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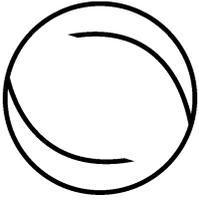
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Varieties of Knowledge and Their Use in Business and Management Studies: Conditions and Institutions

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Abstract

Many research fields combine practical goals with a search for fundamental mechanisms and make significant contributions to theoretical understanding. This is especially so in the social sciences, which are often concerned with policy issues and problems, albeit with varying degrees of directness. Business and management studies (BMS) may be more focused on practical problem solving than other social sciences, but they are equally capable of contributing major intellectual innovations. They produce a variety of kinds of knowledge that are practically useful in different conditions. At least eight types can be distinguished in terms of their horizontal and vertical isolation, and their identification of causal mechanisms. These can be expected to be more or less effective in producing desired outcomes according to three conditions: contextual independence, stability of internal causal processes, and similarity of circumstances. These conditions in turn are likely to be achieved to varying degrees in different socio-economic systems governed by different institutional arrangements, particularly those that encourage varying degrees of managerial authority sharing and inter-firm coordination of economic activities. Differences in the dominant institutions governing knowledge production and labour markets also affect the kinds of research styles and knowledge types that dominate BMS in different societies.

Keywords: knowledge types and use, business and management studies, horizontal isolation, vertical isolation, causal mechanisms, contextual independence, internal closure, institutional regimes, authority sharing, public science systems

Introduction

The relationship between scientific knowledge and technological practice has been the subject of both academic and popular discussion since at least the 19th century, when scientific research became established as a career in some university systems and new industries developed around science-based technologies such as chemical dyes and electrical engineering. In the mid-20th century the apparently central role of the physical sciences in developing military technologies (Mendelsohn et al. 1988), particularly nuclear weapons, and the growing importance of biological research in developing medical technologies, encouraged the belief among policymakers that public investment in scientific research would generate widespread technological and economic benefits, in

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what became known as the linear model of science–technology–industry relations (Guston 2000; Martin 2003).

This simple model of technological success resulting from the direct application of scientific knowledge to practical problem solving has been widely discredited since the 1960s, both among academics studying innovation processes and policymakers seeking increased socio-economic returns from public support of scientific research. Technological advances are now seen as stemming from both practical learning and a variety of different forms of systematic research, and scientific developments are as much influenced by, and dependent upon, technological changes as by purely theoretical speculations (Krohn et al. 1978; Joerges and Shinn 2001).

In considering the nature of technological knowledge and its connections with scientific theories, it is additionally important to recognize that technological research is a distinct kind of knowledge production aimed at understanding how specific materials and phenomena operate in particular circumstances in order to design artefacts for specific functions. Rather than simply involving the ‘application’ of general scientific knowledge to achieve a technological purpose, such research usually requires the development of varied forms of new knowledge to design and construct some system that performs in the desired manner (Laudan 1984; Vincenti 1990), often including theoretically informed trial and error as in much rational drug design (Gambardella 1995).

Furthermore, research intended to deal with practical problems, such as control of alcoholic fermentation, can, and often does, lead to quite fundamental intellectual innovations, as in the cases of Langmuir’s research on the surface physics of tungsten filaments (Reich 1985: 129–122), Pasteur’s work on microbial infection and Keynes’ on unemployment (Stokes 1997: 74). As Stokes (1997: 77) has pointed out, clinical research often requires investigators to identify the basic mechanisms responsible for particular outcomes, and the degree to which research is focused on practical goals is in fact orthogonal to its ability to achieve greater insight into fundamental physical and biological processes.

We can, then, distinguish four ideal types of knowledge in terms of their combination of theoretical or practical purposes and the relative priority of understanding general causal processes. These are pure basic research, such as that undertaken by Bohr on the structure of the atom; use-inspired basic research, such as much of that undertaken by Pasteur; pure technological research, such as that undertaken by Edison on light bulbs; and taxonomic descriptions that have neither practical nor theoretical goals (Stokes 1997: 73–75).

Such distinctions highlight the varieties of research undertaken in the sciences and emphasize the inadequacy of the common separation of pure from applied science, especially the perceived dependence of the latter upon the former. This is particularly so in the human sciences, where most research has some practical intent, however indirectly it may be expressed. As Paul Diesing (1982) suggested some years ago, economics, sociology and political studies are all ‘policy sciences’. Purely theoretical research unencumbered by any practical concern is rare, if not totally absent, in the social sciences, and most research topics are selected and formulated with current social and political interests in mind, albeit with differing degrees of explicitness.

Insofar as business and management studies (henceforth BMS) is a research field producing knowledge for developing and improving social technologies for managing complex socio-economic systems, then, it differs only in degree from the more established policy sciences, and it is equally capable of generating significant understandings of fundamental processes. By being more overtly concerned with the resolution of business and management problems, it is distinct from other social sciences, but studying, say, business decision making can result in major contributions to them, as arguably did Herbert Simon's research on bounded rationality and problem solving.

There are, though, considerable variations in how much academic management research is concerned to identify fundamental social processes as well as to contributing to managerial problem solving. Some is more interested in identifying and developing techniques and practices that seem to achieve particular business results than in understanding the generic mechanisms that explain how and why they do so in particular circumstances. Such largely 'black box' studies of inputs and outputs to particular systems are more similar to Edison's concern to develop commercial electrical lighting systems without seeking to understand the fundamental processes involved, than to Pasteur's search for the microbiological mechanisms that generated and transmitted infections and similar phenomena.

The policy sciences in general, and BMS more specifically, vary, then, both in the extent to which they are directly concerned with social and business problems and in how much researchers are concerned to identify the fundamental processes that generate particular outcomes. They additionally differ in how their knowledge affects social practices and outcomes, especially the extent to which knowledge can be used by various actors to achieve specific results. While some scientific knowledge often becomes incorporated into everyday understandings through education and the mass media, and can change conceptions of rationality, as perhaps in economics degree courses, its direct effectiveness in changing outcomes is usually less evident.

One example of socio-economic theories having a major impact on the social world has been extensively discussed by Donald MacKenzie (2006) in his account of how the Black-Scholes options pricing model helped to construct the Chicago options markets. The role of formal, and indeed highly abstract, knowledge in this case exemplifies what he terms 'positive performativity' (MacKenzie 2006: 17–20) in that the adoption of this model led to these markets becoming more similar in their behaviour to those posited in the underlying theory of financial markets.

This example of how formalized models of ideal economic processes can change behaviour and construct particular kinds of social realities raises questions about the conditions under which such construction can take place, and how different kinds of formal knowledge can affect social phenomena under different circumstances. If part of modern finance theory did indeed alter the nature of economic processes and structures in certain financial markets for a particular period, what characteristics enabled it to do so, why was it used in the specific ways that meant it did alter the nature of these markets, and what were the key circumstances that changed its 'positive performativity'? Further, what

does this case tell us about the varied relationships between different kinds of knowledge in the social sciences and socio-economic outcomes, especially about how different kinds of research in BMS are likely to be effectively used in dealing with particular kinds of managerial problems?

To begin to answer these sorts of questions, we need to a) distinguish between different kinds of formal knowledge, b) consider the conditions in which they are likely to be effectively used to achieve practical purposes, and c) identify the circumstances in which such conditions will probably be realized by varied groups of actors in different societies. This last point in turn involves the analysis of, first, how differences in the organization of economic coordination and control are likely to affect the demand for particular kinds of formal knowledge, and, second, how variations in the way that knowledge production is organized in different societies are likely to affect the supply of different knowledge types and their incorporation into high-level skills. By formal knowledge, I here mean research results, models and theories that are certified through some evaluation process and published in formal communication media such as journals and books.

Accordingly, in this paper I suggest how we could a) usefully distinguish between types of social scientific knowledge for dealing with business and management issues, b) identify the conditions under which these types might be more or less effective, and c) specify the socio-economic situations in which such conditions are likely to be realized in differently structured societies. In the next section, I outline three key dimensions for contrasting types of formal knowledge of business and management issues. Subsequently, I suggest how we might identify the key conditions affecting their effective use in problem solving and decision making to achieve specific objectives. In the following section, I consider how the organization of market economies and their dominant institutions could affect the level and type of demand for different types of knowledge. Finally, I suggest how three characteristics of academic systems can affect the organization of formal knowledge production and its use in high-level skill formation and practical problem solving.

Varieties of Knowledge in Business and Management Studies

In considering how to differentiate types of scientific knowledge that help to develop and improve social technologies in business and management, there are a number of dimensions that could be used. One of the major ones concerns the extent to which researchers are concerned and able to identify the generic *causal mechanisms* that enable desirable outcomes to be achieved. While it could be argued that even the most descriptive narrative or simplest correlation of input and output variables inevitably relies upon some putative model of the motivations and rationalities of the actors involved, as well as of the circumstance in which these result in specific outcomes, nonetheless social scientific theories do differ considerably in how explicitly and precisely such processes are specified (Elster 1998). Generally speaking, the more detailed are such imputed mechanisms, the more precise should be their predictions about the conditions under which particular outcomes occur.

Conversely, accounts that do not attempt to explain how and why something happened are unable to suggest when such effects will take place in future, or what are the key processes involved that are likely to generate them in similar circumstances. Whether these are narrative descriptions of everyday events, or black box correlations of inputs and outputs of some system, they will be of limited use to social technologists since they do not clearly specify how alternative future states of affairs could be produced in particular situations (Mahner and Bunge 2001). At best, they indicate how certain results occurred at the same time as, or shortly after, particular actions and practices were carried out such that it is reasonable to suppose that the same kind of outcome would ensue from similar actions carried out under similar circumstances in the future.

Such causal processes vary in their abstraction from everyday situations, from the particular causes of specific outcomes in individual case studies to the highly abstract reasoning involved in much economic theorizing that is held to apply to all 'rational' human beings. In some variants of rational choice theory, this is so remote from concrete circumstances and contingencies that it becomes tautological and without empirical referents (Boudon 1998, 2003; Mahner and Bunge 2001).

Causal models also vary in the range of different kinds of factors included, and the extent to which these are mutually independent. Qualitative comparative analysis (QCA), as proposed by Ragin (1987), for example, is explicitly designed to incorporate interrelationships between a number of different causal influences, whereas most forms of transaction cost economics (TCE) presume that bounded rationality, asset specificity and opportunism are the only important factors affecting firm boundaries and 'make or buy' decisions, which act independently of each other (Dietrich 1994). QCA involves, then, a wider range of factors, and considers how their interactions affect outcomes to a greater degree than does TCE.

These variations suggest a further dimension for contrasting types of formal knowledge for social technologies, what Maki (1992, 2004) has termed *isolation*. While most social scientific theories deal with entities that are similar to, and whose descriptions overlap considerably with, those used in everyday discourses, and so are different from many natural sciences, which refer to quite different phenomena such as quarks, electrons, mitochondria etc. (Maki 2002), they vary considerably in how much they separate actors and situations from their contexts and ignore most features of their environment. Descriptive accounts of the social processes involved in cases of organizational change, for instance, typically include much more detail about particular individuals and groups, and how they interacted over time, than the more abstract models of firms and markets that are characteristic of much economic theorizing.

This dimension can be further divided into two types of isolation: horizontal and vertical, which Maki (1992) suggests are orthogonal. *Horizontal isolation* occurs when phenomena and actions are sealed off from the influence of a range of factors at the same level of abstraction. For example, in some theories of strategic management, internal organizational conflicts and structures are ignored as significant factors affecting decision making and so are quite horizontally internally isolated. *External horizontal isolation* occurs when the context of a phenomenon is

largely ignored, as when contingency theories of organizational structure claim that relationships between technology, size and workflow standardization hold across all societal contexts irrespective of variations in skill-formation systems, authority relations and other institutional factors.

Vertical isolation is similar to abstraction or idealization in that it refers to the extent to which theories and models abstract from concrete particulars to general phenomena and processes, such as the competitive logics governing firms and markets in all capitalist societies. The key feature here is the remoteness of the actors, their properties and logics, from specific spatio-temporal locations, so that theories of firm behaviour that claim to apply to all legally defined companies in all market economies are more vertically isolated than those that refer to firms in liberal market economies in the 20th century.

These two types of isolation can be combined in a variety of ways. Many orthodox economic theories are both highly vertically and horizontally isolated in that they deal with abstract actors with a very restricted range of properties operating in tightly structured circumstances that are remote from most empirical markets, legal systems and institutional contexts. Both the variety of factors considered relevant, and the significance of the particular characteristics of the spatio-temporal locations in which economic action occurs, are minimized in favour of formalizing idealized relationships between a small number of factors that are held to apply over all market economies.

At the other end of the isolation spectrum, there are detailed descriptions of particular companies' development and change that incorporate both internal organizational processes and structures, and external socio-political factors. These tend to be quite low in terms of both vertical and horizontal isolation, although they do, of course, select and abstract to some degree. A third set of theories and models combine low levels of abstraction with considerable horizontal isolation. Some of these focus on particular companies and industries, often in specific economies and periods, but ignore a wide range of factors that could, in others' eyes, be important.

Chandler's (1977, 1990) mammoth surveys of big business in the USA, the UK and Germany, for instance, offer highly detailed accounts of particular firms' development, while tending to underplay, or ignore, both internal conflicts and external interdependences in favour of an underlying efficiency logic. Strategic management theories based on Chandler's accounts tend to be even more horizontally isolated. As Langlois (2003) has recently pointed out, they additionally ignore the particular historical circumstances of the US economy in the early 20th century that made such a logic apparently efficacious at that time, and that no longer apply. Here, low levels of vertical isolation are combined with some horizontal isolation.

A fourth set of models combine greater abstraction with relatively limited horizontal isolation, such as those that deal with types of firms and markets in particular circumstances. Much institutional theorizing about forms of socio-economic organization, social systems of innovation and production (Amable 2003) and types of market economy abstracts from concrete societies to compare ideal types of business systems and similar patterns of economic coordination and control (Whitley 1999, 2007). Their development and change are then explained in

terms of dominant social institutions and coalitions in particular circumstances and historical periods. Insofar as they tend to ignore the behaviour of internal organizational factors and firms' leading groups, they can be said to display greater internal horizontal isolation than external horizontal isolation.

These four ideal types of BMS theories and models that differ in their degree of horizontal and vertical isolation from everyday descriptions additionally vary in the extent to which they specify the explanatory mechanisms responsible for outcomes, whether these are idealized utility maximization, the pursuit of power and prestige or institutionalized logics of action. Largely black box correlations of inputs and outputs, for example, vary considerably in the range of factors they incorporate, from simple 'best practice' recipes, based on a few key variables, to more detailed narrative descriptions. Similarly, they vary in their abstraction, from accounts of specific cases where particular practices seemed to generate desired outcomes, to highly formalized models of abstract variables optimizing some 'objective function'.

We can combine these dimensions of isolation and causal modelling to differentiate eight distinct types of formal knowledge of socio-economic phenomena that could, in principle, help to develop and improve social technologies. Narrative case studies, for instance, combine low levels of both horizontal and vertical isolation without explicitly identifying the causal mechanisms involved, as in some processual accounts of organizational change. Comparative case analyses, on the other hand, combine limited levels of isolation with a systematic search for causal mechanisms, as in Barrington Moore's *Social Origins of Dictatorship and Democracy* (1966).

More vertically isolated models of ideal types of economic organization and capitalisms also claim to identify key causal processes but abstract from specific spatio-temporal locations to a greater extent, as in many accounts of social production systems (Amable 2003; Hollingsworth and Boyer 1997). Equally, models of best practice vary in their degree of abstraction and explicit identification of the causal processes generating desired outputs. These eight types of formal knowledge are summarized in Table 1.

Given these sorts of differences between knowledge types in the policy sciences, the question then arises as to how, and in what circumstances, can they be used to enhance problem-solving capacities and engineer improvements in practical outcomes? Are there, for instance, particular kinds of problems or situations for which particular combinations of isolation and explanation might be especially appropriate? In what ways might different kinds of knowledge be relevant for specific sorts of practical concerns? Just as the transfer of production and organizational technologies, such as lean production and 'Japanese' HR practices, seems to vary greatly in effectiveness depending upon the nature of the techniques and routines concerned and the circumstances involved (see, e.g., Abo 1994; Botti 1995; Liker et al. 1999), so too we would expect the practical use of formal theories and models to differ according to their nature and the kinds of systems in which they are used. I now consider the kinds of situations in which different types of formal knowledge seem most likely to be effective in the sense of producing particular kinds of desired outcomes.

Table 1.
Types of Formal
Knowledge in
Business and
Management
Studies

Type of formal knowledge	Key characteristics		
	Vertical isolation	Horizontal isolation	Explicit specification of causal mechanisms
Narrative case studies	Low	Low	No
Classifications of ideal types of complex systems	Considerable	Limited	No
Comparative case analyses	Limited	Limited	Yes
Comparative analyses of ideal types	Considerable	Limited	Yes
Descriptive models of best practices	Low	Considerable	No
Black box models of inputs and outputs of idealized systems	Considerable	Considerable	No
Causal models of best practices	Limited	Considerable	Yes
Universal theories of idealized systems	High	High	Yes

Conditions for the Effective Use of Different Types of Knowledge in Business and Management

In the case of the apparently strong impact of part of modern finance theory in derivatives markets, for instance, it seems reasonable to suggest that such highly idealized models of isolated systems may be effective in markets dealing with a limited range of highly standardized assets in frequently repeated and mostly arm's length transactions. Both the internal structure of trading decisions and relationships between traders, and their interdependence with the external environment, were relatively simple, and did not undergo substantial qualitative change until the 'extreme event' of the October 1987 crash (MacKenzie 2006: 184–210).

Furthermore, external circumstances did not change enough to alter the operation of the markets, except perhaps to increase the similarity between the actual conditions governing them and those posited by the models. In other words, highly abstract theories of how markets should price financial instruments may be used to develop such markets when participants and regulators are able and willing to construct high levels of system closure in the sense of generating continuing regularities of events (Bhaskar 1975: 69–79; Sayer 1992: 121–125).

This analysis of the role of finance theory in structuring the Chicago options markets additionally highlights the temporally limited and contingent nature of such 'effective performativity'. MacKenzie (2006: 203–205) suggests that the trauma of the 1987 crash so altered Chicago traders' understanding of options' pricing and volatility that they effectively institutionalized a 'skew' when pricing large 'put' options with low strike prices, which directly contradicted some basic assumptions of finance theory by collectively restricting arbitrage. The experience of the crash led to a violation of the intrinsic condition of closure and to an increased disjunction between the formal model and market practices.

More generally, this example suggests that highly abstract models and theories of socio-economic phenomena derived from generic causal mechanisms are going to be useful to social technologists only when the system being managed is so closed that such mechanisms dominate its operation and actors are constrained to follow their logic. Since theories of highly vertically isolated systems imply that the particular circumstances in which such phenomena occur are irrelevant to system outcomes and processes, the more abstract is a theory, the more its technological effectiveness is dependent on its logic dominating decision making to the exclusion of countervailing mechanisms that stem from the situations in which it is applied.

To use some highly general theories of competitive advantage in making strategic decisions effectively, for example, markets and firms must be so organized that only the variables specified by these theories are significant in determining outcomes, and they do so in the ways that are formally stated. Where such systems do not develop 'naturally', they have to be able to be constructed by managers through rules and sanctions if the models are to be effective.

Similarly, highly general models of best practice are only readily transferred between different kinds of contexts involving different actors when social systems can be sufficiently isolated from these particular conditions to generate the required outputs regardless of the specific circumstances, as perhaps in the cases of some production control and logistics models. For such generic recipes to be effective, the systems to which they are applied have to be so constrained and bounded that the particular nature of the participants, technologies and markets are largely irrelevant to their operation. Overall, then, the effective use of models and theories of abstract, generic processes and systems to achieve technological ends depends on those processes operating in the desired manner irrespective of the specific circumstances in which they are located, and so being contextually highly independent.

Equally, models and theories that horizontally isolate properties and mechanisms from most internal and external characteristics depend on the small number of variables considered critical operating in the desired manner separately from their context, if they are to be effective in generating predicted outcomes. In the case of internally horizontally isolated models, this typically means that decision makers can ignore the effects of internal organizational conflicts, development and change, while the utility of externally isolated models relies on system logics being largely independent of their contexts and key factors operating in much the same way irrespective of their environments. The more interdependent are socio-economic processes with particular features of their environments, such that they change when these alter, the less effective in generating desired results will be models and theories that are highly horizontally isolated.

Turning now to consider the conditions in which models varying in their explicit specification of causal mechanisms can be expected to be effective, there is a general presumption that, the more detailed these are, the more likely they will be useful in engineering desired results because they specify how the key factors are likely to operate to produce them (see, e.g., Mahner and Bunge 2001). Black box models, in contrast, simply correlate inputs and outputs without showing how the former produce the latter, and so identifying the

mechanisms that could be used by technologists. This suggests that the more causal mechanisms are specified correctly, the more they can be relied upon to generate desired results in a wide variety of circumstances. In particular, their efficacy should not be dependent on these circumstances being similar to those in which the mechanisms were originally found to work.

On the other hand, where no causal mechanism is identified, or else is so loosely suggested as to be practically useless, it remains unclear what are the circumstances in which the input-output correlations are likely to prove reliable, and so social technologists wishing to apply such models are likely to do in situations that are quite similar to those already studied. Primarily descriptive knowledge, or general correlations that do not articulate the causal processes through which certain inputs are translated into specific kinds of results, are, then, most probably going to be useful in achieving similar outcomes when the context in which they are applied is quite similar to those in which these results were produced earlier.

Following this discussion, we can suggest how the eight distinct types of formal knowledge identified above might be more or less effective when three key conditions are met: *contextual independence*, *internal closure and stability*, and *similarity of circumstances*, as summarized in Table 2. The first condition concerns the degree to which system properties and actor behaviour function largely separately from the particular situation in which they are located, such that most contextual features can be ignored in applying the model or theory to achieve particular goals. It is considerable when the processes described in the model, or theory, can be reliably assumed to continue to operate in the stated manner irrespective of changing contextual circumstances. It is low or limited when system behaviour is closely interconnected with those circumstances such that, when they alter, so too will its outcomes.

The second condition refers to the stability of the processes generating predicted outcomes such that they can be relied upon to produce the same results from specific actions. High-powered incentives such as stock options, for example, are supposed to ensure continued intensive work commitment in highly risky new technology enterprises in Silicon Valley and elsewhere (Bahrami and Evans 1995; Casper and Whitley 2004; Ferguson 1999), just as many central banks assume that changing interest rates enable them to control inflation. However, these processes can change under some circumstances, such as continued high inflation, so that outcomes no longer follow the same logic. Where such stability is low, practitioners cannot rely on formal models of system behaviour to generate desired outcomes, or at least these have to be supplemented by additional theories that explain how and why changes are likely to occur. In general, at least some stability of internal processes has to be assumed if formal knowledge is to be useful in achieving practical objectives.

The third condition concerns the extent to which the major characteristics of the situation in which the knowledge is to be applied appear to resemble those in which it was found to be effective. The presumption here is that if some set of actions 'worked' in particular circumstances, then they are most likely to do so elsewhere if most of the salient factors appear to be the same. For example, some European countries have attempted to stimulate the development of high-technology clusters

Table 2.
Conditions in
which Different
Types of Formal
Knowledge in
Business and
Management
Studies are likely
to be Effective

Type of formal Knowledge	Conditions		
	Contextual independence	Internal closure and stability	Similarity of circumstances
Narrative case studies	Low	Some	High
Classifications of ideal types	Some	Considerable	Considerable
Comparative case studies	Limited	Some	Some
Comparative analyses of ideal types	Some	Some	Limited
Descriptive models of best practices	Limited	Some	High
Black box models of idealized systems	High	High	Some
Causal models of best practices	Some	Considerable	Limited
Universal theories of idealized systems	High	High	Low

by investing in public venture capital funds and encouraging universities to be entrepreneurial, because they consider these aspects of the business environments to have been crucial to the success of Silicon Valley (Casper 2003, 2007; Lehrer 2000).

In the case of narrative case studies, their usefulness seems to depend quite considerably on the circumstances being similar to those described in the original cases, since there is little information about the core causal processes responsible for outcomes. Contextual interdependence is high because the particular characteristics of the situation in which the events took place are important, and some internal stability needs to be assured for the same or similar practices to generate comparable results. However, the lack of clear explanatory mechanisms that would show how and why they occurred implies that these case studies have rather limited technological efficacy, and the need for similar circumstances to obtain also suggests that they will be useful in only a limited range of situations.

The same sort of reasoning applies to classifications of ideal types. Similarity of circumstances is important, given the lack of clear causal mechanisms, and this restricts the range of situations in which this kind of model would be applicable. The focus on ideal types means that the degree of contextual interdependence is more limited than it is for narrative cases, although the low level of horizontal isolation and considerable range of factors considered means that some aspects of their contexts remain significant. Again, for these typologies to be useful — and their reliability will be limited in the absence of clear causal mechanisms being identified — considerable internal closure is essential.

Comparative case analyses, on the other hand, do identify the key causal processes at work in particular situations, and these should be applicable in different circumstances, especially when internal closure is considerable. However, they are closely interdependent with particular contexts, so that their generality

will be limited. Similarly, the wide range of factors included in such approaches means that applying such analyses across many different situations will be difficult, and their efficacy limited when circumstances are highly varied.

More abstract comparative analyses of ideal types should be somewhat more generally applicable across a range of different situations, provided that internal closure remains considerable and the variety of contextual factors that are critical to the operation of the causal mechanisms is limited. Under these conditions, they should be fairly reliable in generating predicted outcomes, albeit restricted to circumstances where the main features of the ideal types are similar to the empirical phenomena.

On the other hand, descriptive models of best practice are unlikely to be useful over a wide range of situations, given their lack of clear causal mechanisms and close interdependence with particular spatio-temporal locations and circumstances. The presumption is that some degree of internal closure exists, for them to be applicable beyond the initial case, but a considerable degree of similarity in the context will be needed for such applications to be effective. In any event, their reliability is not likely to be very high.

The technological use of abstract black box models of system inputs and outputs, in contrast, assumes high levels of internal closure, and also that system operations are quite independent of their environment. However, the lack of causal processes underlying the observed correlations means that some similarity of context will be essential for applications to be effective, albeit not as high as in the previous cases if the level of closure is considerable.

Causal models of best practice are more interdependent with their environment, and hence more restricted in their range of application than abstract models. Since, though, causal processes are identified, they should be technologically effective in a wider range of circumstances than descriptive accounts of individual cases, and be more efficacious when internal closure is considerable.

Finally, universal theories of idealized systems that specify general causal mechanisms, which produce regularities in a wide variety of situations, assume high levels of internal and external closure. Under those conditions, they will be quite effective and perform to a similar degree to the Black–Scholes model in options markets. However, this level of closure is achieved in only a limited range of circumstances in social systems, and for limited periods, as the same case exemplifies. This restricts the frequency with which such approaches could be relied upon to generate specific results.

Institutional Regimes and the Use of Different Knowledge Types in Business and Management Studies: The Role of Managerial Authority Sharing

These general conditions in which different kinds of formal knowledge could be effectively applied to achieve particular social technological objectives are realized to different degrees in differently organized market economies. As numerous comparative analyses have demonstrated over the past two decades, patterns of economic coordination and control vary systematically and consistently over

some time, between differently organized market economies (see, e.g., Amable 2003; Hollingsworth and Boyer 1997; Whitley 1999), and these variations affect both the extent to which organizational problems and business decisions are contextually independent and strategic managers are able to impose internal closure.

In particular, differences in how leading companies are organized and governed, and in the institutions governing market relationships, can be expected to influence how different kinds of dominant groups develop, modify and use formal and informal knowledge for dealing with variously conceived business opportunities and problems. Thus, variations in dominant patterns of socio-economic organization can help to explain differences in the 'demand' for academic knowledge of organizations and markets, especially the more abstract and general types.

It is particularly the structure of managerial authority within leading firms, the prevalent ways firms deal with each other in variously organized markets, and relations between major interest groups in the society as a whole, that affect the demand and use of formal knowledge in coordinating and controlling economic activities throughout market economies. Differences in the nature of managerial roles and hierarchies, particularly in how managers are constituted as a group controlling resources and decision making, have important consequences for how, and by whom, managerial problems are defined, the sorts of knowledge that are considered to be helpful in dealing with them, and how that is developed and used.

These differences can be analysed along a wide range of dimensions, but perhaps the simplest way of considering how they help to explain variations in the development and use of formal knowledge to deal with business and management issues is to focus on one rather general feature: the overall degree of authority sharing between owners, managers and employees (Whitley 2007). This refers to the extent to which owners and strategic managers involve employees, business partners and other groups in problem solving, knowledge generation and application, and economic coordination and control more generally.

This characteristic of managerial behaviour is strongly affected by the dominant institutions governing economic actors and how they compete. In particular, where they provide few constraints on short-term economic opportunism and permit easy entry and exit from market relationships, long-term relationships between owners, managers and employees are discouraged. Such arm's length business environments make it difficult for companies to make credible commitments to employees and business partners, and so share authority with them to develop distinctive firm-specific competitive competences on a medium- to long-term basis (Whitley 2003b, 2007). Economic coordination in such societies is primarily carried out by managers within each firm acting separately from each other in an institutionally thin socio-economic context.

The stereotyped Chandlerian company in 20th-century USA, for instance, was essentially a managers' organization in which non-managerial employees were largely regarded as temporary members who were not expected to contribute significantly to organizational problem solving or collective knowledge development (Chandler 1977, 1990; Langlois 2003; Thelen 2004). Typically, strong central direction of internal organizational processes within such firms

was contrasted with highly adversarial external relations between them, such that knowledge, risks and opportunities were rarely shared, and market contracting was short term, ad hoc and predominantly zero-sum. Coordinating activities and developing competitive competences in such systems were the responsibility of managers in each firm, as was the implementation of new techniques and routines in a largely unilateral way. Managerial problems were thought to be relatively isolated from their specific organizational, industrial and technological context and so it is not too surprising, then, that it was in the USA that the idea of general managerial knowledge and skills for a wide range of general managerial problems became institutionalized (Locke 1996).

In much of continental Europe, Japan and some other societies, in contrast, states have taken a more active promotional approach to economic development, in which highly organized interest groups have been encouraged to assume a stronger coordinating role (Crouch 1999: Ch.12; Evans 1994; Weiss 2003). As a result, the visible hand of economic coordination and control (Chandler 1977) has been less concentrated in large companies, and more diffusely achieved through cooperation between firms, trade associations, employer and labour union groups, and providers of sectoral business services, including technical schools and other agencies. This means that many coordination problems and concerns that are largely internal to the large firm in arm's length market economies are more institutionally managed in these kinds of market economies, and so firm-based managerial integration is not as dominant.

In addition to encouraging collaboration between companies and other organizations, institutional constraints on short-term opportunism encourage internal authority sharing with skilled workers, especially where strong trade associations enforce effective anti-poaching norms and rules. Long-term membership of, and identity with, the company are more widespread among non-managerial employees in such circumstances than in more arm's length institutional regimes, and careers and competences more organizational specific (Whitley 2007). This means that externally developed generic skills — whether managerial or otherwise — become less important to daily problem solving and advancement than the more firm-specific ones developed over many years within the company or group.

It also means that recruitment and training of new staff who are expected to remain with the company for some time, thus excluding many women and temporary workers in Japanese large firms (Graham 2003), will be more important to employers than where labour turnover is greater, and their long-term contribution to corporate success more valued than short-term ability to do a specific job. Because knowledge and capabilities are relatively firm-specific in leading firms in these kinds of market economies, new employees — or organizational members — have to be trained as much within the firm as in external agencies and are not always expected to be able to carry out particular tasks immediately. Consequently, the ability of newly trained and certified graduates to 'hit the ground running', as the cliché puts it, is less significant for such employers than it is for those in lower-commitment economies, in which short-term contributions are more important.

Table 3.
Influence of
Variations in
Authority Sharing
for the Demand
and Use of Formal
Knowledge in
Business and
Management
Studies

Demand and use of formal knowledge	Degree of internal and external authority sharing	
	Limited	Considerable
Demand for external knowledge for dealing with organizational and strategic issues	Considerable	Limited
Perceived generality of business and management problems	Considerable in task- discontinuous career structures	Limited
Extent of managerial independence in implementing change	Considerable	Limited in the short term
Managerial ability to impose and maintain closure unilaterally	Considerable	Limited
Contextual independence of problems and decisions	Some, in the short term	Limited
Applicability of abstract models of atomistic markets	Considerable	Limited

Similarly, general knowledge of business problems based on idealized models of standard actors facing abstract, highly defined situations is even less likely to be considered useful for dealing with firm- and industry-specific issues in economies where authority sharing is considerable, and commitments are longer term, than in those where constraints on short-term opportunism are weaker. Overall, the greater the degree or organizational specificity of knowledge and capabilities, and the more they vary across markets and technologies as firms focus on particular niches and competences, the less directly useful will be abstract and generic knowledge and skills, and the more valued will be company-specific problem-solving capacities.

These variations in patterns of authority sharing within and between companies can be expected to affect the nature of the demand for different kinds of formal knowledge, as well as the circumstances in which they might be used by different groups, to deal with organizational and business problems that vary in their contextual interdependence and internal closure. These connections are summarized in Table 3 and will now be further discussed.

First of all, it is worth considering the overall likelihood that managers will be receptive to the idea of externally produced knowledge, especially that generated by academics, being useful in dealing with organizational and strategic problems. While, in general, most may well prefer home-grown recipes and routines that take full account of the specific circumstances involved, and so disdain external advice, this attitude is perhaps more probable when problem solving is regarded as a collective organizational activity in which many different groups are involved, than when it is largely or exclusively the province of 'management'. The relative use of different kinds of external management consultants by leading companies seems to reflect this difference in patterns of economic organization (see, e.g., Clark and Fincham 2002; Engwall and Zamagni 1998; Kipping and Engwall 2002).

Furthermore, the establishment of managers as an exclusive dominant stratum in leading US companies, selected more on general educational attainment in task-discontinuous career patterns than on firm-based performance and industry knowledge (Locke 1996; Offe 1976; O'Sullivan 2000), and the institutionalization of a separate managerial labour market seem likely to have both encouraged, and been assisted by, the conceptualization of many organizational problems and business decisions as general managerial issues. As such, they could, in principle, be amenable to generic problem-solving techniques based on general formal knowledge. This view might well have been reinforced, in the case of the postwar business elite support for more 'scientific' approaches to management problem solving and education, by the still-limited legitimacy of US big business after the depression of the 1930s, on the one hand, and the greatly enhanced postwar prestige of the sciences, on the other hand.

Where, in contrast, managerial career patterns are more task-continuous and organizationally specific, in that many managers have similar skills and experiences to other employees, and decision making is more interdependent with other groups inside and outside the formal boundaries of the firm, this construction of organizational concerns and decisions as being exclusively the province of managers is less probable. The need for external legitimacy of managerial authority is less likely to be so intense in societies where managers have extensive organizational experience, and are often qualified in similar competences to many skilled workers, as in Germany (Locke 1989, 1996; Maurice et al. 1986; Thelen 2004).

The appeal of highly general models of business decision making and problem solving for managers in the more institutionally coordinated societies is additionally limited by the greater interdependence of groups within firms, and between market actors, that makes many problems and skills contextually specific and dependent. The more that authority is shared between groups, and commitments are longer term and wider ranging than in spot markets, the more specific problems become to the particular organization, industry and business group, and the more problem-solving knowledge has to take the specific context into account. This restricts, I suggest, the effective application of highly abstract models of idealized systems to deal with them.

Similarly, the more organized nature of market relationships in such economies limits the applicability of formal knowledge premised upon orthodox microeconomic presumptions. Where firms share authority with trade associations, employers' groups and each other, generic models of perfect competition between isolated price-takers are unlikely to be very useful in making decisions. If the postwar German pattern of strong sectoral trade associations, powerful employers' and labour groups and extensive technological collaboration has reinforced the earlier pattern of many successful firms to focus on niche markets with high levels of product customization and close supplier linkages (Dornseifer and Kocka 1993; Soskice 1999), then the effectiveness of formal models of adversarial competition in mass consumer markets seems unlikely to be high.

Finally, the ability of managers to apply general models and theories effectively to deal with organizational problems is probably easier in societies where

authority sharing is not encouraged by dominant institutions and they can control decisions more unilaterally. Because managers in arm's length institutional regimes can, at least in theory, design and direct organizational processes through managerial rules and procedures without needing to ensure the long-term commitment of skilled staff (Whitley 2007), they should be able to impose considerable internal closure on them and ensure stability of internal relationships in organizational systems. In turn, such control can be expected to enable managers to generate reliable outcomes from implementing practices based on general causal mechanisms. Equally, where those models and theories imply radically different practices and routines from those currently in use, as highly abstract and context-independent ones are more likely to do across all possible situations, managerial elites will be more able to implement them, and achieve radical change, than those in more interdependent circumstances.

Conversely, improvements based on formal knowledge that acknowledges the contextually dependent nature of organizations and inter-firm relationships—and so is not so abstract and horizontally isolated—will more probably be accepted and applied effectively where authority sharing is widespread. Just as incremental process and product innovations are commonly regarded as more feasible and effective in economies with considerable employer–employee commitment, so too we would expect incremental managerial innovations to be more readily developed and used effectively there than in ‘hire and fire’ cultures.

Overall, then, the conditions for applying highly isolated models and theories effectively to a wide range of business and management problems are less likely to be realized in the more coordinated economies than in those dominated by arm's length institutions. Organizational processes and decision-making situations will be more contextually interdependent, and radical managerially imposed change less feasible, in these kinds of societies. Since many competitive competences are relatively specific to particular firms and their networks, and also depend on collective contributions over some time for much of their improvement, formal knowledge that matches current practices and commitments is more likely to be applied effectively than highly general and abstract recipes that are meant to be generic across all industries and circumstances.

Public Science Systems and the Production and Use of Knowledge Types in Business and Management Studies

In addition to variations in the organization of firms and markets affecting the demand for, and use of, different types of formal knowledge in BMS, there are also important differences between countries in how research is organized in the public sciences that impinge upon the organization of knowledge production and its effective use in dealing with business problems. These affect the supply of different kinds of knowledge in BMS and how they are incorporated into practical skills.

Public science systems consist of the set of organizations whose employees are primarily concerned with producing publicly certified knowledge together with the particular institutional arrangements governing their funding, establishment of priorities, evaluation of performance and allocation of rewards.

They vary considerably between nation states in terms of the autonomy of scientific elites and their control over access to resources, the diversity of research organizations and their funding, and the organizational segmentation of research goals, labour markets and careers, among other dimensions. These differences affect the overall degree of intellectual pluralism and intensity of reputational competition in the sciences as a whole, although of course these also vary considerably between scientific fields as well (Whitley 2000; 2003a).

Before considering how these differences in the organization of public science systems have affected the production and effective use of formal knowledge in BMS, it is important to note the widespread incorporation of research and teaching in this field into the leading research universities of many countries, especially since the expansion of higher education in the 1960s and 1970s. This has encouraged the institutionalization of a considerable variety of specialist reputational communities producing and evaluating research results for academic audiences on topics that are often remote from the everyday concerns of managers (Locke 1996; Whitley 1984; 1986).

By becoming part of the established university system, researchers in BMS have been encouraged to produce general scientific knowledge of underlying causal processes that were important for understanding a wide range of phenomena. This is because the reputational system for assessing the worth of contributions to knowledge, and allocating rewards accordingly, values most highly those that are useful for others' research, as indicated, for example, by citation counts. On the whole, the study of general mechanisms that purport to explain the properties and behaviour of numerous objects and systems is more likely to be useful to one's colleague-competitors in the sciences than is research on the technological problems of particular sectors and companies (Whitley 2000). It is not surprising, then, that the more BMS researchers aspired to scientific status, the more they focused on general processes of relatively isolated systems rather than on understanding the particular problems of specific industries and technologies. The recent expansion of research evaluation exercises in many national university systems has further intensified pressures on researchers in this area to contribute to academic intellectual goals (Whitley and Glaser 2007).

However, this general academization of business and management studies in many OECD countries took place in quite different institutional settings in which the organization and role of universities varied considerably (Locke 1989; Tribe 1995; Whitley 1995). Among the more important differences for understanding the ways that research in BMS has become institutionalized and separated from practical problem solving in many countries are a) the degree to which research universities dedicated to high science ideals dominate formal knowledge production, careers and the allocation of resources; b) the homogeneity of research goals and organizational groupings across and within leading universities; c) the extent of organizational segmentation of research goals and labour markets. The likely connections between these factors and characteristics of knowledge production and use in BMS are summarized in Table 4 and will now be discussed.

Table 4.
Connections
between the
Organization of
Public Science
Systems and the
Production and
Use of Knowledge
in Business and
Management
Studies

Knowledge production and use in BMS	Characteristics of public science systems		
	Dominance of research universities and high science ideals	Standardization and internal homogeneity of universities	Organizational segmentation of research goals and labour markets
Dominance of scientific goals and standards	+	+	High in universities, low in technology institutes
Responsiveness to market demands for technologically useful knowledge	-	-	High in technology institutes, low in universities
Ease of transferring knowledge and researchers between universities and business	-	-	-
Integration of formal knowledge into high-level practical skill formation in universities	-	-	-

The Domination of Research Universities

The dominance of research universities here refers to the extent to which the leading research-focused universities and their scientific elites dominate the higher education system of a country such that prestige and resources are predominantly allocated according to their standards. Where this is high, we would expect technological research and professional training based on it to be located in the less prestigious institutions. The history of engineering and business education and research in the UK's leading universities to some extent exemplifies this pattern (Hillkin 1967; Locke 1989; Sanderson 1972; Whitley et al. 1981). Where it is more limited, there are a variety of universities and other kinds of research organizations producing knowledge for a number of different purposes, often with resources from different agencies, and technological goals and contributions are not regarded as being so inferior to more scientific ones.

In public science systems dominated by research universities in this sense, the incorporation of BMS into the university system seems likely to encourage researchers to produce knowledge of highly general processes that are quite horizontally and vertically isolated. Indeed, acceptance of the subject will probably happen only if they are seen to follow the research styles and goals of current scientific elites. The more that social prestige and access to resources are concentrated in a few elite universities dedicated to intellectual objectives, the more that researchers in BMS and other professionally oriented subjects will be pressured to organize knowledge production according to similar standards to those current in the established sciences. This means that detailed knowledge of particular industries, firms and markets will be less valued in such science systems than more generic models and theories, and technological applications less rewarded than abstract theorizing.

This tendency will be less marked in public science systems that have a diversity of research organizations dedicated to different purposes and with access to their own resources. Such differentiation of organizational objectives, audiences for research results and funding sources enables BMS researchers to undertake a variety of types of research including technological studies of particular systems and situations. While, then, those established in the leading universities will tend to focus on understanding general processes, others located in organizations with more practical goals and closer to practitioner audiences will be more concerned to research less isolated systems and problems.

The dominant role of research-focused universities and scientific elites in public science systems is also likely to affect three other aspects of knowledge production and use in BMS. Given the pressure to follow the standards and priorities of the leading sciences and academic elites, it seems unlikely that many researchers will respond readily to demands from business elites for technologically relevant research, at least to the extent that this might prevent them from producing respectable scientific contributions. Insofar, then, as the world of professional practice does expect BMS researchers to study the specific problems of particular industries and contribute to the management of particular organizational issues, this will have relatively little impact on research priorities and questions where high science ideals dominate and universities are funded centrally by state agencies. In more differentiated public science systems, such expectations may be met by the technologically oriented research organizations, especially if they are partly funded by companies and industry associations, as in Germany (Abramson et al. 1997).

Similarly, using scientific knowledge to deal with business decisions and organizational problems, particularly when it involves the temporary or longer-term mobility of researchers between universities and private companies, is easier to accomplish when research careers can be organized flexibly and scientists are able to take on a variety of roles without being stigmatized as second rate. This is more likely when research universities do not so dominate prestige and resource hierarchies that leaving them for other kinds of employment or economic activity is widely considered to indicate intellectual failure.

Finally, public science systems dominated by research universities and scientific elites that privilege highly general scientific knowledge over technological achievements are unlikely to encourage the development of high-level professional skills based on formal knowledge that is capable of being directly applied to practical problems. Rather, such higher education systems will prefer to develop very general competences that need substantial further training and experience if they are to be practically useful. The most prestigious qualifications from elite universities are more likely to reflect success in learning general academic knowledge than acquiring technologically relevant skills. The continued preference by the state civil service and many large companies for graduates in classical studies, and the traditional humanities more generally, from Oxford and Cambridge universities in the UK could be seen as indicative of this phenomenon (Glover and Kelly 1987; Locke 1989; Sanderson 1972).

The Homogeneity of University Structures

Another, and often connected, important feature of public science systems concerns the relative homogeneity and standardization of goals and organizational groupings within universities. In highly homogenous systems, the purposes of departments and research institutes are similar throughout universities and they tend to be organized and governed in similar ways across the entire system. This is often because they are state institutions and academics have the formal status of civil servants. In more heterogeneous systems, universities and other research organizations consist of a wide variety of different kinds of departments and schools dedicated to different purposes and governed by more varied procedures and standards, as in many US research universities (Geiger 1986; Graham and Diamond 1997).

Universities also differ in their homogeneity of organizational structures and tolerance of different kinds of research. Many continental European and Japanese universities, for instance, are both highly dependent on funding from state agencies and governed by the same set of rules and regulations throughout the system. Employment conditions, organizational boundaries and governance procedures are standardized throughout national university systems such that newly incorporated subjects like Betriebswirtschaftslehre (business economics) have to conform to them (Locke 1989; Tribe 1995), and researchers had to gain the *habilitation* degree to become a professor in Germany (Locke 1996: 75–76).

Such homogeneity seems likely to encourage university researchers in BMS and similar subjects to conform to prevalent standards of scientific worth and competence, and so to value studies of general processes more highly than those of specific industries and particular technological issues. This, in turn, may well inhibit them from responding to practitioners' demands for relevant research and devoting substantial amounts of their efforts to more technological pursuits. Mobility between universities and business may also be inhibited by such standardization of goals and structures, as researchers prefer to identify themselves more with scientifically focused academic employment and activities than with effective business applications of their knowledge and skills.

Similarly, the more standardized is the academic system of a country, the less easy will it be for universities to incorporate the development of high-level skills based on formal knowledge that are intended to enable graduates to be practically effective in dealing with business issues. If the prevalent system of tertiary education is based on the acquisition of general scientific knowledge in the broadest sense, and the institutions providing it are homogenous, then accommodating more specialist training in practically relevant skills in that system will be difficult.

In contrast, where universities are less internally standardized and incorporate a variety of different kinds of schools and departments pursuing different purpose and research activities, more technologically oriented intellectual goals and careers have been accommodated in separate professionally focused groupings. The more market-oriented US system of higher education has, for example, encouraged greater organizational variety in elite universities such that they have been able to combine a considerable diversity of intellectual

purposes and types of educational activities within a single organizational structure for many decades. This has been facilitated by their ability to attract funds from many different kinds of sources for varied goals, such as state agencies, foundations, alumni donations and patents (Geiger 1986; Stokes 1997).

The early establishment of professional schools in many elite US universities meant that when the considerable increase in federal funding of scientific research after the Second World War supported greatly enlarged research communities, universities had to accommodate a variety of purposes and organizational units rather than just concentrating on high science ideals. This enabled the newly research-focused business schools in the elite institutions to develop distinct organizational cultures and intellectual priorities appropriate to their audiences and supporting groups to a greater extent than in more homogenous systems. They have, then, been able to respond more directly to business demands for technologically relevant research than their counterparts in differently organized academic systems, and also to encourage the direct transfer of formal knowledge to market practitioners, as in the case of options pricing models (MacKenzie 2006).

This greater pluralism of the postwar US university system, relative to many of those in Europe and Japan, is echoed by considerable openness to external mobility and permeable labour markets. Mid-career business managers are more able to undertake advanced research training and become certified researchers, and established academics are able to establish their own companies without great loss of intellectual credibility or risk of expulsion from academic labour markets. It also, of course, meant that developing new programmes to train people in high-level skills that promised to be directly useful for business and management, such as the MBA degree, could be more easily accommodated in elite universities than in more standardized public science systems.

Organizational Segmentation of Goals and Labour Markets

Turning now to consider the third important aspect of public science systems to be considered here, the extent of organizational segmentation of research goals and labour market, this refers to the strength of the separation and division of labour between research universities focused on the production of theory-driven knowledge for intellectual reputations, applied research institutes, technology transfer agencies, research association laboratories and private companies. Where these have quite distinct goals, funding arrangements and control procedures, so that researchers in them are trained in different ways, do different kinds of work and have separate career paths, researchers are discouraged from undertaking a wide variety of types of research within universities, and from moving between different kinds of employers, without suffering a great loss of intellectual credibility.

In less segmented systems, types of research goals, reward systems and legitimate audiences for research results are not so organizationally separated, and it is easier for scientists to undertake different kinds of research within the same organizational unit, as well as to move between different types of employers.

Highly organizationally segmented public science systems encourage university researchers to focus on scientific goals at the expense of more technological ones, and to regard demands for technologically relevant research as best answered by other organizations. Knowledge and skill transfer between types of research organizations will be relatively slow and difficult in such systems. Rapid technological responses to new research results are unlikely to occur here, and technological trajectories will continue to develop largely in isolation from radical intellectual innovations. For example, the separation of much biological research from medical schools and hospitals in France, Japan and, perhaps, Germany, has been seen as inhibiting the development of biotechnology firms in these countries (Henderson et al. 1999; Kneller 1999, 2003; Thomas 1994).

In contrast, where organizational segmentation is lower, knowledge and skills flow more easily between different kinds of research organizations and the development of joint projects and fast adaptation to new knowledge is facilitated. Low segmentation can also allow academic scientists to pursue a variety of objectives more easily, and thus transfer their results directly to the development of new products and processes, than in more segmented environments. As Stokes (1997: 45) pointed out, it has long been a feature of the US research system that many organizations, such as research universities and Bell Labs, have provided a home for researchers pursuing both theoretical and applied goals. The founding and development of Genentech exemplify these low levels of organizational and goal segmentation in the emergence of the US biotechnology industry (McKelvey 1996).

It should also be easier in such societies to undertake high-level skills training in the elite universities than where segmentation is greater. This is because producing knowledge that can be incorporated into practical skill formation is usually regarded as the province of the technologically focused organizations rather than universities in segmented public science systems, and the latter remain mostly concerned with more general education. Since many of these organizationally separated systems have developed in the more institutionally coordinated countries of continental Europe, it is not surprising that high-level managerially focused MBA programmes have been rather slow in becoming widely accepted in many European societies (Locke 1996).

In summary, the production of general scientific knowledge of relatively isolated phenomena and systems in BMS is more likely to be encouraged in public science systems dominated by research universities that are quite homogenous in their internal structures and centrally funded than in those with more differentiated research organizations where funding is also quite diverse. Responsiveness by university researchers to demands for technologically relevant knowledge can also be expected to be limited where high science ideals dominate, organizational groupings and purposes are standardized, and technological research is highly organizationally segmented. Knowledge transfer between universities and the world of practice will also be more difficult in such public science systems, as will the integration of formal knowledge into high-level skills that are intended to be directly applicable to business and managerial problems.

Concluding Remarks

The discussion of how different kinds of formal knowledge in BMS might be used effectively to deal with practical problems in different circumstances suggests a number of general conclusions. First, it is worth emphasizing that technological research, while usually focused on the accomplishment of specific purposes in particular situations, can involve the search for fundamental mechanisms and make significant contributions to more general intellectual concerns. Insofar as research in BMS is concerned with technological goals, then, this does not preclude it from studying generic processes and contributing to more general scientific objectives. Since most, if not all, of the social sciences are concerned with policy issues directly or indirectly, there is no sharp qualitative distinction to be drawn between them and BMS, and it is unclear in what sense the management sciences could be considered to be 'applied'. Rather, there are a variety of different kinds of formal knowledge of business and management issues that differ in their particularity and concern with identifying the operation of general causal mechanisms.

Second, the effective use of such formal knowledge to achieve practical purposes depends considerably on the kind of knowledge being used and the circumstances involved. The conditions in which very abstract models and theories could be effective are highly restrictive and unlikely to occur very often. As the case of the Black–Scholes–Merton model for pricing options illustrates, even when they are apparently effective, this will often be limited in time as actors learn and/or change their minds about risks, and change some of the rules of the game. Additionally, where models do not identify the key causal mechanisms that are responsible for generating the desired results, they are unlikely to be widely applicable.

Third, the demand for general scientific knowledge produced by academics to deal with business and management problems, and how it is used, vary considerably between differently organized economies. In particular, variations in dominant institutions governing coordination and control processes affect a) the firm and sector specificity of managerial problems, b) the role of managers in creating organizational capabilities and c) their ability to act unilaterally in changing routines and strategies. These features, in turn, influence the level of practitioner interest in generic theories and models that purport to improve competitive competences across firms and industries. They also affect managers' willingness to adopt radically new patterns of behaviour based on formal knowledge, as well as their ability to impose and maintain considerable internal closure of organizational processes.

Fourth, the considerable differences in the organization of public science systems affect the relative intellectual value of different kinds of knowledge and the processes through which these are used for technological purposes. Variations in the role and structure of research universities and related institutions dedicated to producing public scientific knowledge influence the dominant status of scientific research on fundamental processes relative to more technologically focused studies, as well as the ease of incorporating practitioner-related research goals into elite universities. They additionally affect the

organization of labour markets for different kinds of researchers, and the attractiveness of transferring between them.

Overall, then, formal scientific knowledge of firms and markets varies greatly in its isolation from everyday descriptions and specification of explanatory mechanisms, as do the conditions for its effective use for practical purposes. The more idealized are the generative mechanisms involved, the more general they may be in principle, but the range of situations in which they could be used to improve business and management practices effectively is quite constrained. These situations are more likely to arise in arm's length institutional regimes with heterogeneous university systems than in more coordinated ones that have relatively centralized, standardized and organizationally segmented public science systems.

Note

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