

The strategic positioning approach to knowledge dynamics

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Theme: Visualising knowledge dynamics.

Abstract

The strategic positioning theory concentrates on sharing of heterogeneously distributed resources and governance of these resources depending on the goals of the individual scientists and their institutes. This allows heterogeneity in strategies in the production of knowledge. This approach leads to the introduction of mode3- the research entrepreneur.

In this paper we discuss how the strategic positioning theory can be used to study knowledge dynamics to better understand mechanisms of the dynamics and to use this knowledge for policy making and research management.

Results of this research can help scientists, research institutes, and policy makers in the development of research strategies and policies enhancing production of knowledge.

Introduction

In 1999, Gibbons explicitly raised the need for a new social contract between science and society that would result in mutual interactions and in a 'socially robust' scientific knowledge production (Gibbons, 1999). Up until now the delivered solutions (e.g. Leydesdorff & Etzkowitz, 1998; Novotny et al., 2003; Swan, 2007) primarily focus on describing the relationships between science and society. We have proposed an answer to the articulated need from the strategic positioning theory based on a strategic management view: mode3 – the research entrepreneur (Kurek et al., 2007).

The strategic positioning theory

This theory allows us to discuss the need for governance (organisational autonomy) as well as the need for dependencies in and between scientists (strategic interdependence) (Kurek et al., 2007). The strategic positioning theory is built on the premise that scientists will develop strategies to interact with their environment based on their competences, unique resources (inside-out) and will look into the environment and adjust their strategies to external changes (outside-in), however, only to changes relevant for pursuing their goals, including the production of knowledge. This results in a view combining the inside-out with the outside-in view, representing a management approach rather than a policy approach.

The strategic positioning theory results in three relevant modes: mode1, mode2 and mode3 (see figure 1) to analyse differences between scientists and disciplines. These modes of strategic positioning are different from the modes introduced by Gibbons et al. (1994) as the latter takes the outside-in view only hereby overemphasising homogeneity in relations between scientists and their societal environment (Kurek et al., 2007; Heimeriks & Vasileiadou, 2008). In the strategic positioning theory, the relative strategic positions in terms of goals, resources etc. of scientists and the environment are analysed, in this way introducing heterogeneity in these relations.

		<i>need for organisational autonomy</i>	
		low	high
<i>need for strategic interdependence</i>	high	mode2	mode3
	low	mode0	mode1

Figure 1. Modes of strategic positioning

In this paper we discuss how the strategic positioning theory can be used to study knowledge dynamics to better understand mechanisms of the dynamics and to use this knowledge for policy making and research management.

Results from the empirical study

Before doing so, we would like to focus on the application of the strategic positioning theory to the production of knowledge and how we measure the positioning of scientists. The strategic positioning theory assumes that the production of knowledge (dependent variable) is explained by strategic interdependence and organisational autonomy (both independent variables). We reconstruct scientists' strategic interdependence and organisational autonomy by observing the organisation of making research results public, the acquisition of scientific information as well as the acquisition of resources from the societal environment.

The production of knowledge is measured as the number of articles published by a scientist normalised per year.

Strategic interdependence is measured in:

- dependence on colleagues in writing articles
- dependence on information sources in acquiring scientific information
- dependence on the societal environment

Organisational autonomy is measured in:

- deciding what to write in articles
- deciding where to submit the article
- deciding when the work can be published
- deciding which relevant articles to include in articles
- deciding which scientific information to acquire
- deciding on research goals.

The strategic positioning theory has been tested in an empirical study on 28 scientists at a research institute for nanotechnology.

The results show that the theory is able to predict the production of knowledge: different combinations of strategic interdependence and organisational autonomy result in differences in the production of knowledge (see figure 2). The predicted production increases with the increase of the degrees of both interdependence and autonomy, i.e. is the highest for extreme degrees of mode3 (Zalewska-Kurek, 2008).

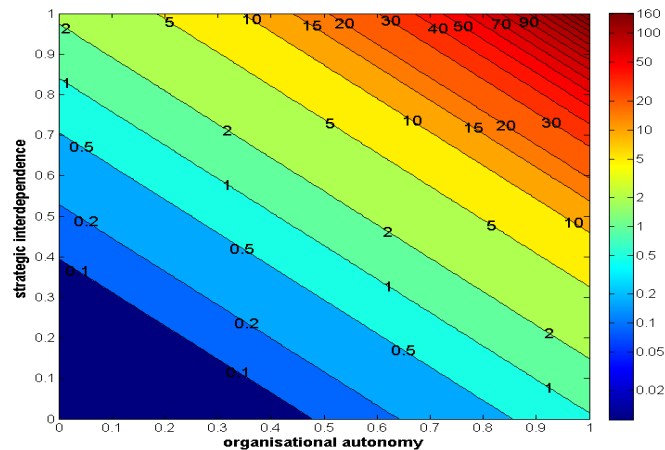


Figure 2. The predicted production of knowledge for the studied institute under various combinations of strategic interdependence and organisational autonomy.

The strategic positioning theory applied to knowledge dynamics

In the approach presented here it is assumed that knowledge dynamics result from and are being observed in the interaction between scientists and their environment. Scientists interacting with their environment establish different types of relations affecting the production of knowledge. In these interactions it is possible to observe knowledge dynamics and governance patterns from an overall perspective on the science system and its developments. It is also possible to observe how scientists react to the developments of the environment as expressed e.g. in research policies.

Science policies do not always acknowledge differences between or changes in disciplines. As pointed out by Bonaccorsi (2008) and Kuhlmann et al. (2007) scientific disciplines are heterogeneous and as such should be dealt with by tailoring different policy instruments (i.e. funding criteria) to different disciplines. In our recent study on nanotechnology and social sciences we also observed that different strategic approaches have to be taken and different strategies developed to manage scientists from these disciplines (Zalewska-Kurek, 2008). The disciplines in the samples differed in terms of organisational autonomy and strategic interdependence as well as in productivity and publishing habits. In the nanotechnology sample scientists were highly autonomous but at the same time highly interdependent on colleagues, whereas in the social science sample scientists were highly autonomous (even higher than in nanoscience) but almost not interdependent on colleagues (ibid.).

In the discussion on knowledge dynamics Bonaccorsi proposes three aspects of dynamics of scientific disciplines: *rate of growth*, *diversity*, and *complementarity* (2008). We see that these aspects fit the dimensions of organisational autonomy (OA) and strategic interdependence (SI) and allow us to develop indicators for these dimensions.

Rate of growth is here a dependent variable affected by two explanatory independent variables: autonomy and interdependence. This dependent variable can be measured by e.g. number of papers produced by scientists associated with a certain discipline.

Strategic interdependence (sharing of heterogeneous resources) in a relation between scientists measured at the level of scientific disciplines can be observed by a number of indicators such as:

- Interaction with other scientists (*institutional complementarity*):
 - Sharing research facilities
 - Joint initiatives to acquire research funds
 - Sharing knowledge and expertise
- Sharing cognitive approaches (*cognitive complementarity*)
 - Sharing methods, theories, hypotheses

When analysing positioning of scientific disciplines by studying scientists we can also measure the need for the governance of relations between scientists. Heinze and Kuhlmann (2008) state that “governance refers to analytically distinguishable forms of institutional coordination of autonomous, but interdependent actors”. According to these authors, the governance dimensions refer to: *organizational dimensions*, *resources endowment*, and *thematic interdependence*. We argue that the two latter dimensions belong to the dimension of strategic interdependence.

Resulting from a combination of the definition of OA from the strategic positioning theory and the dimensions presented by Heinze and Kuhlmann (ibid.), and the aspects presented by Bonaccorsi, the coordination is observed in decisions on:

- Studying instrumentations, methods
- Choice of topics, methods, instrumentation
- Decisions regarding use of methods, theories, instrumentation, etc.
- Motives to study certain topics, phenomena
- How do studied topics relate to what scientists from other disciplines do? How do they relate to a particular/studied scientist did in the past?
- Problem solving: how? Who? Whom to ask?

These exemplary aspects can serve as observables. With the strategic positioning theory it is possible to deliver an expanded and comprehensive list of indicators.

Management and policy instruments

The results of the field study in nanoscience show internal dynamics of scientific disciplines leading to different strategic positioning and therefore the strategy development has to be analysed separately for each discipline. On the basis of such an analysis, this strategy development can be accounted for in policy models. Policy makers can be provided with an instrument that will allow them analysing strategies of scientists within scientific disciplines that they take an interest in. Therefore, we should talk about the strategy development rather than policy making when talking about knowledge dynamics, because research polices should fit strategies of scientists. It is up to scientists to decide on directions in the production of knowledge by accepting policies and adapting to them or not.

The results of testing the strategic positioning theory also show that the strategic positioning of scientists indeed affects the production of knowledge: different combinations of strategic interdependence and organisational autonomy lead to differences in the production of knowledge. Thus, we are able to predict the production of knowledge with this theory. Furthermore, we are able to measure the gap between the autonomy and interdependence curves which illustrates the alignment of these two variables ($\Delta=0.05$ figure 3). The gap is an easy measure for the impact of the strategic positioning of scientists on the production of knowledge, the smaller the gap or the more aligned the variables the larger the production.

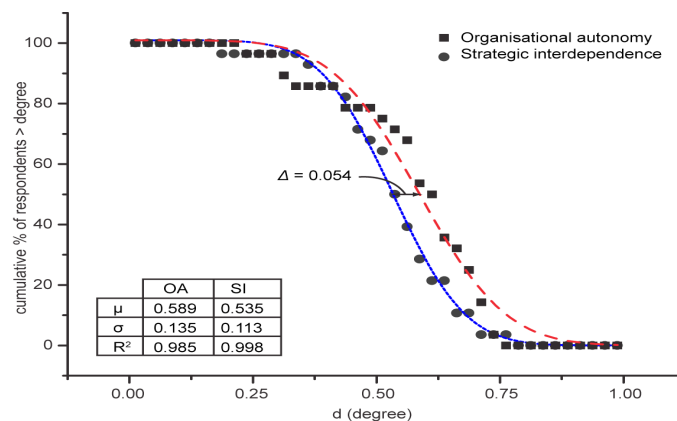


Figure 3. The cumulative distribution of interdependence and autonomy higher than d (degree).

The observed gap between interdependence and autonomy can be used as an interesting management tool provided by this theory for developing strategies and policies. The assumption is that to ensure a higher production of knowledge research management should stimulate closing the gap by strategically repositioning scientists in an aligned way. Closing the gap is then a challenge for the management of such a research group or institute. A research group or institute is well advised to stimulate the strategic interdependence between scientists in combination with a reasonably high degree of autonomy of the individual scientists as the combination of high need for both interdependence and autonomy results in higher production of knowledge.

The theory gives insight on which settings could and should be created by research managers or policy makers, given the specific domains and organisational conditions and their long-term goals.

It could be also useful for knowledge dynamics. Scientific disciplines are very dynamic as there are constantly new fields being added (as indicated e.g. by newly launched journals). It is interesting to recognise how disciplines interact and evolve and how productive they are in order to enable their further growth. This could be crucial for the allocation of resources.

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