Sectoral Network Structures as Determinants of Structural Change

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Published in:
Green Industrial Restructuring

Publication date:
2001

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1 Introduction

Sectoral networks can theoretically influence environmental protection in industry in two different ways. Firstly, sectoral networks can influence the direction and pace of structural change in industries (A_1 in Fig. 1 and can consequently have an indirect effect on the environmental stress caused by these industries (A_2 in Fig. 1, i.e. inter-sectoral change). Secondly, sectoral networks can also have a direct effect on environmental stress through their capacity to develop collective strategies to cope with the environmental stress produced in these sectors (B in Fig. 1, i.e. intra-sectoral modernisation). Although the latter is a fascinating topic for analysis in itself, this paper will mainly concentrate on the former (and on A_1 in Fig. 1 in particular). As far as structural change is concerned, it is clear that other factors (such as business strategies, local factors, legal measures, etc.) also play an important role. However, for conceptual reasons, this paper will demonstrate and concentrate on the importance of sectoral networks for structural change.

On the basis of the empirical evidence presented in the case studies of environmentally intensive European basic industries, this chapter will examine whether and, if so, how conclusions can be drawn as to whether sectoral networks provide an explanation for the process of restructuring and decline observed in the industries studied. The following starts by sketching out what is generally understood by "sectoral networks" (Sect. 2). In Sect. 3, the case studies in this volume will be presented in the light of the information they contain on the presence of sectoral networks and the types of structural change they have undergone. In the subsequent section, some speculation will be formulated on the possible relationships between types of networks and the processes of structural change observed (Sect. 4). The paper closes with some general conclusions and suggestions for a follow-up to the project which is more oriented around actors and policy (Sect. 5).

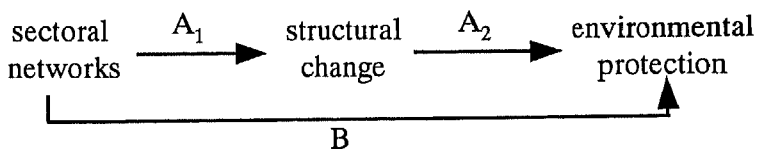

Fig. 1. Possible influences of sectoral networks on environmental protection

2 What are Sectoral Networks?

An extensive body of literature on sectoral networks has appeared, which cannot be reviewed in detail here (Kenis and Schneider 1991, 1996; Alter and Hage 1993; Messner 1995). Generally speaking, three main research themes within the literature can be made out: The first is extensive research which concentrates on the identification, definition, structural and functional *description* of sectoral networks. Secondly, some research attempts to identify and specify the *causes* of their existence and of differences in their structure and functioning. Thirdly, there is research which concentrates on the *consequences* of sectoral networks.

Given the title of the present chapter (sectoral network structures as determinants of structural change), it is the second and third research areas which are particularly relevant here. In the following, the sectoral network is treated as the *independent variable* while structural change is treated as the *dependent variable*. What follows therefore explains in somewhat more detail what sectoral networks are and how they are commonly described in the literature. On the basis of this description, the next section specifies a number of dimensions which are useful for evaluating the degree and type of sectoral networks as identified in the case studies (the first research area). Based on this information it will then be possible to analyse the consequences of the presence and type of sectoral networks on structural change (the third research area). The second research area (the causes of sectoral networks) will only be touched upon in the conclusion.

Structural change can be dealt with by implementing various types of governance structures. In addition to the traditional *market/state* dichotomy, *networks* have been identified as another distinct, significant, and frequently implemented governance mechanism in industrialised countries (see Kenis and Schneider 1996, Hollingsworth et al. 1994, Hollingsworth and Lindberg 1985, Campbell et al. 1991). In the case of structural change[1], governance through sectoral networks means that the parties negotiate among themselves the need for, or distribution of, mutual burdens and benefits from industrial restructuring. Sectoral networks constitute observable and relatively stable groups of organisations formed in alliances or coalitions to promote the collective interests of some or all industrial actors by discussing common interests and by ranking their collective priorities.

Industrial governance by networks differs from state-led industrial governance in the sense that the principal mode of co-ordination is not based on command or direction but rather on negotiation. It also differs from market-led industrial restructuring in that each firm does not merely pursue its own business rationale by concentrating exclusively on "internal restructuring" (see Ruigrok and van Tulder 1995). In contrast, networks are horizontal systems of co-ordination between firms, public administrations, and associations.

[1] Sectoral networks are understood here as those affecting structural change and industrial restructuring. It should be noted, however, that a substantial portion of the sectoral network literature deals with other sectors than the industrial, e.g. the health sector, the welfare sector, etc.

They tend to be more stable than market governance, even though this stability is not imposed from above. Instead, shared norms, attitudes of trust, considerable knowledge about and respect for one another stabilise the relationships between the actors. Normative mechanisms, negotiations, and socialisation within the group co-ordinate relationships and discourage opportunism over relatively long periods. Here is a governance mode in which medium- and long-term policies can develop to cope with the structural problems of a specific industry.

Take, for example, the problem of over-capacity in an industry which produces basic goods and is exposed to all the pressures of the global market. Such industries are characterised by low technological complexity and mass production. Large economies of scale and significant fixed costs also tend to be common characteristics. In these industries, full capacity utilisation is the prime condition for competitiveness. Consequently, when firms are confronted with high fluctuations in demand they are almost immediately confronted with high risks. Much is at stake: many workers stand to lose their jobs and investors stand to bear huge losses. During a period of recession, market-led industrial policies in such sectors therefore lead to the closing down of plants – eventually even to the complete disappearance of an industry in individual states.

In order to prevent or overcome the negative consequences of market-led industrial restructuring (such as massive unemployment and large-scale capital depletion), a directly state-led industrial policy is often the preferred option. In most cases, such a state policy amounts to subsidising industries in order to save jobs. However, such actions often increase the risk of impairing the long-term structural adaptability of that particular industry at the same time.

Alternatively, in order to compensate for the shortcomings and self-destructive elements of the market – and, at the same time, pre-empt state intervention – firms within an industry can organise themselves and join together to cope with an impending crisis. In such a situation, they agree upon mutual rules of conduct, linking their own individual autonomy to their medium- and long-term collective interests. Networks put actors into a situation where they are not forced to react so rapidly, more flexible, and less constrained by disruptive developments. This offers a governance mode through which they can better adapt to changing circumstances. Industrial restructuring through networks is based on intensive integration and co-operation between the parties concerned. The actors explicitly negotiate and define rules of conduct, even though they do not necessarily codify them in contracts or other formal agreements. These arrangements make possible the design and implementation of medium- or long-term policies for greater competitiveness and facilitate collective decisions by the firms involved in high-risk investment projects.

In addition to the *functional* properties described above, sectoral networks can also be described in structural terms (Atkinson and Coleman 1989, van Waarden 1992, Messner 1995, Alter and Hage 1993, Kenis and Schneider 1991). In general, i they include "a few or not too many" (Marin and Mayntz 1991: 17) *actors* from different backgrounds (private, public, non-profit); they are characterised by hori-

zontal, informal and decentralised *relationships*; they can be distinguished by *rules of conduct, actor strategies* as well as *power structures* between the actors.

3 A "Sectoral Network" Evaluation of Ecologically Intensive European Basic Industries

The case studies in this volume will now be evaluated as to the evidence they contain regarding sectoral networks as a driving force in structural change. As a first step, a table has been drawn up, summarising information on the properties of sectoral networks and on structural change in the ten different sectors. A second stage speculates on possible relationships between sectoral networks and structural change (Sect. 4). The types of *structural change* summarised in Table 1 are primarily those concerning the type and degree of decline observed in the different industries. These types of structural change seem to be the most significant in the context of this volume, as they also directly influence the degree of environmental stress produced by these industries.

As far as summarising the properties of *sectoral networks* is concerned, it should be stated clearly at the outset that it is not possible to provide a comprehensive or exhaustive picture of the various sectoral networks. The main reason is that the data-collection instrument on which the different case studies were based was not explicitly directed at assembling the sectoral network data referred to in Sect. 2. Consequently, evidence on sectoral networks must rather be implicitly deduced and may on occasion be incomplete. In order not to run up against the "law of the instrument"[2], the case studies will be evaluated flexibly, using somewhat general categories. Attention will therefore be paid to some basic and minimal components which every sectoral network comprises: the number and types of actors involved, the extent and types of relationships between these actors and the degree and type of collective strategies produced through these relationships.

Before turning to some speculation about possible relations between certain types of networks and the processes of structural change observed, some general remarks on two points: firstly, the degree and type of structural change observed across the different sectors and, secondly, the importance and significance of sectoral networks across these sectors.

As far as structural change is concerned, it is clear that a fall in production and employment has been observed in all sectors over the last two decades. However, there are some important differences regarding the absolute pace and extent of the decline. What is even more important for the present chapter, however, is that there are significant differences between the rates of decline in different sectors. In some cases, the decline fits well into the general picture of structural change

[2] "Give a small boy a hammer, and he will find that everything he encounters needs pounding. It comes as no particular surprise to discover that a scientist formulates problems in a way in which requires for their solution just those techniques in which he himself is especially skilled" (Kaplan 1964, p. 28).

across Europe (e.g. aluminium in Germany and fertilisers in Austria). This is an indicator that market forces and *internal restructuring* were the principal governance modes at play. In other cases the decline is atypical (e.g. coal in Germany). It is especially these atypical structural changes which point to the fact that there is something else at work. The important question now is whether what is at work here is the sectoral network and if so, how it produces these atypical situations. Before turning to an analysis of this relationship in the next part, the first question is where evidence on the existence of sectoral networks is to be found.

The best way to identify sectoral networks is by first concentrating on the evidence regarding "sector integration" (see Table 1). In cases where specific relationships (such as information exchange, coordination, co-operation, etc) exist between a differentiated set of actors, occasionally leading to collective sectoral strategies, there is strong evidence for the presence and functioning of sectoral networks as a governance structure. Based on these criteria, it can be assumed that sectoral networks exist in the chlorine and cement industries and in the iron and steel sector in Germany, as well as in the oil refineries sector in France.

4 The Relationship Between Sectoral Networks and Structural Change

In what follows, a number of observations are made as to whether and how sectoral networks have been influencing structural change in the cases studied. These observations are of a somewhat general nature and should be treated with some caution, for two reasons. In the first place, as mentioned before, the data available on structural change in the case studies are limited. Secondly, even if such data were available, a thorough analysis would still be problematic, since the study of the consequences of sectoral networks is still a very underdeveloped area in the literature. As a result, few analytical tools or concepts are available to study this relationship. Nonetheless, a number of clear indications can be found.

Firstly, in the absence of sectoral networks, structural change leads to a faster and more radical decline in the number of jobs and in production capacity. This observation is based on the fact that such sectors are governed primarily by the mechanism of the market, which will push towards internal restructuring.

Secondly, structural change in the context of sectoral networks can lead to outcomes which better safeguard production capacity and thereby often employment as well. This can be deduced from the fact that sectoral networks, if they develop, will aim primarily at protecting the industry from certain unexpected events. Sectoral networks are often effective devices for *internalising* or *externalising* uncertainty (see Kenis 1992). This phenomenon, an atypical decline due to the presence of sectoral networks can be observed in the case of the French Oil refineries. Here, co-operation in cutting surplus capacity developed on the sectoral level. Or, in the case of German coal mining, sectoral networks developed which led to an atypical (for Europe) slowing of production.

Table 1. A "sectoral network" evaluation of ecologically intensive European basic industries

sector study	sector differentiation		sector integration		type and degree of structural change
	number of firms	*other actors involved*	*types of relationships*	*collective strategies*	
chlorine Germany		products licensed by the state; extensive state regulation	members of one association; consumer relations	division of labour for final products	drop in production at the beginning of the 1980s and 1990s; minimal drop in employment; production of CFCs and chlorinated solvents halted
fertilisers Austria	very high concentration (3 main firms)	fertiliser tax introduced in 1986 and abolished after Austria's entry in the EU; regulations on fertiliser use			between 1974 and 1995 a 35% fall in production and a general decline in fertiliser use (less agricultural land, increased organic farming, etc.)
aluminium Germany	5 primary and 11 secondary aluminium companies	environmental regulations; no state protectionism			slight decline in production; the number of primary aluminium companies has halved, the number of sec. aluminium companies has fallen slightly since the 1970s
cement Denmark	1 company (since 1980)	zoning regulation, health protection and recent environmental regulations; Northern Jütland County Council (environmental authority)			same level of production in 1996 as in 1960, with falls in 1981 and 1990
cement Austria	9 companies: 3 of them make up 2/3 of the turnover; multinationals have recently entered the market	government import regulations; construction sector; Eastern European cement producers; government environmental regulations (since 1993)	negotiations between government, construction and cement industries and between Austrian and Eastern European producers on export self-restriction	an Austrian cement cartel until recently; cartel was transformed into *Strukturkrisenkartell*	39% decline in production between 1974 and 1996, and a fall in the number of companies and production sites; increased import pressure since the 1990s; increased competition from multinationals; decline in employment (54% since 1974); decline in cement prices

coal mining Germany	3 enterprises in 1997	government import and other regulations; state subsidy of production; regulated by the European Union; strong trades unions; importance of regional actors	close links between companies and regional politics; decisions mostly compromises between all actors	sustained coal production despite its not having been competitive since the 1950s	drastic decline in production since the mid-1950s (by 2/3); drastic decline in employment since the mid-1950s (by 85%); decline in number of enterprises (from 32 in the 1960s to 3 in 1997)
steel Germany	22 enterprises in 1996	state subsidy; political regulation only since the beginning of the steel crisis; environmental regulation	co-operations dating back to the 19th century (e.g. horizontal and vertical integration, specialisation); mergers	co-operation on better utilisation of capacity (since the early 1960s)	decline in production between the mid-1970s and early 1980s; stagnant since then; decline in employment since the 1960s (by more than 70%); decline in the number of enterprises; over-capacity; diversification towards high-quality and high-grade steel
steel Luxembourg	1 company		(not relevant since only 1 firm involved)	(not relevant since only 1 firm involved)	mining abandoned (since 1981); pig-iron: from 25 production sites in 1970 to none in 1997; crude steel: halved, finished steel: slight drop (since 1973); drastic decline in employment since 1974 (by 79%)
oil refineries Netherlands	8 enterprises	a large number of actors have been involved in the formulation of the NEPP (National Environmental Policy Plan)	many actors are traditionally involved in public decisions	climate of tolerance and consultation	some decline in the 1970s, significant decline in the early 1980s; recovery and increased production since 1983
oil refineries France	13 refineries (six of which control the largest share of the market)	government price control until 1985; a manifestly state-directed energy policy; associations (U.F.I.P., Europia, E and P); the EU Council; *L'Institut Français du Pétrole*; French Ministry of Industrial Relations; *Direction des hydrocarbures*; Ministry of Environment; ADAME	agreements on co-operation between companies (e.g. on distribution activities, capacity reduction); negotiations increasingly taking place	a "petrol charta" was in use until 1992; joint distribution activities; joint negotiations and action on reducing over-capacity	employment has halved since 1975; production capacity halved between 1976 and 1989; it has stayed at the same level since 1989; 37 refineries have been closed since 1977

Thirdly, sectoral networks do not necessary have to concentrate on conserving existing production facilities and workforces, but may develop collective strategies which help to facilitate processes to minimise the economic and social impact of structural change. For example, sectoral networks could facilitate the restructuring of the sector in such a way that existing resources (production facilities and personnel) are invested and redirected towards other productive areas.

Finally, there is some evidence that the influence sectoral networks have on structural change depends to some extent on how far the sector is "closed" or "open". Sectoral networks in "closed" sectors are generally thought to be counterproductive for an industry's successful long-term structural adaptability, whereas sectoral networks in "open" sectors facilitate this adaptability (see Traxler and Unger 1990). The reasons are that, in closed markets, institutional sectoral networks will tend to reduce competition between firms and may develop into "quasi-cartels". In open sectors, on the other hand, pressures emanating from the global market play an important role. In such situations, sectoral networks will facilitate modernisation and innovation within their sectors.

These various findings as to the effects of sectoral networks on structural change, although they represent only a few examples, indicate the complexity of the relationship. While the absence of sectoral networks generally seems to lead to a faster decline in production capacity, the effects of the presence of sectoral networks are much more ambivalent. Sectoral networks can stabilise or slow down a decline in production, can lead to a decrease of, or even a shift in, production and can affect long-term structural adaptability positively or negatively, depending on the characteristics of the sector. As a result, on the basis of these findings, it is impossible to give a general answer to the question of whether – in those cases where sectoral networks exist – they lead to a better or worse situation from an environmental perspective. The answer to this question is very much contingent on the type of structural change produced by the sectoral network in place. The fact that no straightforward correlation seems to exist between the presence of sectoral networks and the direction of structural change might be considered rather disappointing, from both a theoretical as well as a practical point of view. If, however, we examine the logic behind this finding in somewhat more detail, interesting new perspectives emerge, with consequences for further research.

5 Conclusions and Suggestions for Future Research

This chapter set out to analyse the relationship between sectoral networks and the direction and pace of structural change in industrial sectors. The assumption was that the direction and pace of structural change ultimately influences the environmental stress produced by these industries. An evaluation of the sectoral networks as well as of the direction and pace of structural change in the industries studied in this book shows that there is indeed variance between industries in respect of these two dimensions. Some industries are characterised by a high pace of industrial

change, others by rather moderate change; in some industries, sectoral networks seem to constitute an important governance structure, in others they are not present at all. At the same time, however, another important finding is that the two variables (i.e. structural change and sectoral networks) hardly correlate with one another. At first sight, this conclusion might appear disappointing. A closer look reveals, however, that there is a certain logic to it, and this logic becomes especially important for the formulation of future research and has implications for policy.

The above findings are logical and consistent if one takes into account an important characteristic of sectoral networks, i.e. that they are non-*specialised* governance structures. This means that they do not concentrate on a specific concept of governance but must be seen rather as structures which combine a variety of such concepts. In contrast, markets or power structures are considerably more specialised, and consequently bind the actors to a more limited spectrum of alternatives (e.g. short-term target maximisation in the case of market competition). It is especially during periods of radical change that specialised governance structures can be seen as somewhat disadvantageous. In contrast, the availability of a greater spectrum of alternatives – as is the case with network and similar structures – increases flexibility for actors and allows for alternative paths of action. It is precisely this property of governance forms, i.e. the degree of specialisation, which explains why consistent outcomes can be expected from cases where the market or the state is the principal mode of governance and why outcomes can vary greatly between each other in cases where sectoral networks are the governance structure. This is mainly the result of the flexible character of sectoral networks as a form of governance.

On the basis of this conclusion, two main directions for further empirical and theoretical research can be mapped out. Firstly, far more detailed research must be conducted on the relationship between sectoral networks and structural change. Since sectoral networks clearly have an influence on structural change, but not one which is straightforward, additional research is necessary. This research should concentrate on the relationship between specific characteristics of sectoral networks and the outcomes these produce. It is obviously the characteristics of given sectoral networks which influence the outcomes they produce. In this research, different sectors in different countries must be analysed in detail in the two main dimensions specified, i.e. differentiation and integration. Only such detailed research can give indications as to which specific types of outcome (e.g. increased, decreased or stagnant production) result from which types of sectoral network.

A second line of research might be to concentrate rather on the direct influence of sectoral networks on the environment alone (see B in Fig. 1). As argued above, given the fact that sectoral networks as governance forms are characterised by the fact that they combine a variety of approaches and interests, it seems obvious that they are the ideal device by which such differing and often contradictory demands as efficiency, employment, environmental protection, etc. can be met. There is already a number of studies which have shown that sectoral networks can indeed

play an important role in this respect (cf. e.g. Grundmann 1997, Gray and Hy 1986, Rinquist 1994). The cases covered in this volume could also be very valuable tools for research analysing these types of relationships.

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