen as important systems for transferring knowledge from the academic to the business world. Policy supported network-like constructions have also increased dramatically. In the US alone there are about 50 policy supported biotech cluster projects. In the small country of Sweden, the business magazine *Biotech Sweden* (May 2003) reports a new record in Swedish biotech clusters, “from zero to fourteen within a few years”. What all these constructions have in common is the mission of supporting the transfer of scientific knowledge to entrepreneurial business projects.

However, the network phenomenon is also criticised. “*Networks combine the idea of connection with the idea of disconnection*”, says the sociologist Zigmunt Bauman (Axess, 2003, nr 6, sid 13) who sketches a considerably darker picture of the emerging network society. Instead of a stable and reliable world, characterised by defined roles and engagements, Bauman (2002) stresses that network structures are loose and temporary constructions, characterised by a lack of long-range obligations. Sociologist Manuel Castells (1998) paints an equally dark picture of the emerging network society, but, in contrast to Bauman, due to its enormous power rather than its fleeting character.

At first glance it can be regarded as a paradox that the interpretation of networks made in the IMP tradition recognises both of these views of networks. Thus, networks in the IMP tradition are regarded as structural Janus faces. On one hand all these networks that emerge as a consequence of interaction over time have the appearance of a heavy colossus. Regardless of how great the awareness of their negative effects, they cannot change rapidly. On the other hand these networks are full of resources whose features are still waiting to be handled. Thus, it is a picture similar to the one sketched by Edith Penrose (1959); “No matter how we consider the putting together of the ‘jig-saw-puzzle’, we may still find that a number of awkward corners persist in sticking out”. *And, it is not in the construction of networks, but in the constant confronting and recombining of these “awkward corners”, that we can find the source of network dynamics.*

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Hoping for networks

In one of the publications of Vinnova (*Verket för innovationssystem*, Swedish agency for innovation systems) from 2002 it declares, in accordance with sociologist Manuel Castells' observations: "The network society is taking shape." According to its sister organisation Nutek (*Verket för näringslivsutveckling*, Swedish business development agency): "a national demonstration of strength" has been launched to "develop and disseminate knowledge" supporting and facilitating the development of what are usually called "dynamic clusters" and "innovation systems." Behind the commissions is the ministry of industry, employment and communications, which regards this as a prescription for creating vigorous businesses and economic growth.

These attempts to create connections between the worlds that "produce knowledge" and those that "produce industrial products" show that confidence in the "linear model" has waned.¹ As long as we could rely on the idea that investments in research automatically lead to technical development, which in its turn provides economic growth, the question of how you create an industrial dynamic was easier to deal with. The basic prescription said that the localisation of a university in Östersund or Kalmar would cause enterprise to blossom in the region. Today, both hard-bitten municipal politicians from Blekinge to Norrbotten and experienced advisers in civil service departments know that the question is considerably more complex. The development needs helping along the right track, but what should this look like? Many of the new theoretical network models promise methods for linking together scientific research, technical development and industrial renewal. And what can an administrator dealing with development issues in the areas of Norduppland or Bergslagen do other than follow the network prescriptions offered by policy organisations and academics? So let us look a little closer at the theoretical bases for these prescriptions.

Networks and their effects have generally become a much hotter issue; networks are debated, they are researched and political decisions are taken about them. But in academic research, connections and their effects were for a long time relegated to narrow fields of research in sociology and anthropology. In economics, connections are quite simply defined as non-existent. The ideal type is the autonomous actor, who can take part in an exchange with anyone at all, and for whom all information other than price is superfluous. Connections and

network-like structures are regarded as the exceptions, a result of market mechanisms not working. It is instead within those disciplines developed in close interaction with the empirical world—sociology, business economics, different historical disciplines—that the influences of connections have been so strong that they could not be dismissed as exceptions.

Despite the limited interest shown by traditional economic theory in networks it is in the economic and politico-economic spheres that one finds the most positive interpretations of “the network society.” This applies above all to the actors, authorities and policy organisations which have the task of stimulating economic growth. The connections that are considered especially promising are those that are developed between the “knowledge creating” (academic) world and the “knowledge using” (industrial) world. Or, as it is put on the homepage of the ministry of industry, employment and communications (October 2003): “Research is a growth factor of strategic importance for trade and industry. A well-functioning collaboration between universities, colleges, research institutes and business is important for favourable development.” Building networks round units that can be thought to create or alternatively transform knowledge into innovations has become an ever more vital task of those organisations responsible for growth-creating measures. In Sweden these are primarily Vinnova, Nutek and ITPS (*Institutet för Tillväxtpolitiska studier*, Swedish institute for growth policy studies).

This view has its ideological base in the theoretical school called “innovation systems.” A number of internationally active economists, who have become interested in those knowledge-producing and knowledge-exploiting actors who can be identified in the processes of industrial development are sponsoring the concept, among them Giovanni Dosi, Chris Freeman and Richard Nelson. Vinnova provides the following interpretation on its home page (October 2003): “An innovation system consists of a network of organisations, people and rules within which occur the creation, dissemination and innovative exploitation of technology.”

The research into innovation systems shows that the production of knowledge does not automatically lead to economic growth. In order to be transformed into new products and expanding businesses the knowledge must be taken out of its isolated existence with the knowledge producers and be linked to units which can be thought to exploit it. But for networks of this kind to lead to increased growth it is, according to the advocates of

innovation systems, important that these constructs are built within the “right” areas, the new “research-intensive growth areas” such as life science and telecommunications, which can create a “renewal of the production structure.” The “wrong” areas are, for example, steel, forest industries, mechanical technology and engineering (*Vinnova 2002*, with contributions by Edqvist, Jacobsson, McKelvey and Asheim). That Sweden, despite its high R&D intensity in the OECD context, has a relatively low proportion of R&D-intensive products, is seen as the result of the fact that we still to a large extent have the “wrong” production structure.

Even if research into innovation systems has directed effective criticism at the linear model, it still leaves vital questions about the constructions of innovative networks unanswered. Is it possible in advance to distinguish which units and what knowledge should be included in a network? What role should existing networks, all those connections between customers and suppliers, where knowledge is developed and modified into intricate systems of technical and economic solutions, play in such innovation systems.

One example of how difficult it is in advance to identify central knowledge producers in an innovative system is what could be called the “low tech” paradox. A number of the country’s established industries have now, and have had for a long time, significant roles in the growth of innovative industrial networks. Who could have predicted a few decades ago that the know-how the dying Facit company left behind would become a central source of knowledge for the “biotech supply” companies of today? Today Partnertech, the former Facit, is an important supplier of technical solutions to a number of domestic companies in the life science field. And if we look back a few decades, who would then have imagined that the problem that Sockerbolaget (‘The Sugar Company’) was having with contamination in sugar beet juice would lead to a research project which firstly solved the problems the authorities and defence establishment were having in a replacement for blood plasma, secondly gave rise to a separation medium that revolutionised research into big proteins? This gel, based on the high molecular glucose Dextran, called Sephadex, later became the basis for one of the world’s biggest biotech supply companies, Pharmacia Biotech, today belonging to Amersham Biosciences.²

Another aspect of the “low tech” paradox is that some of the country’s major machines for employment and profit, still innovating within their respective fields, are to be found in areas which, according to the innovation system thinkers, are “wrong,” for example, in trade and

distribution (like Hennes & Mauritz, Ikea, Clas Ohlson) and the forestry industry (like SCA, Stora, Södra, Modo).³ Behind the unglamorous name “forestry industry” hides one industrial job in four in Sweden, within the walls of the archetype of “low tech,” a middle-sized sawmill, there is IT equipment corresponding to that found in a Boeing 747.

A further question which is ignored in the approach to innovation systems is whether the resources that are valuable within the knowledge-producing, academic networks can also create economic value in the industrial networks. And naturally vice versa, whether the technical and economic problems that exist in the industrial networks can give rise to knowledge within the academic world. That Swedish investment in knowledge production does not appear to leave a direct impression in the form of new products and businesses is explained by the fact that the country not only has the “wrong” production structure in relation to its research but also by the fact that we have the “wrong” system for transferring knowledge from research to industry.

The reasoning presupposes that what is a highly valued resource in an academic network also is valued in an economic, industrial network. But the academic world rewards research creating radical new knowledge. It can attract new research partnerships, bring in new research funding and result in publications in highly esteemed journals. In the company networks, on the other hand, people are forced at each stage of innovation or streamlining to ponder how the new idea can be combined with the old. If it is not possible, then no economic value is created, irrespective of how highly the new idea is valued in the academic world. This is presumably the explanation for the fact that the knowledge which today underlies the greatest income within the Swedish biotech supply industry, the separation technique, came to the fore in academic world in the 1930s and 1940s and had its heyday in the 1950s, 1960s and 1970s.⁴ It is perhaps not so much a matter of the “wrong” production structure and the “wrong” system of transferring knowledge as of the “wrong” view of how networks function. But let us take a closer look at another theory of networks.

Yet another type of network connections considered growth-creating are those found within “geographically defined areas” between “related industrial and social organisations,” so called “clusters.” Compared with the innovation system theoreticians, the advocates of clusters represent a more heterogeneous approach. Here we encounter such different schools as the

American business strategist Michael Porter's cluster approach, the Italian research into industrial districts and the American studies of social networks.⁵

There is a basic difference between the network structures discussed by theoreticians of innovation systems and the theoreticians of clusters. The latter emphasise that networks of this type do not need to develop in research-intensive areas in order to be growth-creating. On the contrary, they are fascinated by the fact that inherent properties of a place seeming to be so economically sound over long periods of time, despite Manuel Castell's declaration that the forces of globalisation have replaced "space of place" with "space of flows" and caused economic activities to become "deterritorialised." Industrial activity at such different places as Gnosjö, Modena and San Diego endure as regards both the direction of their operations and of their survival.

Michael Porter has formulated the most influential definition of a cluster: "A cluster of independent and informally linked companies and institutions represents a robust organisational form that offers advantages in efficiency, effectiveness and flexibility."⁶ His geographical network model is strongly coloured by the strictly stylised model world of the traditional economy. The actors who populate the networks are still independent and the connections providing the greatest viability for development are not the direct collaborations but the indirect ones characterised by competition or rivalry. The stronger the rivalry the more viable the development, says the Porter model. Together with the knowledge that "spills over" from indirect connections both the efficiency and the growth of new solutions is stimulated.

Irrespective of whether the ideas about geographically defined clusters or networks have been inspired by Porter's rivalry ideas, or by other more or less related approaches with a greater stress on collaboration, they are based on a common assumption about how such structures function. It is primarily competition or collaboration within geographically defined networks which fosters development. This interpretation has left traces in a lot of policy-initiated projects, aiming to build up geographical networks, above all in the form of what has been called "innovative clusters." Attempts to establish these have, according to the economic geographers Anders Malmberg and Peter Maskell, become the OECD-world's favourite prescription for creating growth.⁷ A quick look at some national and international policy organisations indicates that Maskell and Malmberg are not exaggerating.

Faith in the possibility of building innovative networks within, above all, “high tech” areas is strong both nationally and internationally. When, during the autumn of 2003, Sweden hosted the sixth international conference “Innovative Clusters: a new challenge,” where Porter’s model formed the common ground, the conference was attended by policy representatives from 50 or so countries. It should be reported here that, merely in the USA’s biotechnology field, there are 48 different regional ventures which all aim at building biotechnology clusters. The launch of 19 new cluster projects, where the IT and biotechnology fields had a prominent position, was reported at the same time from Japan. Here in Sweden the branch paper *Biotech Sweden* reported a “record increase from zero to fourteen” biotechnology clusters in a couple of years. It is implicit that it is possible to find a use for all the innovations will be produced in these biotechnology clusters.

It has not seemed to dampen ambitions that a number of these projects are struggling with major financial problems, as only a fraction of all the companies that were dreamt of have been successfully created. A topical example is Texas Research Park, which is bleeding after investment of almost a billion, but which can only show 20 or so companies instead of the hundred odd that were expected. Nor are ambitions dampened by the fact that American analysts have begun to compare investments in an industry which has such a limited number of possible users to “spending all your life savings on lottery tickets” (Joe Cortright, *USA Today*, 30 October 2003). If it is now so difficult to build successful networks, whether you call them innovation systems or clusters, what then is it that is wrong with the prescription?

Like the innovation system ventures the cluster schools are based on the idea that industrial dynamics arise within defined systems, irrespective of whether the limits are set around system-related knowledge producers or geographical neighbours. While innovation systems in this way ignore the role played by actors defined as “wrong,” the cluster schools ignore the role other places have in the process. It is the cluster’s “infrastructure” which is regarded as a creator of viability and which “fosters knowledge transfer and the formation of technology-based companies.”⁸ The connections developed within the geographically delineated networks are presumed to be distinctly different from the circumstances that generally characterise institutional actors. Again it is the stylised model world’s assumption about autonomy that comprises the normal state of affairs; connections and networks are a geographical exception. But by regarding networks as geographically distinctive exceptions people ignore the content in the connections and network-like structures that bind places together. A geographical

network blossoms perhaps not only because of what is to be found in the industries in the neighbour's backyard, but above all through what can be "taken home" in all the networks and interplay that link regions together.

The hypothetical question as to what would have happened if we had attempted to create the Swedish biotechnology supply network on the basis of the innovation or cluster schools is of course impossible to answer, but nevertheless tempting to speculate about. How would all the central pieces of knowledge garnered from completely different areas forming the "biotechnology innovation system"—from low tech industries such as the cellulose industry, the foodstuffs industry and the precision engineering industry—have been managed? How would we handle the fact that only a limited part of all of these academic and industrial pieces of knowledge has been obtained within a certain geographical and operationally limited network, irrespective of whether we set regional or national boundaries to this? With the empirical experiences about how the Swedish biotechnology supply industry has grown up, it is easy to understand the resigned statement from a technician who at "middle management" level has worked on creating financially viable products on the basis of a number of different types of knowledge in a biotechnology supply company: "The question is whether all these investments in systems and clusters in all good will do not herd us into such a small pen that they crush us to death instead of giving us greater viability."

An even more important question from a policy point of view which the cluster school has left unanswered is what role the close geographically defined networks play at times of economic setbacks. All the theoretical models of how geographically defined networks should be built up start from the fact that these structures constantly drive forward the ability for innovation and growth. Then Paul Krugman's advice about trying to occupy as central a cluster role as possible, to "get into the midst of the buzz," appears reasonable. But as soon as we assume that network constellations in the form of clusters can also be hit by stagnation or even decline, then the same advice seems much more dubious. What does it matter if you find yourself in the centre of a geographically defined area with strong network connections when the users of what is produced, whether it is steel or biotech products, can no longer transform this into economic values? The cluster schools provide no directions as to how industrial units which have the greater share of all the connections within both a geographically defined area and an operationally connected network should act when the dynamics do not appear.

Fear of networks

The network pessimist Zygmunt Bauman's words must seem like music to the ears of all those politicians and special advisers in different authorities struggling to create new life in networks structures characterised by stagnation or decline: "All links within the framework of the networks contain from the outset the possibility of disconnection, termination" (*Axess*, 2003, nr 6). How marvellous would it not be for them if the network society meant a transition from fixed to transitory structures, in which a connection quickly and neatly can be uncoupled in favour of another. Then, for example, the small and medium sized sawmills, which are stuck in their dependency on raw materials, could be given the advice to break the connections with the great forestry companies, where they have never been preferential customers. And the suppliers who are stuck with customers in a fluctuating biotech tool supply industry would be recommended to change cluster.

But that networks should be transitory and temporary phenomena is contradicted by a third group of network researchers, the business economists, historians, economic historians and historians of science who have in common the fact that they are working according to STS or IMP, the "letter schools." Apart from the insights that connections between economic actors are presumably as old a phenomenon as economic exchanges themselves, these schools are united by their considerably more modest expectations of the possibilities of administering forth successful networks.

Unlike Bauman and Castells these researchers do not regard the networks as anything new. Whilst the STS researchers emphasise networks as being a centuries-old phenomenon, IMP adds that industrial relations over decades commonly occurs. But beneath the surface of these apparently stable constructs more or less dramatic technical and industrial development projects are being carried on. Not even the fact that companies are wound up and disappear seems to be a way out of the economic networks. Of course connections built up between representatives of different companies and organisations can lie dormant for shorter or longer period, but often blossom up again later to comprise parts of partly new structures.

On the other hand the STS and IMP researchers agree with Bauman's and Castells' view that networks are something quite different from a guarantee of what is positive. The risk of

nepotism and stagnation that is latent in all networks is depicted as follows by historian Ylva Hasselberg:

Social networks are traditionally regarded as forces for positive change. Social contact networks, industrial networks and local development clusters almost have the role of a research “open sesame” gateway into successful business development. Rarely or never is attention drawn to the downsides of strong social networks or the conserving results of the fact that connections between previously dynamic actors slowly stiffen into preserving patterns of practice.¹¹

A similar image is drawn by the IMP researchers Håkan Håkansson and Ivan Snehota in the article “The Burden of Relationships”¹², in which they show how close and strong networks can force industrial actors into a web of demands for maintaining the established deliveries, something which in its turn smothers all forms of force for development. Of course a company or an organisation can dispense with one or another connection, but to change the majority of the network connections which constitute a part of a larger process in which knowledge and physical resources are transformed into economic value, is according to this network model regarded as harakiri.

Networks as the fruit of interaction – and not as an organisation form

Despite this, IMP’s network model cannot be regarded as explicit network pessimism. Rather the message is that connections and networks are something that all companies and organisations are embedded in, whether they want it or not. In this way this network model makes a clean break with classical economic theory’s market assumption, in which autonomy is the rule and connections are the exception. Just as connections and networks can be the greatest obstacle in the development of both private companies and industrial regions, they can also be their greatest force for development.

Everything depends on how well companies and organisations alone or working together with others, succeed in creating combinations of both existing and new, physical and intellectual resources. It is not just a question of developing systems in order to transfer new sophisticated knowledge from the academic to the industrial world, nor the fact that knowledge passively

can “spill over” when companies compete or have other indirect connections. Instead it is about direct interaction, if not to say confrontation, where new knowledge (irrespective of whether it comes from the academic or the industrial world) must be reshaped before it can be put together with existing knowledge and become economically valuable. Because, irrespective of whether the user networks are made up of “low tech” or “high tech” these worlds are characterised by the fact that they are well provided both with knowledge and investments, and not least by commitments vis a vis other users.

The difference between how IMP and other network approaches, such as innovation systems and clusters, define networks can appear to be academic hair-splitting. But the images of networks that these models produce are just as different as the images a photograph gets by changing from zoom to wide-angle. Specific to IMP network thinking is that the focus is placed on how resources, physical as well as intellectual, acquire their value by how they are combined with other resources across company boundaries.

One illustration in normal Swedish may explain it better: A pile of ice on the frozen River Torneälv can have economic value, depending on the network in which it is embedded. If it is to be broken up to provide a fairway for shipping, it is pure cost. But it can also be put into the hands of a number of sculptors and house builders flown in from different parts of the world. If their constructions then fit into the structures built up by a number of tourist offices and travel organisers who sell “experiences,” above all to customers at a great geographical distance from access to ice and snow, then a resource that so far has mostly generated costs becomes central to growth.

When networks and the creation of economic values in this way are traced from the encounters that occur between resources, whether it is in the form of academic knowledge or natural products, network images appear that differ significantly from those produced by innovation and cluster approaches. The geographical aspect appear to be very significant, but above all in the form of how properties in other geographical networks can be combined with one’s own networks. When the geographical location of Swedish companies’ most important customer and supplier connections were traced, there were only a few percent of them that were regional, whilst about 90 per cent were national or international, The knowledge that is wrapped up in the academic world appears to be very valuable, but most often indirect, through education, rather than through the innovations that are created. When, for example,

the sources of innovation for a good 100 central Swedish companies was surveyed, only a few percent of them referred to academic units, while close to 90 per cent had their roots in direct interaction with customers or suppliers¹³

The constant combination of resources that is carried on within and between companies and organisations results in network structures that can be regarded as structural masks of Janus. On the one hand there are the investment-heavy and traditional colossuses, that cannot be changed overnight, despite the insights that they have a number of undesirable effects.

On the other hand there are those networks full of cunning ruses and opportunities which have as yet not been taken advantage of. When new and established knowledge is built up into new products and new areas of use and gives rise to new companies or gives new vitality to established industries, then the networks around these activities are of course incredibly inspiring.

So it is not so strange that networks of this kind induce the desire to intervene and work actively so that certain solutions become successful, or others are knocked out or closed down? The paradox is just that, as soon as one actor—it might be a policy organisation, a company or an authority—succeeds in directing a network, the network dies. Of course the activities can continue in the form of some “organised network,” but in practice it will function as a hierarchy directed within the planned economy, in which one or a few actors’ views of what is the “best” solution will dominate. This applies not merely to all attempts to build up networks around new knowledge with the aim of creating new products, new companies and blossoming regions. It is also a constant danger inherent in all established networks populated by actors who are too strong or dominant.

Thus, creating economically vigorous networks is neither about out-competing surrounding units nor about directing a structure in a particular direction, but rather about keeping a “rainforest”-like process alive, in which actors with differing interests attempt complementary methods of creating value out of resources on which they are mutually dependent.

Notes and references

1 For a more detailed discussion see VTI-projektet, www.kth.se.

2 See Lasse Johansson, *Nittonhundraelva, Nittonhundraåttiosex. Pharmacia 75 år*, 1986, and Alexandra Waluszewski, “A Competing Cluster or Seven Decades of Combinatory Resources?”, *Scandinavian Journal of Management* (to be published in 2004).

3 The same pattern can be distinguished in a number of other industrial networks. That part of the IT world that deals with process management has, for example, important roots in some of the country’s “basic industries” such as forestry and steel, and their suppliers.

4 A closely related variant of innovation systems has been launched by the sociologists Henry Etzkowitz and Loet Leyersdorff in “The dynamics of innovation”, *Research Policy*, vol. 29, No. 2, February 2000. Under the name “Triple Helix” they launched a network approach marked by its focus on “network drivers”. These are private actors who attempt to increase their “competitiveness in the market”. They act as “stage keys” and create “spiral movements” which “lift” the dynamic to new levels. The authors do not go into either exactly how this works or how the interactions contribute to creating economically sustainable growth or improving the economy in existing companies. But, just as in the innovation system approach, theirs presupposes that the resources found in academic and other societal areas are not only technically possible for transference to the industrial world, but can also contribute to an increased economic outcome.

5 See Anders Malmberg, *Klusterdynamik och regional näringslivsutveckling*, 2002, for a detailed survey of the different cluster approaches.

6 Michael Porter, “Clusters and new economics of competition”, *Harvard Business Review*, November–December, 1998, p. 80.

7 Anders Malmberg, & Peter Maskell, 2002, “The elusive concept of localisation economies”, *Environment and Planning*, vol. 34, p. 431.

8 Walter W. Powell *et al.*, *The Spatial Clustering of Science and Capital*, 2001.

9 See Sven Widmalm, “The Svedberg och gränsen mellan vetenskap och teknik” in *Artefakter* (Ed. Widmalm), to be published in 2004.

10 For an overview see Håkansson & Waluszewski, *Managing Technological Development*, 2002, or www.impgroup.org

11 Ylva Hasselberg, *Spindeln i nätet*, 2003.

12 Håkansson & Snehota, “The Burden of Relationships”, *Network Dynamics in International Marketing*, Ed. Peter Naudé & Peter W. Turnbull, 1998.

13 Håkan Håkansson, *Industrial Technological Development*, 1987, and Bertil Markgren, *Är närhet en geografisk fråga?*, 2001.