Actor-networks and the evolution of economic forms: combining description and explanation in theories of regulation, flexible specialization, and networks

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Received 10 June 1993; in revised form 14 April 1994

Abstract. Declarations of societal shift, economic transition, and the dawning of a new era have now become commonplace in social science, particularly in the analysis of economic forms. In this paper, three influential accounts of economic change are examined and are found to be overwhelmingly concerned with identifying new orders, paradigms, or modes of accumulation. First, regulation theory is described. Although this perspective is valuable in its focus upon institutional ensembles and interrelations, it lapses all too easily into structuralism; that is, these institutional ensembles can be explained by their structural 'coupling' to the mode of production and the mode of regulation. Second, flexible specialization is considered. Here again the explanation of new industrial forms is distinguished from their description by the use of 'ideal types'. These types define the contours of the new era. Last, networks are also identified as the dominant organizational form of the post-Fordist era. The argument proposed here is that networks are not new and are insufficiently distinct from other forms of organization, yet they do help to focus attention on network analysis. Drawing upon the work of actor-network theorists, such as Callon, Latour, and Law, I argue that networks must be analyzed from within; that is, we should seek to follow network builders as they weave together heterogeneous materials. Thus, explanation emerges only once description has been pursued to the 'bitter end'. It is from within the processes of economic change that our own accounts must be constructed, and this militates against theatrical declarations of new orders, eras, etc. We must explain by using the descriptions of network construction and not by recourse to some underlying historical logic.

Introduction
As Smart notes in the introduction to his book Modern Conditions, Postmodern Controversies, "change constitutes an increasingly prominent aspect of modern life. Indeed it might be regarded as the defining feature, for modern times are generally held to be changing times" (1992, page 1). He identifies a number of commentators who seem to have little doubt that the present era constitutes a significant time of transition: "Ideas abound concerning the 'end of history' (Fukuyama), the 'end of the social' (Baudrillard), as well as the end of industrial society and the promise of the Enlightenment (Touraine)" (page 1). Smart suggests, however, that we need to exercise caution in our analysis of this transition and quotes Foucault, who says

"I think we should have the modesty to say to ourselves that, on the one hand, the time we live in is not the unique or fundamental or irruptive point in history where everything is completed and begun again. We must also have the modesty to say, on the other hand, that ... the time we live in is very interesting; it needs to be analyzed and broken down, and that we do well to ask ourselves, 'What is the nature of our present?' ... With the proviso that we do not allow ourselves the facile, rather theatrical declaration that this moment in which we exist is one of total perdition, in the abyss of darkness, or a triumphant daybreak, etc. It is a time like any other, or rather a time which is never quite like any other" (Foucault, 1983, page 206, quoted in Smart, 1992, page 6, emphasis in original).
Despite such pleas for restraint, recent years have seen a marked tendency to talk in terms of 'breaks', 'transitions', 'turning points', etc. According to one commentator, "We appear to be in the midst of a transition from one form of social and economic organization to another and it is quite likely that a period of extensive and often disruptive experimentation and restructuring is inherent in this process" (Schoenberger, 1988, page 245). Contemporary theoretical analyses in the post-Fordist literature attempt to excavate the key forces governing this shift from one societal 'form' to another and seek to discern the shape of the new 'order'. Yet, although pronouncements are made on the death of one order and the rise of another, there is a simultaneous pulling back from 'grand theory' in social science. In the wake of the challenges mounted by postmodernism, post-Marxism, poststructuralism, postfunctionalism, and the like, social theory has been scaled down. It is now 'local' knowledge, Western knowledge, and simply one of a number of competing perspectives in the world. There is a curious incongruity here between 'theatrical declarations' of shifting epochs and the rather nervous, though admirable, attempts to find a new role for social theory in the light of the (re)discovery that the world is made up of many different (and possibly divergent) lifeworlds.

I wish to argue here that the discourse surrounding post-Fordism has been, in Foucault's terms, insufficiently modest. The general argument being proposed is that accounts of societal shift are inherently 'structuralist'. By this I mean that they have a tendency to explain social processes by reference to some preexisting account of epoch-like change. By focusing on societal transformation these explanations ultimately regard action and process as the consequence of structural determination. It will be argued that it is more appropriate to see structural change as the outcome of a range of complex social processes. These cannot be properly described (or explained) by a priori accounts of structural transformation.

The two most influential perspectives in the post-Fordist literature are regulation theory and flexible specialization. A brief review of each will be presented here and both will be critically assessed in order to illustrate the problems associated with 'macro' theorizing of transitions, new regimes, orders, etc. However, it is also recognized that regulation theory and flexible specialization analyses have yielded important insights into the complexity of economic forms and their relationships to

Law (1994) has recently provided four principles which would lie at the heart of a 'modest sociology'. These are:

(a) **Symmetry**: that is, the need to assert that "everything deserves explanation and, more particularly, that everything that you seek to explain or describe should be approached in the same way ... you don't start by assuming that there are certain classes of phenomena that don't need to be explained at all" (pages 9-10);

(b) **Nonreduction**: entailing abandoning reductionism whereby a line is drawn between two classes of phenomena, that is, those that drive and those that are driven; a modest sociology will be **relational** with "no privileged places, no dualisms and no a priori reductions" (page 13), it will not distinguish between the drivers and the driven before it starts although it will allow that such a distinction may emerge as an effect;

(c) **The social must be seen as a recursive process** rather than as a thing, and social processes are not driven by what lies outside; they drive themselves;

(d) "Act unto others as you would have them act unto you. Or better, act unto yourself as you would unto others" (page 16). The last principle is **reflexivity**, an extension of symmetry in that we are no different from those whom we study: "we too are local and recursive effects, and have nothing to do with immaculate conception or any other form of privilege" (page 16).

Law goes on to put these principles into effect in the study of a laboratory. No attempt will be made in what follows to adhere slavishly to these, although it is hoped that the analysis presented in this paper largely accords with Law's modesty.
noneconomic institutions. This becomes clearer when we turn to examine a third approach, the network paradigm, which can be seen as emerging from regulation theory and the flexible specialization literature. Under this heading a rather eclectic body of work will be considered which can by no means be characterized as a distinct school of thought. What these accounts have in common is the view that new network forms of industrial organization are becoming increasingly dominant. However, I wish to distinguish the network paradigm as it is currently being used in economic geography from network analysis. The latter is proposed as an approach with the potential to address many of the concerns now high on the agenda of academic enquiry but in a way that negates the need to talk about structural shift. In short, my argument is that network analysis may be new but networks are not.

The form of network analysis being proposed here draws heavily upon the actor-network approach of Callon, Latour, and Law, developed most notably in the sociology of science and technology. Their work is used to demonstrate how the concerns of regulation theory, flexible specialization, and the network paradigm can be recast within a framework which ties together the 'micro' and the 'macro', and action and structure, in a nondeterministic and nonreductionist fashion. It is argued that economists and sociologists should try to restrict their explanations to that which can be supported by description, and that descriptions should emanate from studies of network construction. That is, we should not seek to stand apart from those we study, in the belief that social science has privileged access to the world. Neither should we propose that there are certain phenomena, such as the capitalist mode of production, classes, or interests, that do not need explaining at all. Even more importantly, we should avoid using these phenomena to explain those events and processes that we can see. As I hope to show, putting these simple conceptual and methodological proposals into effect will entail abandoning some of our most treasured beliefs.

**Regulation theory**

The regulation approach has been particularly influential in charting the shift from Fordism to post-Fordism and is becoming widely used in a variety of fields in social science. It has proved attractive because it is seemingly able to account for structural stability and shift yet also to speak of contingency and action. It retains many of the basic tenets of Marxism yet remains cogniscent of post-Marxist critiques. For reasons of space, the regulation approach will be summarized very crudely here (for fuller summaries, see Dunford, 1990; Jessop, 1990; Tickell and Peck, 1992).

The starting point for the regulationists (notably Aglietta, 1979; Lipietz, 1985; 1987) is an analysis of the fundamental social relations of capitalist societies. The central question they address is, 'how, if such societies are riven by class antagonisms, can their reproduction be achieved?' The answer to this paradox is proposed as the 'mode of regulation', that is, structural forms which allow for the expression and containment of social conflict, facilitating the cohesion of capitalist accumulation in the medium term. The regulationists thus deny that the capitalist mode of production is comprehensible in terms of a single set of laws that remain unchanged; rather, they discern a succession of phases, each distinguished by certain historically developed, socio-institutionally defined, structural forms that give rise to distinctive economic trends and patterns (Brenner and Glick, 1991, page 47).

In order to understand how capitalism 'works', the regulationists propose the concepts of 'regime of accumulation' and 'mode of regulation'. The first of these describes the medium-term to long-term stabilization of the allocation of production between consumption and accumulation. The regime of accumulation is made
up of two components: (1) the ‘accumulation system’, referring to conditions of production, such as the amount of capital invested and its distribution amongst the different production sectors, and (2) the ‘mode of social regulation’, an ensemble of regulatory mechanisms which guarantee the reproduction of the accumulation system. The second component “consists[s] of habits, customs, social norms and enforceable laws which create ‘regulatory systems’. These in turn ensure that individual behaviours are integrated within the overall schema of capitalist production, thus mitigating the conflict inherent in capitalist social relations” (Tickell and Peck, 1992, page 192).

A regime of accumulation, therefore, identifies a systematic organization of various elements within the social field: the organization of production, income distribution, exchange of products, and consumption (Dunford, 1990). Changes within these elements are coordinated so that trends in productivity are linked with changes in the distribution of income and those in the field of consumption. The “virtue” of this approach “is that it insists we look at the total package of relations and arrangements that contribute to the stabilization of output growth and aggregate distribution of income and consumption in a particular time period and place” (Harvey, 1989, page 123). It is thus a ‘macro’ account and concentrates on how ‘micro’ phenomena are ‘pulled’ into place within particular regimes.

The time period for the stabilization of accumulation regimes depends on the role of the mode of regulation. As Lipietz (1987, pages 33–34) argues, if a regime is to reproduce itself for any length of time “there must also be institutional forms, procedures and habits which either coerce or persuade private agents to conform to its schemas”. However, crises may emerge as a mode of regulation shows itself to be unsuited to an accumulation system. This may be because the emergence of a new regime is being held back by an outdated form of regulation or because the regime has itself reached the limits of its potential. To overcome a crisis, a new relationship between accumulation and regulation must be established. The crisis, the dislocation between one regime and its successor, may be a long drawn out affair, or a new coupling may be established within a short space of time. For Lipietz (1987, page 15) the important point is that “the emergence of a new regime of accumulation is not a preordained part of capitalism’s destiny”. New regimes are established through struggle, they are “chance discoveries ... and if they are for a while successful, it is only because they are able to ensure a certain regularity and a certain permanence in social reproduction”. (2)

Although regulation theory draws much of its inspiration from classical Marxism (as well as post-Keynesian general equilibrium theory and the Annales school of the longue durée) it has explicitly sought to avoid the problems of functionalism and teleology which have dogged structural Marxist narratives in the past. Lipietz, for

(2) As is well known, the regulationists have identified two regimes of accumulation—the extensive and intensive—and two modes of regulation—the competitive and the monopoly. These can be discerned in successive phases of development in Western capitalism. The first, apparent through the late 19th century, lasting until the First World War was founded on expansionary growth in new industrial sectors (coal, steel, chemicals), British international hegemony, and the Gold Standard. Following the Second World War the contradictions in this extensive accumulation regime were resolved by the monopoly mode of regulation. Here intensive production in the lead (consumption) sectors, via productivity increases, allowed real wages to rise while the state intervened to create the appropriate conditions for mass consumer demand. During the early 1970s this regime entered a period of crisis heralded by the ‘oil shock’, which led to a fall in levels of profitability and limits on wage levels and thus on demand, and we are now poised on the edge of the post-Fordist era although its precise complexion is still hard to discern (Peck and Tickell, 1992; Tickell and Peck, 1992).
instance, makes this explicit when he argues that analyzing the resolution of the contradictions of capitalism within stable modes of regulation should not be taken as meaning "that if it works, it's because it has been designed to work, that the 'function' of a mode of regulation is to make a regime of accumulation work" (1987, page 16). Rather it is simply that a given regime of accumulation and a particular mode of regulation stabilized "because they allowed social relations to be reproduced for a certain length of time without a crisis arising". At best, he argues, we can talk about an a posteriori or a metaphoric functionalism, but, by focusing on institutional ensembles, networks, procedures, and strategy, the regulationists embrace contingency and diversity. All these phenomena must be taken seriously in their own right and cannot simply be understood "using the pass key of a historicico-philosophical theory whose main virtue is that it is supra-historical", says Lipietz (1987, page 12). However, this does not mean abandoning any sort of 'scientific' understanding of history; it means paying closer attention to the principles of dialectical materialism. These are: "(1) the study of the regularities which past struggles have imposed upon human relations; (2) the study of the crises which arise within those regularities because contradictions are only provisionally resolved; and (3) the study of the changes within those regularities that result from humanity's on-going struggles for or against freedom" (Lipietz, 1987, page 12, emphasis in original).

Despite this commitment to open-ended theory, some critics have argued that the charge of structural functionalism is not easily dismissed (Clarke S, 1988) and that the methodological statements of intent sit uneasily with the concepts of regulation theory. Hirst and Zeitlin (1991) find three main sets of problems. First, they ask, what is to be regulated in this approach—"Is it the general contradictions of capitalism as a mode of production ... or the specific dilemmas of an individual regime of accumulation?" (page 20). This question is important because, in practice, regulationist analyses tend to concentrate on the contradictions of capitalism by privileging a single component of the system—the wage-labour nexus or the form of competition—to characterize the whole accumulation regime. Furthermore, "most regulation school analyses reason in practice as if the persistence of the objects of regulation could be accounted for by the development of a smoothly functioning mode of regulation" (Hirst and Zeitlin, 1991, page 21). Second, there is a set of problems associated with the relationship between theoretical abstractions and empirical cases. Hirst and Zeitlin question whether the historical instances of accumulation regimes can be distanced to any significant extent from the structural properties of capitalism and, therefore, whether specific institutional ensembles can vary to anything more than a limited extent under a given mode of regulation. This is evident, they claim, in discussions of post-Fordism, where regulationists display a tendency to fall back on the general tendencies of capitalism as a mode of production to explain the likely shape of the 'new order'. Last, despite a rejection of classes as collective subjects constituted in the mode of production, regulationist analyses seem to be overwhelmingly concerned with class struggle. However, little consideration is given to the formation of these and other social actors (see also Graham, 1992).

An interesting account of how regulation theory might be steered around these pitfalls is provided by Jessop (1990). Drawing upon the 'realist' mode of inquiry,

(3) I should make clear that Jessop's reading of regulation theory is not to be taken as representative of all work under this heading. It may be that many authors would not subscribe to the redefinition of concepts and methodologies that Jessop provides. The point is that Jessop makes a sophisticated attempt to account for many of the underlying assumptions of regulation theory. In the main, these remain implicit and unexplored.
he argues that "our knowledge of the world is never theoretically innocent" (page 163) and that to begin with a simple conception of the real world would lead to empiricism. Understanding 'concrete reality' involves a shift from a simple superficial category to an account which is complex, composed of the 'underlying real mechanisms', connecting them to the actual empirical components of research. In the course of 'scientific inquiry' these concrete outcomes come into increasingly complex articulation with the underlying concepts. There is a "dialectical interplay" between the abstract and the concrete, leading to the development of concepts as the world comes to be understood: "Thus theoretical argument moves between hypothetico-deductive and experimental phases so there is a continual, dialectical transformation of concepts" (page 164). This theoretical enterprise is, therefore, conceived as open and in continual dialectical interplay with concrete reality.

Jessop goes on to argue that the basic forms of the capital relation do not determine the course of accumulation, for this depends on a variety of institutional forms, social practices, norms, etc. Specific modes of regulation are historically contingent and, importantly, modes of regulation should not be conceived as merely functioning in relation to pregiven objects of regulation (such as the commodity form, laws of profit, and the wage relation). Instead "modes of regulation and their objects would be seen as structurally coupled and historically co-evolving and no a priori primacy would (or could) be accorded to one or the other" (page 186). Here the objects of regulation gain only a relative fixity through regulatory practices, becoming definite objects of regulation. Thus regulation is unstable, partial, complex, and changing. In this way Jessop seeks to demonstrate that "there cannot be a radical break in the spiral movement of analysis as one proceeds from the abstract and simple to the concrete and complex—with natural necessities on one side, contingent events on the other. For any natural necessities of capitalism must be recursively and tendentially reproduced through social practice, articulated more or less closely as moments in specific modes of regulation. In this sense these natural necessities are rational abstractions: there is no logic of capital, but a series of logics with a family resemblance, corresponding to different modes of regulation and accumulation strategies" (1990, page 189).

These 'logics', and corresponding modes of regulation, open up a plurality of approaches within any accumulation regime. The regulatory ensembles may vary between, and even within, nation-states. Furthermore, an accumulation system on a world scale will always be emergent, contingent, provisional, and unstable.

If systems of accumulation and regulation are as precarious as Jessop allows, then what is the relationship between structure and agency or (as Jessop prefers) strategy? In line with his general 'balancing act' Jessop believes "the reproduction of capitalist societies is neither a fateful necessity nor a wilful contingency" (page 194) and "there can be no one-to-one correspondence between structure and strategies" (page 195). Instead, we must examine issues such as "institutional inertia" and "strategic selectivity" (page 196) in order to show the complex interaction between struggle and structure. Jessop cites how institutional ensembles create "significant barriers to a general attack on the capital relation by fragmenting and disorganizing opposition and resistance and/or channelling it along particular paths where it threatens less harm to the core institutions of capitalism" (page 196). Thus there is room for struggle (though again the emphasis seems to be on classes) within certain structured formations; the outcomes are not predetermined, but some are made more likely than others.
Although Jessop strives to establish dialectical relationships between underlying structures, institutional forms, and social action, in this respect Bonefield (1993) considers his account to be seriously flawed. Bonefield discerns a number of 'gaps' between, on the one hand, abstract laws, metaforms, and a determinist conception of capitalist development and, on the other, conjunctures, variables, accumulation strategies, and contesting forces. The former group are, in Bonefield's view, either determining or indeterminate: they explain either everything or nothing. He concludes that

"... his argument comprises a vicious circularity of presuppositions. He presupposes structural selectivity as conditioning the action of social subjects and then he presupposes that structural constraints emerge from the strategic conduct of social subjects. Each is supposed to make sense of the other. In other words, the real world lies outside theory's grasp. Jessop's 'realist ontology' turns against itself inasmuch as it offers no concept of the real ... If one were to follow Jessop, all theory would be able to achieve is to say that the real world is changing within a framework of structurally defined parameters whose concrete implications defy conceptualization" (pages 41-42).

According to Hirst and Zeitlin (1991), such tortuous attempts to steer regulation theory away from economic determinism, historicism, and functionalism only make sense within a body of theory which is founded on a structuralist and historicist conception of Marxism (exactly the type of analysis the regulationists were trying to avoid). If the starting point of the analysis is certain fundamental features in the mode of production, and the existence of certain tendencies in capitalism, then how are these to be allied to conjunctures, crises, and struggle? “The answer it appears is to postulate levels of analysis, and to use the higher levels of generality to explain the specific conditions which are the only real states of existence of the capitalist system; capitalism exists not as a generality but as specificity” (page 28). If the starting point is the contradiction in the mode of production then concrete economic conditions must resolve this crisis. This derives from the view of society as a ‘totality’ (see also Graham, 1992). When the capitalist mode of production is proposed as the underlying determinant, levels of abstraction are needed because this totality is simply not present in the concrete (if it were then it would necessarily be functionalist) so it must withdraw to a higher level of abstraction. According to Hirst and Zeitlin,

"The problem with totalization is that it stakes too much on the validity of concrete generalities. It is forced to limit possible phenomena to fit in with the general principles of social organization that make social relations consistent wholes. The problem with regulation theory is not its commendable drive to break away from the worst features of totalizing Marxism; rather it consists in the belief that they can be purged by using the device of levels of abstraction while retaining elements of the concept of mode of production ... Only a complete break with classical Marxism would resolve these problems of evidence, but that would explode the general problem of 'regulation' in terms of which these questions of evidence arise" (1991, pages 30-31).

Despite the efforts to move the theoretical framework away from the totalizing discourse of structuralist Marxism, in the end the struggle to introduce contingency, indeterminacy, and process merely serves to highlight how far the ensuing account is tied to its initial assumptions. It sets out to explain the continued reproduction of the capitalist mode of production, which is deemed to be inherently 'crisis ridden'. In order to account for this reproduction a range of phenomena (collectively understood to be the mode of regulation) must be found which allow the stabilization of
particular accumulation regimes. Thus any account of why these phenomena emerged, and were successfully stabilized, must eventually pay heed to the requirements of the accumulation regime (which in turn is tied to the mode of production). In order to escape the quite explicit functionalism and determinism of this position, various levels of abstraction are proposed and these are considered to be in 'dialectical interplay' with one another, but the balance of determination is still weighted on the side of structural requirements (for instance, Jessop's notion of structural selectivity). Moreover, as regulation theory moves closer to multiple logics of capital, strategies, contingency, and provisionality so it gradually loses its ability to explain. It is only by remaining tied to its initial assumptions that it can retain any explanatory force, otherwise it runs dangerously close to mere description. There is thus an unbridgeable gap between the levels of explanation and description, one which the most sophisticated method of theorizing is unable to span.

Regulation theory is thus a 'macro' account in which the 'micro' level is ultimately pulled into place and, as an explanatory framework, it is deeply flawed. Nevertheless, the priority attached to the study of organizational norms of production, relationships between branches of the economy and political institutions, management practices, patterns of consumption, and the codification of social norms, is extremely helpful in thinking about networks of interrelationships and breaks down the boundaries between the economic life and other social, political, and cultural spheres. The regulation 'school' has provided some very rich descriptions of industrial complexes and the ways in which these are linked to consumption practices and political projects. In this respect, regulation theory can usefully complement another perspective on the 'transition'—flexible specialization.

Flexible specialization
Having produced an effective critique of regulation theory, Hirst and Zeitlin go on to propose flexible specialization as a superior 'model'. The main concern here is to identify the key forces shaping the 'new order' (which is held to specialize in 'flexibility') rather than, as in regulation theory, periodizing capitalism, by using the mode of production as the underlying explanatory mechanism.

A succinct account of the flexible specialization perspective on the shift to post-Fordism can be found in Sabel (1989) where a 'textbook' example (page 30) is provided of the formation of regional economies. These formations, Sabel argues, can be seen as a response to the continuing instability of international markets since the early 1970s. At this time, firms in 'new industrial districts' began to escape from ruinous price competition with low-wage mass producers by using flexible machines and skilled workers to make semicustomized goods that could command an affordable premium in the market. From the early 1970s onwards the small and medium-size firms in these regions learned to use the new flexible microprocessor-based technologies and elaborated cooperative practices. These cooperative practices were formalized in the 1980s, leading to business alliances and the collective provision of services. Contemporaneously, large firms also began to reorganize themselves into much more flexible units. In the mass-production (Fordist) period the large firms typically were governed by an elite corps of strategic planners at the company headquarters. Management was organized into a pyramidal structure, with this corps at the top and increased specialization further down the hierarchy. The division of labour was regulated and policed through strict quality control and time-and-motion studies, and subcontractors were often played off against one another. Tasks and 'skills' changed slowly and could, therefore, be learned 'on the job'. Little formal training was necessary.
The division between 'conception' and 'execution', and all the organizational costs associated with maintaining it, made sense over huge production runs. However, Sabel argues, in the 1970s, markets for mass-produced goods began to fragment, and these mass-production firms found themselves in a much more unstable environment. Now "firms learned to expect the unexpected" (page 32) and began to introduce many more new products to increase their chances of finding a 'winner'. In order to speed up product development and manufacture, large firms had to reorganize: "In a word—their word—they had to become more flexible" (page 32). This, in turn, led to the dissolution of the divide between conception and execution, blurring the distinction between planning and production at all but the highest levels. Now "all but truly strategic decision-making authority is decentralized to operating units" (page 32) (a kind of 'subsidiarity' principle in the workplace) with workers and subcontractors treated as 'partners' in the production process. Within the large corporation, therefore, the individual units came to resemble autonomous small or medium-sized firms. To meet the changing needs of these new volatile markets, production had frequently to be reorganized. Products had to be (re)designed, with design incorporated much more closely into production, and new flexible technologies were introduced to facilitate this continual innovation of products. The large corporation effectively coordinated the various units and the array of subcontractors. The cumulative effect of these organizational changes was that large and small firms came to resemble each other much more closely, and all were striving for flexibility.

The 'new industrial districts' arose from the clustering of these networked units which developed because firms no longer wished to hold large stocks or parts inventories. If production is to proceed smoothly these stocks, parts, and other services must be close together. From a 'transactions cost framework' it has been argued that the frequency of transactions between firms determine the extent of spatial agglomeration. Where transactions are numerous and involve constantly changing products and services there is a strong incentive—the reduction of transaction costs—for the interacting firms to cluster spatially (Scott, 1993; also, see Gertler, 1988).

The criticisms that have subsequently been made of the flexible specialization approach fall into two main areas. First, the categories of mass production (or Fordism) and flexible specialization (or post-Fordism) are seen as overgeneralized. In their review of Piore and Sabel's (1984) book, The Second Industrial Divide, Williams et al (1987) argue that the division between Fordism and flexible specialization is too simple: "it tries to stuff too much into the same bag" (page 417). They base their critique upon the sheer difficulty of identifying particular enterprises or industries as instances of mass production or flexible specialization. Furthermore,

(4) The types of spaces identified in this literature fall, according to Gertler (1992), into three main types:
(a) new production districts as described above, which might include such areas as Silicon Valley, the Third Italy, much of southern Germany, the Scientific City of the Paris Basin, Hong Kong, Taiwan, and South Korea (Scott, 1993, page 222);
(b) 'rusting relics' of the earlier production complexes, such as the North East and Mid West of the USA, the Midlands and the North of England, and perhaps the Ruhr in Germany; and
(c) 'zones of intersecting industrial practices' between the other two, where the new 'flexible systems' are being imported by external agents. An example here would be the 'Japanization' of Mexico (Gertler, 1992, page 267).
Thus far the flexible specialization literature has concentrated on the first of these three categories.
Ford himself “did not provide a strategic model which his successors imitated” (page 421). Williams et al argue that “Ford's innovations may have been important but they are hardly responsible for the whole trajectory of development in the advanced economies” (page 421).

The second area of criticism can be summarized by Gertler’s question: “When is a district a ‘district’?” Or, “how do we recognise a true ‘industrial district’ or ‘territorial production complex’ when we see one?” (1992, page 263). Amin and Robbins (1990), for instance, examine a series of case studies in the Third Italy (Emilia Romagna, Toscana, the Marche, the Abruzzi, and the Veneto) and discern “significant differences between them in terms of their origins and their consolidation as industrial districts” (page 17). They conclude that “In the new orthodoxy, virtually any example of localised economic life which is new or thriving, and which displays some sign of collaboration between specialised units, is to be interpreted as an industrial district” (page 21). Even in the high-technology districts of the USA, marked differences in social organization are apparent between such areas as Silicon Valley and Route 128 (Gertler, 1992; Saxenian, 1991). Amin and Robbins (1990, page 23), therefore, reject any overarching structure of transformation and are sceptical of the notion of post-Fordist industrial spaces: “Such a theory tends to be either so vague and diluted that it can apply to any example of a local production complex or [it] ignore[s] continuities with the past”.

In response to these two sets of criticisms, proponents of the flexible specialization thesis have redefined their conceptual and methodological claims. Hirst and Zeitlin (1991) defend the approach by arguing forcefully that “in no sense can this be seen as an evolutionary teleology in which the triumph of flexible specialization as a specific model is a necessary consequence of some immanent logic of economic or technological development” (page 6). This is because mass production and flexible specialization are ideal types. Thus we should not expect to find vast numbers of either in empirical research: “hybrid forms of productive organization are the rule rather than the exception ... firms in most countries and periods deliberately mix elements of mass production and craft or flexible production” (page 6). The use of ideal types allows this approach to be alert to many different institutional ensembles and the different sets of social relations within which flexible production systems operate. Contingency and complexity may be emphasized and the crucial role of strategy is recognized; flexible specialization approaches are “aware things could have been otherwise” (page 24).

These ideal types are necessarily at some remove from observable empirical evidence. According to Hirst and Zeitlin, there are three components of this relation between theory and evidence (pages 25–27). First, theory can be used in ‘normative-empirical’ mode; that is, it should be used to identify progressive flexible specialization strategies and to investigate whether these can be made more widely applicable. Second, flexible specialization is a ‘positive heuristic’. The ideal type is not an empirical generalization so we should not expect to find the majority of enterprises conforming to it, particularly when flexible specialization analyses are keen to stress the importance of social context, strategy, and the variety of possible outcomes. “Flexible specialization cannot be reduced to a few simple hypotheses. At the same time, this theoretical complexity is not the result of ad hoc argumentation and incoherence” (page 26). Third, the approach serves as a ‘negative heuristic’. It is set within a much broader theory about production systems and their wider sociopolitical context. It therefore focuses our attention on how such systems and their contexts are changing.
Hirst and Zeitlin argue that the aim is to observe tendencies which indicate “the displacement of mass production by flexible specialization as the dominant technological paradigm of the late twentieth century” (page 36). On the one hand, it seems that Hirst and Zeitlin wish to abstract the concepts from the ‘real world’, yet, on the other, demonstrate how they direct our attention to observable trends. The concepts are protected by their ‘purity’, that is, they are unlikely to ‘exist’ in their pure form, yet they are extrapolated from ‘reality’. A variety of phenomena have been synthesized within the model in order to highlight the ‘essence’ of the new industrial paradigm. Mass production and flexible specialization can, therefore, be utilized as ‘measuring rods’ or as models for (regional) development (although for critics such as Williams et al and Amin and Robins even here their value is questionable) but in both cases they tell us very little about how or why the world is changing in the way it is. Furthermore, by dealing in the broad sweep of history—the shift from one paradigm or regime to another—they may actually be diverting our attention from many of the important things that are happening in the world (Amin and Robins, 1990). Sayer and Walker (1992, page 199) summarize this view when they say:

“What has to be recognised is that capitalist industry has always combined flexibilities and inflexibilities. What may be emerging now are new permutations of each rather than a simple trend towards greater flexibility alone. The variety of such combinations cannot be grasped by inflexible dualistic frameworks which counterpose the old as the inflexible to the new as flexible”.

The presentation of flexibly specialized organizational forms as ‘ideal types’ leads to a misplaced emphasis on the transition from one ‘order’ to another and exposes the limited explanatory resources available to those using this approach. This account can only explain the emergence of new economic forms by retreating to a higher level of abstraction, that is, by stating these forms characterize the new (flexible) order. However, the work undertaken in this vein has served to focus our attention on new organizational forms and the creation of new industrial spaces at the international, national, regional, and local levels. Like regulation theory, the flexible specialization analyses alert us to the complex relationships between economic and other social and political institutions and to how these shifting organizational forms effect broader spatial changes. The industrial formations which seemingly characterize the new era are clusters or ensembles of economic and non-economic relationships. Furthermore, the ‘internal’ organization of the firm is seen to be increasingly tied into the ‘external’ institutional environment. The complexity of these clusters or ensembles, and their constituent parts, becomes clearer when we turn to a third approach which is beginning to emerge from those considered above, the network paradigm.

Networks
Perhaps the clearest exposition of the ‘network paradigm’ can be found in Cooke and Morgan (1993). In a discussion of new trends in corporate strategy and regional development Cooke and Morgan outline how a number of theorists have utilized ‘networks’. The network paradigm can be considered to mark the emergence of a relatively distinct economic form because “in network modes of resource allocation, transactions occur neither through discrete exchanges nor by administrative fiat, but through networks of individuals or institutions engaged in reciprocal, preferential, mutually supportive actions ... Complementarity and accommodation are the cornerstones of successful production networks” (Powell, 1990, page 78, quoted in Cooke and Morgan, 1993, page 544).
According to Cooke and Morgan a wide and growing spectrum of corporate activity now seems to fall within the network mode of organization. The two previously dominant forms of economic governance—markets and hierarchies—suffer from market imperfections and hierarchical rigidities, respectively; they “were too polarised ... [and] failed to capture a wide array of economic activity that took the form of interfirm collaboration, such as strategic alliances, buyer–supplier partnerships, joint ventures, and corporate consortia” (Cooke and Morgan, 1993, page 545).

Networks can be identified, in Cooke and Morgan’s view, both at the interfirm and at the intrafirm levels. At the intrafirm level the new networking practices “appear to be critical to the ‘new order’ that seems to be supplanting the classical Fordist order” (page 545) [“the classical Fordist organisation ... was segmented rather than networked” (page 549)]. Firms are now compelled to coordinate their activities much more effectively and “most multinationals are now evolving from a centralised hub towards an integrated network” (page 548). External networking is also becoming widespread as close producer–user interaction, joint ventures, strategic alliances, and collaborative relationships between suppliers and subcontractors are driven by technological change, a shortening product-life, customized markets, competitive pressures, etc.

Cooke and Morgan clearly regard networks as acquiring a new dominance in the field of industrial organization. This new paradigm seems to be emerging from the shortcomings associated with markets and vertical hierarchies, primarily because of changing technologies, demand, products, etc. Likewise, Dicken and Thrift (1992) believe that enterprises should now be considered as vast and complex networks of power relationships (page 279). They say “a particularly fruitful way of conceptualizing the organization of production chains and production systems is as a complex set of networks of inter-relationships between firms which have differing degrees of power and influence” (pages 285–286, emphasis in original). They agree that these organizational frameworks come about as firms seek flexibility, but they caution against making universal generalizations from a limited number of empirical cases. The flattened hierarchy of these networks, which include intrafirm and interfirm linkages, can in practice take many different forms.

Two main forms of interfirm network relationships are identified: subcontracting, and strategic alliances. Strategic alliances are now part and parcel of the competitive strategies of nearly all large corporations. Companies may form a series of alliances with other firms which also have their own networks of external relationships. These might include cooperative arrangements involving the production of scientific and technological knowledge, cross-licensing agreements, joint marketing arrangements, etc. Although these relationships seem to herald an era of cooperation between often fierce competitors, they can also be interpreted as attempts by established firms to increase their concentration and dominance in particular market structures, precluding the development of other independent competitors (for example, on firms in the biotechnology sector, see Walsh, 1991).

Subcontracting is a more traditional practice, usually involving a large firm putting some of the production process out to a series of satellite firms. However, Dicken and Thrift identify a new organizational form termed “the vertically dis-aggregated network organization” in which “almost all functions in the production chain, other than those of central control and co-ordination, are contracted to independent firms but in which the final product is marketed under the lead company’s brand name” (1992, page 286). Again, Dicken and Thrift warn against assuming that all large firms are proceeding along the same path of development;
there are a variety of organizational forms, many of which may be hybrids of hierarchies and networks.

Cooke and Morgan as well as Dicken and Thrift believe that the shape of these various organizations has implications for the geography of production and development, and that territorial assemblies of firms, subsets of firms, and their networks of relationships can be identified. Some of these may be confined to approximate geographical areas, some may be spread further afield. This then leads on to a consideration of how these organizational networks are differentially 'embedded' in particular places and how different forms of business organization evolve in different sociocultural contexts. However, although these organizations are tied into particular places, they often transcend these places and extend their networks over ever-increasing distances.

The term 'global order' has emerged as a shorthand description for the spread of long networks, such as multinational firms. In part, the reason why the role of these firms (the longest networks) has expanded is associated with the development costs of new technologies (semiconductors, for instance) which outstrip the resources of all but the largest companies. Furthermore, the growth trajectories resulting from these developments can often lead to a convergence of innovations. New forms of equipment and raw materials, such as network technologies, require new forms of knowledge (Clarke P and Staunton, 1989), and certain places become favoured receptors for 'cutting-edge' innovations. New patterns of inequality between places may, therefore, arise.\(^{(5)}\) Not all environments can be regarded as receptive to all innovations. The capacity to 'alter' and 'modify' requires levels and types of expertise which may be quite unequally dispersed, particularly as innovations become tied more closely to specialist scientific knowledge. Furthermore, "as this happens, it may become increasingly difficult to borrow or imitate without a reasonably high-level domestic science capability" (Rosenburg, 1982, page 277). In their discussion of information and communication networks Robins and Gillespie (1992, pages 160–161) discern fresh patterns of territorial inequality arising from the uneven diffusion of new technological forms:

"The danger is that the new global order will be marked by a new segmentation of 'on-line' and 'off-line' territories, as it were; by a hierarchy that differentiates those localities that can harness territorial endowments to the network structure and those characterized by both internal fragmentation and external disarticulation from the network."

Dicken and Thrift believe it is the large corporation—"the centre of strategic decision-making" (1992, page 288)—which "binds places together through its own internal links and its multiple links with other firms". This theme is also taken up

\(^{(5)}\) Gertler (1992; 1993) alerts us to the 'cultural' barriers which can affect the uptake of new technologies. He believes that an organization's ability effectively to implement complex technological forms depends to some extent upon the producer and the customer being able to establish a close relationship. This is particularly important when the technology involved is expensive, complex, and developing rapidly. An "interactive mode of technology acquisition" (Gertler, 1993, pages 3–4) allows purchasers to gain information about the machinery, and the producers to stay closely in touch with their markets. Such a relationship is clearly easier if they are located within the same national or regional space and if they understand common industrial practices and technological discourses. So new networks can be constructed and consolidated using certain 'cultural pathways', and this may entail some continued importance for spatial proximity; as Lipietz puts it, "in order to seize 'opportunities' it is necessary to be there, to be on the spot, to see with your own eyes, eyeball to eyeball" (1993, page 13).
by Amin and Thrift (1992a; 1992b). With the growth of global production networks, or 'filieres', they argue, come problems of coordination and integration for the strategic centres. They identify three such problems:

representation: information has to be gathered about what is going on in the various parts of the network; this is facilitated by the adoption of new technologies which allow for increased amounts of information to be gathered but which increase the interpretive load and lead to the development of particular 'expert systems' (after Giddens, 1990) or 'knowledge structures';

social interaction: this is still needed to gather information and to tap into these expert systems or knowledge structures; also, with the development of strategic alliances, social interaction allows for the establishment of trust and cooperation;

tracking innovation: this refers to the need to keep up levels of productivity, development of new products, and successful marketing within a decentralized system, again raising problems of representation and interaction.

These three problems require the establishment or maintenance of strategic centres so "although the world economy is becoming decentralized ... it is not necessarily becoming decentralised" (Amin and Thrift, 1992a, page 576). The centres are necessary for the construction of expert discourses and knowledge systems and for social interaction. Furthermore, these have to be geographical centres. They become 'nodes' in the economic and spatial network.

It is the 'nodes' that are of particular interest to Amin and Thrift, and they are concerned with understanding how these establish and maintain their dominance. In this context they believe that

"the study of these 'growth poles' illustrates only too clearly ... that success—in terms of holding down the global (local embeddedness) and thereby generating self-reproducing growth—cannot be reduced to a set of narrow economic factors. This is not, of course, to claim that economic factors are unimportant—the experience of growth poles shows that a basic requirement for success seems to be the presence of strategic functions at the top end of any industrial division of labour or value-added chain. Instead, it is to claim that social and cultural factors also live at the heart of economic success and that those factors are best summed up by the phrase 'institutional thickness'" (1992b, page 14).

By 'institutional thickness' the authors mean a strong institutional presence (such as firms, financial services, chambers of commerce, etc—many of the institutions mentioned in the 'new industrial spaces' literature) which can provide a basis for the growth of strong local business practices and forms of collective representation. Institutional thickness, however, will only transpire if there is a high level of interaction between these institutions, resulting in collective behaviour. This collective behaviour, in turn, must be based on a common agenda for development and business practice.(6)

(6) Amin and Thrift admit that the term 'institutional thickness' is a general concept, "even vague" (1992b, page 14). Although it might be useful in focusing our attention on different forms of institutional interrelations, the idea of 'thickness' seems to bring us no nearer to understanding how these institutions are tied together and how power flows through the networks. It is also unclear to what extent their approach differs from the earlier work on clustering and industrial districts. In particular, we must still ask whether the dynamics leading to 'thickness' come from within institutions, from their local context, or from some interrelationships between the two.
Thus networks are now believed to be fast emerging as the dominant organizational form. This paradigmatic shift bears many similarities to both regulation theory and flexible specialization, and, again, the same reservations must be expressed about the forms of analysis which accompany the declarations of a 'new order'. As Cooke and Morgan admit (1993, page 549) networks are not a new phenomenon, for they have been around since the early industrial revolution (see also Sayer and Walker, 1992, page 131) and this leads to the suspicion that we are now seeing simply new variations of the network form. Furthermore, can markets and vertical hierarchies also be considered as networks? Are the distinctions between these forms as sharp as the theoreticians of post-Fordism would have us believe?

The discovery of networks must be rescued, in my view, from ideas about paradigmatic or epoch shifts. If networks are ‘found’ suddenly to predominate in economic life, marking the shift from Fordism to post-Fordism, then they will merely be placed within the existing accounts of economic change. Suddenly they will be everywhere and will constitute the future in much the same way as ‘flexibility’. This is already evident in the explanations offered for the ubiquity of networks, that is, changes in technology, shifting consumption patterns, competitive pressures, etc. The ‘new order’ is again put in place. But, as Amin and Thrift illustrate, the discovery of networks has led to important questions being posed such as: ‘What holds networks together?’ ‘How are the cultural, the social, the economic, the technical combined within networks?’ ‘How do (global) networks reach so far?’ ‘What constitutes successful or strong networks?’ The analysis of networks is, therefore, placed firmly on the agenda. Moreover, we must now consider whether the above questions can be adequately addressed by forms of analysis that depend on ‘transitions’, global shifts, etc, for their explanatory power. Rather than step outside when it comes to providing an explanation of network formation and consolidation should we not attempt to explain from within? If so, we must also ask whether our description of networks will be qualitatively different from their explanation.

Network analysis

The predominant concerns in the regulationist, flexible specialization, and network literatures revolve around the desire to explain wholesale changes in economic forms yet still maintain room for contingency, action, innovation, etc. I have argued that these accounts are 'structuralist': they ultimately explain these new forms by recourse to societal shifts and other external causes (although in the case of ideal types it might legitimately be argued that they do not explain at all). I also proposed that the network paradigm is useful, not because it more accurately identifies a new stage in capitalist development but because it directs our attention to the processes of network construction, consolidation, and stabilization. This means taking seriously what is going on inside the networks and means we can, perhaps, forget external causes. Rather than considering economic structures as the determinants of economic activity, network analysis seeks to understand these structures as the outcomes of active attempts to construct and maintain power relations (or the 'powers of association'); see Latour, 1986; Amin and Thrift, 1994).

Network analysis is not new in social science and takes many different forms, from studies of kinship networks to studies of technological systems. Networks are traditionally defined as specific types of relations linking sets of persons, objects, or events (Knoke and Kuklinski, 1982; Mitchell, 1969). The ties between these entities are usually referred to as the network structure. Social networks are often conceptualized as the relations between actors and are, therefore, specifically social
in nature. However, the above discussion of economic forms, particularly around issues of ‘flexibility’, has shown that the establishment of the new corporate networks owes perhaps as much to the adoption of new technologies as it does to the activities of social actors in the strategic centres. What the above analyses also seem to indicate is the need to go back to the basics of organizational structure. Just what is being held together in economic institutions?

This question has recently been carefully considered by Sayer and Walker (1992). In their analysis of the social division of labour, they pay close attention to the integration of elements within the production process. They identify in the literature on industrial organization two kinds of production chains—sequential processing, or vertical integration, and component assembly systems, or horizontal integration. However, Sayer and Walker suggest that this dualism fails to encompass the real complexity of integrated production systems, for:

“Input-output analysis has demonstrated that the economy can be divided into hundreds of thousands of production cells, and each of those cells takes inputs from many places and sends outputs in many directions; in a highly developed division of labour everything ultimately connects with everything else. Production systems overlap, sharing inputs from common sources and sending outputs from one process to many others. Steel goes into drill bits, automobile frames, and ball-bearings; ball-bearings are used in bicycles, automobiles, and textile machinery; automobiles may, in turn, be used by pizza parlours, gardeners and airline companies. This creates systems of nested and branched integration” (pages 111-112).

We are presented here with a picture of the economy as an extremely complex web of linkages. However, Sayer and Walker go on to stress that some connections are more important than others, certain “root and branch” connections or linkages, which they term “production systems” (page 112). They believe that “we do not yet have an adequate conception of integration to handle these intersecting pathways in a completely coherent way … the truncated terminology of vertical integration and disintegration still dominates the discourse on organization in economics and geography” (page 112).

Sayer and Walker recognize that “the varieties of social linkage and co-ordination, direction and regulation, stabilization and mobilization are difficult to formalize” yet “we still need to investigate the formal modes of organization available to capitalists who seek effective integration of production systems” (page 118). Although they identify a basic ‘triad’ of forms: the workplace, the firm, and the market—integrated through physical enclosure, legal ownership, and equal exchange, respectively—Sayer and Walker are keen to move beyond a firm–market dichotomy and insist that once we ignore this simple duality “it becomes possible to see that the world outside the firm needs to be managed and the world inside the firm needs to be regulated in the light of external conditions” (page 128). Thus industrial organization and structure are the outcomes of the many processes of integration and management, that is, of the way resources are mobilized and linked both inside and outside the firm.

In the rest of this paper I wish to explore the potential of a sociology of ‘linkage’ or ‘association’ in explicating some of the basic principles of integration. This is pitched at an abstract level but is intended to allow the analysis of economic forms to be conducted in such a way that description and explanation are tied closely together. In searching for a repertoire which explains from within the processes under consideration, I have turned to a form of network analysis emerging from the sociology of science. What is distinctive about this approach, termed actor-network
theory, or the 'sociology of translation' (see Callon, 1986; Latour, 1987), is that it attempts to elide 'why' questions with 'how' questions. Modes of production, structures, classes, and interests should not be treated as the causes of events but as a set of effects arising from a whole complex of network relations. Furthermore, these networks of relations are believed to be made up of heterogeneous materials, that is, both of humans and of nonhumans. Any kind of order, association, or network can only emerge from a range of different, human and nonhuman, material and nonmaterial, resources. This is because any social order, to be effective and stable, must spread across space and time, for, as Law reminds us, “left to their own devices human actions and words do not spread very far at all” (1994, page 24, emphasis in original). He concludes that “materials, such as texts and technologies, surely form a crucial part of any ordering”.

From this perspective it is worth adopting Callon's (1991) notion of techno-economic network, which refers to “a coordinated set of heterogeneous actors which interact more or less successfully to develop, produce, distribute and diffuse methods for generating goods and services” (page 133). Callon takes further Amin and Thrift's (1992b, page 14) observation that a range of factors are to be found at the heart of economic relations and proposes that networks are constituted by both the social and the material. This approach combines the insights of economics, that it is things that draw actors into relationships, and of sociology, that actors come to define themselves, and others, through interaction. Putting these together leads to the idea that “actors define one another in interaction—in the intermediaries that they put into circulation” (page 135, original was emphasized). Callon identifies types of intermediaries—texts, technical artefacts, human beings, and money—which allow networks to come into being [they give “shape, existence and consistency to social links” (page 140)]. But they are far from passive tools: texts and technical artefacts, for example, define the roles played by others in the network—not only nonhumans (machines, accessories, power supplies, etc) but also humans (salespersons, consumers, maintenance engineers, etc).

The network is, therefore, defined by the actors and the circulation of intermediaries. This still leaves the question of how networks are established and stabilized. In order for an actor successfully to enrol entities (human and nonhuman) within a network, their behaviour must be stabilized and channelled in the direction desired by the enrolling actor. This will entail redefining the roles of the actors and entities as they come into alignment, such that they come to gain new identities or attributes within the network. It is the intermediaries, referred to above, which act to bind actors together, 'cementing' the links. When there is a perfect translation, or redefinition, of actors' identities and behaviours then these are stabilized within the network. The stronger the network, the more tightly the various entities (human and nonhuman) are tied in. Despite their heterogeneity, they work in unison. Each actor is able to “speak for all, and to mobilize all the skills and alliances within the network” (Callon, 1991, page 151). The more stable the network the more irreversible the translations. The links and relationships would be predictable, standardized; the network would be “heavy with norms” (Callon, 1991, page 151). However, the ‘power’ of the intermediaries may be curtailed by actors modifying or appropriating them in accordance with their own projects. Where the translation process has been weakly executed, the enrolling actors find their status continually in question and find it hard to mobilize the other parts of the network. Thus, successful or strong networks might be considered to be those where the processes of translation have
been effectively executed, allowing the enrolling actor to consolidate the network on its own terms. \(^{(7)}\)

The dynamics of these networks can only be understood if we attend to the processes of translation. If the translation process has been successful, and has stabilized the network, then we can trace its operation unproblematically. Where the network is fragile then the more free play the constituents have and “the more they can be understood in terms of concepts such as strategy, the negotiation and variation of aims, revisable projects and changing coalitions” (Callon, 1991, page 154).

Effectively, this approach places power at the centre of the analysis. However, power is seen as the outcome of the strength of the associations between actors. The stronger the network the more powerful the translating actor (Latour, 1986). Thus, those who are powerful are not those who ‘hold’ power but are those able to enrol, convince, and enlist others into networks on terms which allow the initial actors to ‘represent’ the others. Powerful actors speak for all the enrolled entities and actors, and control the means of representation. [They “speak for the others that have been deprived of a voice, that have been transformed from objects that spoke for themselves into mere shadows of their former selves” (Law and Whittaker, 1988, page 179).] The controlling actor grows by borrowing the force of others; it can inflate to a larger size [becoming what might be termed a ‘macroactor’ (Callon and Latour, 1981). Power is, therefore, the composition of the network; if it lies anywhere it is in the resources used to strengthen the bonds (Latour, 1986).\(^{(8)}\)

By placing power at the centre of the analysis (it is the ‘glue’ that binds the network together) we can take up Amin and Thrift’s concern with representation, social

\(^{(7)}\) The examination of industrial structure often reveals the existence of quite stable networks. For Dosi and Salvatore (1992, page 176) “what is remarkable about the majority of firms is their relative ‘coherence’ in their lateral and horizontal business activities”. They propose the following determinants of ‘coherence’ (pages 178–181):

(a) ‘learning’, meaning the accumulation of knowledge residing in organizational routines;
(b) ‘path dependencies’, where organizational routines and past patterns of investment naturally close off certain courses of action and thus determine development trajectories;
(c) ‘complementary assets’, which derive from path dependencies as firms acquire assets upstream and downstream in the value-added chain and these steer the adoption of new technologies;
(d) ‘technological opportunities’, which give further impetus to path dependencies as “the depth and width of technological opportunities in the neighbourhood of a firm’s prior research activities are likely to affect a firm’s options with respect to both the amount and level of R&D activity that it can justify” (page 180); and
(e) ‘selection environments’, referring to levels of competitiveness and technological ‘discontinuity’.

Dosi and Salvatore identify “the availability of free cash flows as the key regulator of selection” (page 181), for this will determine the level of financial support needed from external institutions and the extent to which the firm is exposed to financial market discipline. It is important to recognize that these features of coherence result, in our terms, from past processes of translation and serve as resources and constraints in new attempts by actors to enrol others and mobilize networks. They can be taken as indicators of network stability and coherence.

\(^{(8)}\) In this light Schoenberger’s (1994) analysis of the power of top managers pays too little attention to the relational complexion of power. For instance, it is argued that “What sets top managers apart from other persons in the firm is that they possess the power to define what counts as power” (page 445). Although this may be true it does not tell us how things got this way, for such a state of affairs comes at the end of the story. Thus when Schoenberger states the “manager’s need to defend his own worldview and sense of self may come seriously into conflict with his need to defend the competitive position of the firm” (page 447), by restructuring the organization, for example, this downplays the extent to which this sense of self (as powerful) depends upon others.
interaction, and the tracking of innovation within the strategic centres. We can begin to investigate how labour, raw materials, and machines are integrated within the production process, how information flows through the system, how "extended production systems, designers, production engineers, and marketing departments mesh their efforts ... how machines [are] monitored, materials tracked, tasks charted and the results evaluated" (Sayer and Walker, 1992, pages 113–114).

An example of how networks are bound together using the process of translation might be the use of accountancy to enrol diverse organizational settings. Miller, for instance, considers that

"accounting seeks to align the actions of 'free' individuals with specific objectives by enclosing them within a particular calculative regime. Rather than telling individual managers which investments to choose, why not specify a percentage rate of return to be earned on all investments and leave them to make decisions 'freely' themselves? Why not, in other words, seek to produce an individual who comes to act as a self-regulating calculating person, albeit located in asymmetrical networks of influence and control?" (1991, page 7).

Furthermore the practice of accountancy constructs calculable spaces for these new 'calculating selves' to occupy. New 'abstract' spaces may come into existence, such as divisions, budgets, profit centres, business units, etc, but it is “only through the practices of accountancy that these abstract spaces become calculable, comparable and open to financial valuation” (page 10). However, if the network is stabilized and the process of translation standardized then the technology of accountancy has succeeded in bringing a diverse range of entities into alignment. The network might be characterized as 'flexible' (if the accountancy technique is appropriate for that type of organization form) but that tells us nothing about how such flexibility has been achieved or how actors and entities are held together.

To turn to the geography of actor-networks, a crucial issue is how actors are able to mobilize networks to 'act at a distance' (Latour, 1987; Law, 1986). When we speak of 'global' or 'local' networks we are really raising the issue of the reach of the network and how others in distant places and at other times find themselves ‘fixed’ by the strategic centres or nodes. The ‘scale’ of these processes refers to distance, to the attempt by external actors to enrol local actors within particular networks of control. The question of scale (global, local), therefore, can be posed in another way: what links local actors to nonlocal actors (that is, actors in another locale) and how do these nonlocal actors effect change and control at a distance? Latour (1987) believes that the question is rather simple: “how to act at a distance on unfamiliar events, places and people? Answer; by somehow bringing home these events, places and people”. This can usually be achieved by three means:

“(a) render them mobile so they can be brought back; (b) keep them stable so that they can be moved back and forth without additional distortion, corruption or decay; and (c) [make them] combinable so that whatever stuff they are made of, they can be accumulated, aggregated, or shuffled like a pack of cards” (page 223). Accountancy works in this fashion by reducing the variety of activities in one place to a set of figures which can then be transported to another place to be acted upon. As accounting moves up or through hierarchies, managers or cost centres become objects and relays of power. Therefore, “actions on the actions of managers become possible through the visibility, calculability, and comparability that accounting provides” (Miller, 1991, page 15). The networks can be ‘governed’ from the place where decisions are made using the calculative technologies of accounting and other methods of “enterprise calculation” (Williams, 1987, page 95).
Through translation processes it is possible to do things in one place (for example, the centre) that dominates another place (for example, the periphery): "heterogeneous sociotechnologies ... open up the possibility of ordering distant events from a centre" (Law, 1994, page 104, emphasis in original) and the centre is a place which monitors and represents the periphery and then calculates how to act on the periphery.\(^9\) So the term 'local' has a double meaning: first, it refers to the coordinated practices of actors in some predefined 'locality' (captured, perhaps, by notions such as 'institutional thickness'); second, it refers to the incorporation of local actors within various economic, social, and political networks in which the local is 'brought back' to the centre. Conversely, the global can be seen as the way discrete locales are integrated into particular 'long-distance' networks or as a shorthand term describing the existence of many long-distance networks.\(^10\)

The construction of networks, and the ability they give certain participants to 'act at a distance', is what ties the 'local' to the 'global'. By examining the connections in this way we are able to specify the exact means by which the local is represented within the network, as elements are combined, mobilized, and, through forms of calculation, carried to the centre. We are not concerned here with the simple unfolding of social structures in space but with the means whereby networks of actors construct space by using certain forms of calculation and representation. Our understanding of both the 'local' and the 'global' will change, for we must now trace the networks as they extend through space and time. We must trace the continuities from the 'local' to the 'global', or, more strictly speaking, from one locale to the next and to the next and so on. Thus "the words 'local' and 'global' offer points of view on networks that are by nature neither local nor global, but are more or less long and more or less connected" (Latour, 1993, page 122).\(^11\)

Given the heterogeneity of the links between actors, the capacity to build networks and the ability to act at a distance will be subject to processes of innovation. These innovations may take various forms but if they are successful they will allow networks to reach further and further from the centres.\(^12\) Size is a product of network extension and it should, in principle, be possible for us to follow actors as they weave

\(^9\) Law (1994, page 104) provides the following examples of monitoring, representation and calculation: "bureaucracy; double-entry bookkeeping; logarithms; statistical methods; cartography; xerography; computing; accounting procedures; and the distinction between management and administration".

\(^10\) A notion such as time–space compression, which is used by Harvey (1989) to describe the experience of 'postmodernity, can now be understood as the creation of space and time within a multitude of long networks as entities are moved back and forth at increasing speeds.

\(^11\) Latour (1993, page 117) cites the example of a railroad and asks "is [it] local or global?". The answer he provides is "neither", for "it is local at all points, since you always find sleepers and railroad workers, and you have stations and automatic ticket machines scattered along the way. Yet it is global, since it takes you from Madrid to Berlin or from Brest to Vladivostock. However, it is not universal enough to be able to take you just anywhere. It is impossible to reach the little Aubergnat village of Malpy by train, or the little Staffordshire village of Market Drayton. There are continuous paths that lead from the local to the global, from the circumstantial to the universal, from the contingent to the necessary, only as long as the branch lines are paid for."

\(^12\) It is worth noting that this type of analysis carefully avoids technological determinism in accounting for organizational development [even though new technologies may facilitate the faster and easier (re)combination of entities within networks]. Webster (1991) demonstrates in relation to computer-aided production management that as technology comes to be applied it is adapted to existing features of the work organization and may be modified by the requirements of local users. Taking its place in this new situation, technology will not only combine elements in the production process in a novel way but will itself be incorporated into
together intermediaries, by using the translation process. Furthermore, as networks become successfully consolidated they may enter into interrelationships, or be dependent upon other networks [as in, for instance, the application of digital micro-electronics to computers and telecommunications (Dosi and Salvatore, 1992)]. We must, therefore, expect to see a coevolution between networks (in much the same way as actors and intermediaries coevolve within networks). Thus these networks may reach the status of 'macro' actors. However, caution must be exercised here. In actor-network theory the difference between the 'macro' and the 'micro' is held to be simply one of scale; 'size' is nothing more than the end product of network extension. Thus, "to make use of a separate vocabulary for the large tends to conceal both the processes by which growth occurs, and the uncertainties that are involved in maintaining power and size. In addition it reifies the status of the large, and makes it appear as if the latter could never decrease in size and become weak" (Callon, 1986, page 228). The use of two separate vocabularies, one for the large and the other for the small should, therefore, be avoided.

Towards an evolutionary account
In summarizing the analysis so far, it should now be clear that explanations of economic change which depend on some conception of societal or structural shift should be abandoned. Instead, we have seen the economy presented as a 'grid' of interrelations between multitudes of units. These interrelations come in different shapes and sizes, but can be understood as networks. By adopting the network approach, the distinction between the units and the interrelations becomes increasingly blurred—the 'inside' and the 'outside' can be understood only in terms of chains of links. These chains are made up of heterogeneous materials and are held together by power, but power is not some reified essence, it is simply the tie that binds actors together.

Although the economy as a whole can be considered in this way, there are clearly some links which are more interesting than others, perhaps because of their strength and durability and/or because of their 'reach', that is, the ability they give strategic centres to 'act at a distance' in both space and time. Both the flexible specialization and the network literatures point us in the direction of 'innovative' networks, those that are believed to be the 'next wave'. However, instead of examining their success from 'within', these approaches are all too ready to offer explanations from 'without', that is, networks accord with the structural requirements of the mode of production or regulation or they correspond to the ideal types of the existing elements in the workplace. As Callon reminds us, "technology both creates systems which close off other options and generates novel, unpredictable and indeed unthinkable options" (1991, page 132). Moreover, once established "it is sometimes possible to predict the way in which a [techno-economic network] will evolve. The unilinear model of technological change is not always wrong. But more often the actors have significant degrees of freedom. They develop complicated strategies and many possible innovations with unexpected social and technological implications" (page 133). So we cannot prejudge the outcome of any innovation. Rather, we must follow it as it weaves its course through the social field, as all the actors coevolve.

This term is used in a similar, though more restricted, way by G Clark (1993, page 310) when he conceptualizes the structure and management of transactions between small firms. The term "chain-of links" is chosen "to represent the contingent nature of inter-firm transactions where the execution of each transaction for a specific good or service becomes the basis of further exchange culminating with the production and sale of a good in a particular market". He also considers the spatiality of the chain-of-links.
of flexible specialization or post-Fordism. As Callon and Law (1989, page 77) note, these, and all other a priori distinctions must be abandoned for, as we have seen above, they serve merely to obscure the strategies and practices of the network builders. It is only by thoroughly describing these sets of interrelations that we hope to explain the emergence and stabilization of networks. As Latour (1991, page 129) puts it “the explanation emerges once the description is saturated”.

We can consider ‘regulation’ and ‘flexibility’, therefore, to be the outcomes of perhaps a multitude of different processes that in retrospect look like structural changes. Rather than proposing structural change as the determinant, we can consider this again as the outcome. A more useful way of viewing such a wholesale shift might be as the result of the coevolution of entities, actors, and networks. As Callon and Law (1989) show, in order for new networks to be constructed, the enrolling actors or strategic centres have to draw upon materials, actors, and intermediaries, which will already be inserted in established networks. Thus, “the innovator ... is one who is able to use resources drawn from a series of pre-existing networks to build a novel network which is able to sustain a two-way exchange of resources within these networks” (page 72, original was emphasized). As networks become interlocked, we might expect to see patterns of interdependency emerge. The more successful these interdependencies, in terms of the durability and strength of the associations, the more stable the coevolution. Thus, coevolution might be considered as the translation of innovations, actors, identities, practices, etc, within networks or it might be used in a broader sense to capture the aggregated outcome of many network activities, what we would usually refer to as the ‘macro’ or structural level. As more of these become interrelated, so systemic properties may emerge. Thus the ‘system’ comes last—it is an outcome.(14)

There is no ‘philosophy of history’ or necessary law of societal development governing the coevolution of networks, yet this approach could be adapted to demonstrate how the various components of a regime of accumulation and a mode of regulation coevolve [or ‘incubate’, as Altvater (1992, page 23) puts it] in ways quite compatible with the broad thrust of the regulationist approach. What remains valuable about the regulationist project is the identification of the institutional mixtures or ensembles which characterize any particular regime. It directs our attention to the way that the ‘economic’ is not really economic at all, or, rather, it is economic, political, technical, social, and so on all at once. We must examine each of these spheres as outcomes of network formation rather than distinct system components with their own specific logics, modes of explanation, and so on (and thus matching disciplinary boundaries). From the perspective outlined in the previous section, these spheres should be considered as the outcome of the processes of network construction and consolidation. Different networks will generate effects which become bracketed into the economic, the social, the natural, yet as actors weave together networks they will use whatever materials come to hand, and may be unconcerned about their provenance. The techno-economic networks are composite for “they mix humans and non-humans, inscriptions of all sorts, and money in all its

(14) Latour (1993, pages 3–4) believes the term ‘network’ to be much more useful than ‘system’ for investigating the making of associations: “More supple than the notion of system, more historical than the notion of structure, more empirical than the notion of complexity, the idea of network is the Ariadne’s thread” which allows us to trace the “delicate networks ... which remain more invisible than spiderwebs”. Hughes (1988), on the other hand, believes the terms ‘network’ and ‘system’ are not so far removed from one another and tends to use them interchangeably. There is clearly a need to clarify just what can be considered a network and what a system.
forms" (Callon, 1991, page 153). We must ‘follow’ the actors through the network as they build and shape its contours, and we cannot specify in advance where their efforts will take them. The behaviour, definition, roles, and interests of actors are negotiated within the network. There is, therefore, no theory or model of the actor or the network that can be specified a priori, for “the actor has a variable geometry and is indissociable from the networks that define it and that it, along with others, helps to define” (Callon, 1991, page 154). It is only in retrospect that we can understand how actors and networks have coevolved and how these coevolutions were maintained or undermined.

This general approach bears a resemblance to evolutionary theories of economic change (Dosi et al, 1988; Hodgson, 1993; Nelson and Winter, 1982), often described as ‘neo-Schumpeterian’ (Amin, 1994), whereby economic development is understood as “changes in economic life [which are] not forced upon it from without but arise by its own initiative from within” (Schumpeter, 1943, page 63, quoted in Clark N and Juma, 1988, page 212). Thus any ‘transition’ should be considered as both cumulative and sequential, for, as Schumpeter has stressed, “every concrete process of development rests upon preceding development ... Every process of development creates the prerequisites for the following” (Schumpeter, 1943, page 64, quoted in Clark N and Juma, 1988, page 212). Changes in economic life, derive, in Schumpeter’s view, from innovation and risk taking which follow particular development paths (Dosi, 1982), although the effects reverberate through the ‘system’. The benefit of the actor-network approach is that it allows us to see these paths as determined by the networks, and it supplies a few simple rules for the investigation of these. Furthermore, it firmly moves us away from any individualized notion of innovation, for the accomplishments of innovators (innovations) can be understood only from within heterogeneous networks. Moreover, as Callon and Law (1989, page 78) point out, from the perspective of the actor-network, “whenever we look at social action we discover a degree of innovation—that is, we find new sociotechnical combinations being assembled and imposed (or failing to be imposed) on others”. Thus innovation is not simply the provenance of a few key innovating firms but is part and parcel of all network formation.

This sociological perspective might usefully complement institutional economics. By using notions such as ‘translation’ we can investigate institutions or networks as sets of power relations. Networks may come in many shapes and sizes, and the relations which bind actors and entities together will vary. The reasons why some are more successful than others cannot be specified in advance. It is only by following the network—or system—builders in action (Hughes, 1983; Latour, 1987), describing how power relations are constructed, that the reasons for their success can be discerned. If we then find successful network forms which display common characteristics we may be able to talk of a new ‘system’, ‘paradigm’, or ‘capitalist mode of development’. Even then we should not become too attached to our ‘macro determinants’, for, as Callon reminds us, “there is no ultimate guarantee, no explanation in the last instance that cannot, in turn, be questioned” (1986, footnote 10).

(15) Sayer and Walker (1992, page 117) believe production integration may be achieved by means of such devices as “authority, coercion, persuasion, moral stricture, reciprocity, planning, religious conviction, common language, national solidarity, and representative democracy”. What is most striking about this list is its firmly social character. Yet integration is unthinkable without technology, texts, money, and a whole variety of artefacts.

(16) The trick here is to allow actors to teach us the causes of the success or failure of network building. We do not fix the causes—such as efficiency, interest, or structure—in advance. These come at the end of the story (Latour, 1991).
Conclusions
The type of approach I have developed here attempts to close the gaps between our concepts, methodologies, and objects of study. It seeks, as Dreyfus and Rabinow describe Foucault's methodology, "to stay as much as possible on the surface of things, to avoid recourse to ideal significations, general types or essences" (1982, page 132). In this way the explanation of economic change is proposed in terms which bear a close resemblance to its description. We do not specify different levels of analysis in advance, neither should we adopt different repertoires for different social phenomena. We no longer need, therefore, an explanation which privileges external forces. This is particularly true for 'causes' such as 'the capitalist mode of production'. As Latour emphasizes,

"Paradoxically, the cause appears as the consequence of expanding the networks and of reinforcing the centres. This is very beautifully expounded by Braudel (1985). You cannot explain the development of the world economy by invoking a force of some sort (for instance, capitalism) because this cause is itself helpless as long as centres do not exist which are able to capitalize on a larger scale on whatever is produced and sold. The heterogeneous association of many elements (which was supposed to be explained) is precisely what, in the end, gives strength to this capitalism which was supposed to offer an explanation" (1988a, page 162, emphasis in original).

There is no need, therefore, for the analyst to propose an explanation (as in regulation theory) or a form of analysis (as in the ideal types of flexible specialization) which erects a 'great divide' between 'us' (the explanation's proposers) and 'them' (those we propose to explain). Instead,

"the name of the game will be to leave the boundaries open and to close them only when the people we follow close them. Thus, we have to be as undecided as possible on which elements will be tied together, on when they will start to have a common fate, on which interest will eventually win out over which. In other words, we have to be as undecided as the actors we follow ... The question for us, as well as those we follow, is only this: which of these links will hold and which will break apart?" (Latour, 1987, pages 175–176).

It is from within the social processes of economic change that our own accounts must be constructed. These will necessarily be 'hybrids' (Latour, 1988b, page 43), made up of the language of the social sciences and of those networks and subsystems that form our objects of analysis (just as those networks will themselves be hybrids, made up of the heterogeneous 'materials' used by actors in their construction). By following actor-networks as they coevolve we may establish more clearly the "complexity of historical becoming" (Touraine, 1988, page 11) in ways which consider how such 'becoming' arises not from some underlying historical logic but through human action. This is not such a prestigious enterprise as announcing the birth of a new (post-Fordist) society but is perhaps a more effective way of thinking "about questions of actualisation, about the complex processes through which social realities are constituted" (Smart, 1992, page 221).

Acknowledgements. I would like to thank Philip Lowe, Andy Pratt, Neil Ward, and participants at the Advanced Research Seminar on Globalization and Localization at the Department of Sociology of Rural Development, University of Wageningen, for their comments on an earlier version of this paper. I am grateful to an anonymous referee for comments on a later version. The usual disclaimers apply.
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Actor-networks and the evolution of economic forms


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