

The research entrepreneur: strategic positioning of the researcher in his societal environment

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At present, two modes of the strategic relationship of the researcher with his environment are known. These are the 'ivory tower' and 'strategic research', known also as mode1 and mode2. In this paper, we develop an analytical model that not only predicts these two well-known modes but also leads to a new, third mode - the research entrepreneur. The research entrepreneur is directing his environment by creating demand for his scientific products instead of supplying on the demand of his environment. The first results of a few cases from an empirical study conducted at the MESA+ Institute for Nanotechnology confirm the feasibility of the model in creating observables for the different modes of strategic positioning of the researcher, in this case MESA+.

THE SCIENTIFIC RESEARCH AGENDA is largely determined by the relationship between research and society at large. This relationship is presently in flux, moving towards intertwinement of research and society. Researchers and practitioners involved in this discussion elaborate on the future role of university and society in the production of knowledge (eg Godin and Gingras, 2000). This subject was addressed in a number of papers and journal issues such as in a special issue of the *British Management Journal* (Hodgkinson, 2001; Starkey, 2001; Starkey and Madan, 2001), the *Academy of Management Journal* (2001) and in a special issue of *Research Policy* (Leydesdorff and Meyer, 2006). In 1999, Gibbons explicitly raised the need for a new social contract between research and society that would result in mutual interactions and in 'socially robust' scientific knowledge production (Gibbons, 1999). To the best of our knowledge no adequate solution has been given up till now.

The delivered solutions (eg Leydesdorff and Etzkowitz, 1998; Novotny *et al*, 2003; Swan *et al*, 2007) are primarily based on descriptions of the observed relationships between research and society. These solutions however, don't lead to the study of the mechanisms of such relationships and are as a consequence not informative about the goals and choices of the researchers and their institutes behind such relationships. To arrive at a more systematic and comprehensive, that is, a more analytical approach to this relationship, we develop a model explaining this relationship and the strategies behind it, starting from the researcher instead of the society.

This relationship between society and researcher should reward both parties. For the society the relationship is rewarding if the research product that is the result of the relationship will serve society; for the researcher if this will serve him or her to attain their goals. The decision to enter the relationship with society, more specifically the societal environment, is a choice of the researcher. At present, two modes of such a relationship between the researcher and the environment are known. These are the 'ivory tower' and 'strategic research' modes, known also as mode1 and mode2 (Gibbons *et al*, 1994). In this paper, we develop an analytical model that not only predicts these two well-known modes but also leads to a new mode, mode3 — the research entrepreneur. The research entrepreneur, compared to the researcher in mode2, is more leveraging in the relationship with the societal environment. The research

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entrepreneur is directing his environment by creating demand for his scientific products instead of supplying on the demand of his environment.

Generally, as in the above-mentioned studies of the relationship between research and society, the choices of researchers and their institutes are studied as reactions to changes of policies and developments in the environment such as social and technological change and change in the policy of the government. In studying the setting of goals and the choices related to these we start from the researcher in his environment and his long-term priorities. This is an inside-out perspective allowing us to study and understand the strategies of these researchers. This model thus enables us to analyse strategies being developed by the researcher, at different levels of aggregation as an individual researcher, a research group, or a research institute. The starting point for developing such strategies is always the researcher influencing and being influenced by his environment. This environment, defined as the world outside the researcher at a given level of aggregation, is thus a dynamic environment and can include another researcher or government as well as industry. Both the researcher and his environment can develop strategies, such as to improve each strategic or competitive position. This view is fundamentally different from the view of the societal environment influencing the researcher, that is, only the outside-in view, generally taken in the policy studies concerned.

The main goal of the researcher is to contribute by scientific research to scientific knowledge. To attain this goal the researcher seeks partners to share heterogeneously distributed strategic resources, such as research facilities, knowledge, funds. Next to sharing resources, the researcher has to make the strategic choice (see also Knorr-Cetina, 1981: 33–48; Laudel, 2006) to what extent he is willing to accept the other partner to participate in governing research. Strategic choices are an integral part of the strategy leading to the strategic position of the researcher given his specific goals. These choices are strategic in the sense that making them structures the researcher's further behaviour because every such a choice limits the next choice he makes; for example, setting research goals affects further choices regarding the acquisition of resources offered by the societal environment. The goals of the researcher are strategic in a similar sense as they structure the researcher's behaviour and choices. If not explicitly mentioned, choices as well as goals, resources and relationships are considered as strategic in this paper. The strategy that the researcher develops, and therefore the strategic positioning, is not always conscious and explicit. Especially, individual researchers with their primary focus on conducting research often do not reflect consciously on the strategic character of their choices. Nonetheless, the researcher has a goal to attain — with long-term consequences, such as a career in industry, tenure or growth of the research enterprise — even if it is not explicit.

In any relationship the issue of trust is a relevant issue (Hummels and Roosendaal, 2001). However, this paper deals specifically with strategic positioning of the researcher in the societal environment. The model of strategic positioning considers trust, as trust is not a specific object of study, as a condition, other things being equal.

The strategic positioning of an individual actor as well as of a more complex organisation within their broader environment is a subject of strategic management studies. These studies analyse long-term goals of organisations and the way these goals are attained in positioning. In this paper we make use of the models providing such analyses in order to develop an analytical model of the strategic positioning of the researcher within his environment.

Strategic position of the researcher

The strategic position that the researcher establishes to attain his goals, is expressed in the negotiated and agreed relationship between the researcher and his environment. This being the case, this relationship, like any other relationship, is seen as a (temporary) strategic alliance, joint venture, merger or acquisition between business partners. Such an alliance can be established between the researcher and his societal environment, even with another researcher or

research group bound in a joint research project or programmes. An example of a relationship between two individual researchers is the relationship between a PhD student and his supervisor sharing heterogeneous resources such as knowledge, skills, facilities and research funds. To describe this relationship we can apply the established strategic management model for such a strategic relationship (Haspeslagh and Jemison, 1991). This model assumes that collaboration will be maintained if and only if this collaboration results in creating added value for both partners as compared to the situation in which such collaboration does not exist. This model contains two general dimensions to characterise the relationship: the organisational autonomy and the strategic interdependence of each of the partners in the relationship. This model can be applied to any relationship, irrespective of the nature of the relationship, between two or more partners because there is always an exchange of resources, and partners always have some degree of organisational autonomy that can be measured in a relationship at hand.

Strategic interdependence is defined as the deliberate sharing of heterogeneously distributed resources, assets and capabilities between the partners in order to achieve a joint goal. Strategic interdependence is thus a necessary but not a sufficient condition for an effective collaboration, meaning that close collaboration goes hand in hand with a position of high strategic interdependence, and vice versa.

Organisational autonomy of the researcher is defined as self-governing in deciding about the directions of research in a competitive environment, including setting goals, in which scientific knowledge is being created and scientific information is being used. A high position in organisational

autonomy allows partners to make autonomous strategic decisions regarding setting goals and establishing how to attain these goals. A position of high strategic interdependence does not necessarily exclude a position of high organisational autonomy of the researcher. A strategic position is defined then as a combination of positions in organisational autonomy and strategic interdependence.

In this research, the assumption is made that in any relationship the partners strive in principle to maximise their own organisational autonomy and to minimise their own strategic interdependence. However, in a relationship, partners may give up organisational autonomy and accept strategic interdependence, both to an acceptable degree. This depends on the attractiveness of the researcher's goal dictating what kind of collaboration is acceptable, for example, career, the growth of the group or institute, etc. If this goal is very attractive the researcher may compromise this position. The feasibility of achieving a goal determines such an acceptable position in either organisational autonomy or strategic interdependence. This means that the positions in organisational autonomy and strategic interdependence can be different for each different collaboration, even between the same partners, resulting then in a different mode.

A model of possible modes of strategic positioning based on these two dimensions, organisational autonomy and strategic interdependence, is shown in Figure 1. This model provides a typology of modes of positioning. In reality these modes are not discrete but continuous. The four distinct modes contain a variety of different positions along the axes. The first type is characterised by a position of both low organisational autonomy and low strategic interdependence. In the mode0 situation (see Figure 1) there is no strategic relationship between the

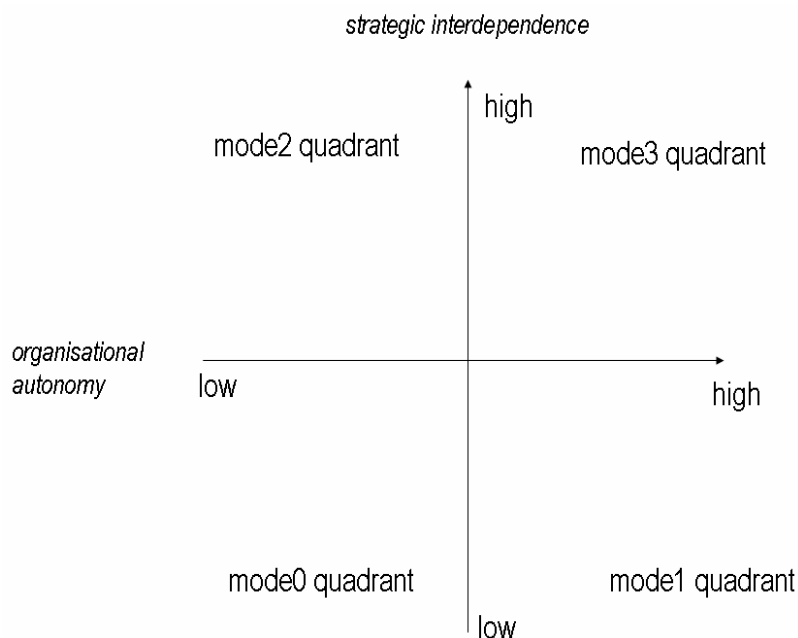


Figure 1. Types of modes of strategic positioning

researcher and the societal environment. An example of such a mode is a researcher in the Middle Ages associated with and paid by a sovereign. This mode is rather irrelevant for this discussion.

A second type is a position of high organisational autonomy and low strategic interdependence. In model 1 (see Figure 1), the researcher sets research directions driven by scientific curiosity. There is almost no relationship between the researcher and his societal environment. Therefore, the researcher does not need to take into account societal needs and demands when setting research goals. Results of research are not necessarily meant to be of societal relevance. Therefore, the researcher communicates and collaborates with his research environment and not with the societal environment. In this case, the researcher is not connected to the societal environment and therefore does not influence this environment. This type of researcher positioning is well-known as “ivory tower” or “free research” (Gibbons *et al.*, 1994).

The third type is a position of low organisational autonomy and high strategic interdependence. In this mode2 (see Figure 1), the societal environment directs the researcher. It influences research directions taken by the researcher and thereby influences the scientific products the researcher delivers. This means that the researcher matches his own research problems to existing research programmes based on the demand of the societal environment. According to Novotny *et al.* (2003), the researcher is “context-sensitive”. Examples of this mode are consultancy and research outsourced by a financial partner if this partner demands particular studies to be carried out and the researcher complies. In this case, the researcher does not influence his societal environment in creating demand for his scientific products but supplies in reaction to demand by the societal environment. The researcher listens to his environment and fulfils societal needs. By the societal need we mean a need which is explicitly expressed by the partner of the researcher, as a representative of the societal environment, in the relationship. The properties of this mode show that this mode is comparable with Gibbons’ mode2 or strategic research as broadly described by him, his co-authors and Ziman (Gibbons *et al.*, 1994; Ziman, 1994).

The fact that the model adequately predicts these two well-known relationships of ivory tower researcher and mode2 researcher means that the model is consistent. Given this consistency, the model postulates a fourth possibility, which has to be observed empirically. Failure to observe this mode means that as a characteristic of a deductive model the model has to be revised. This fourth possibility is characterised by a position of high organisational autonomy and high strategic interdependence. We call this mode mode3: the research entrepreneur. This represents a new type of positioning of the researcher and his research with respect to the societal environment.

The mode3 position of high organisational autonomy and of high strategic interdependence means that the researcher shares resources with his environment as the mode2 researcher does. But in contrast to the mode2 researcher, the research entrepreneur has the opportunity to autonomously determine directions of research. He retains his own responsibility for directing a project. The research entrepreneur is an answer to the need for a social contract rewarding all the parties, as proposed by Gibbons (1999): the research entrepreneur interacts with the societal environment in such a way that “he speaks to the environment and the environment speaks back to him”. The research entrepreneur “speaks to the environment” by developing, like a business entrepreneur, appropriate strategies to create demand for his scientific products, in this way influencing his societal environment. In this context, he influences strategies and policies developed by his environment. The environment “speaks back to him” by developing appropriate strategies reflecting its interests and accounting for the strategies developed by the researcher, resulting in possible research policies. The two parties, the researcher and the societal environment, are keen on establishing this relationship; the researcher because his research will be funded and his research interests will be realised, the societal environment because scientific results will be applicable and appropriate policies can be set. Being a part of the societal environment (we will elaborate on that in the next paragraph) the research entrepreneur can recognise and define a societal need for improving and further developing new or existing products, and deliver such a product.

Instead of just being oriented towards society, the research entrepreneur is fully intertwined with his societal environment yet strategically interdependent of it. At the same time, as stated above, the research entrepreneur is highly autonomous. This position of high autonomy is expressed in decisions regarding research goals to achieve, potential collaborators or potential users of research results. The research entrepreneur acting within his societal environment and having a clear strategic position towards this environment increases his ability to influence this environment.

The model proposes a continuum of modes of strategic positioning; we argue that one and the same actor can display a combination of different positions in different relationships compatible with his goals

Summarising, the model proposes a continuum of modes of strategic positioning with four ideal types. Given that there is a continuum we argue that one and the same actor can display a combination of different positions in different relationships compatible with his goals. The model of strategic positioning allows an inside-out approach in developing strategies next to an outside-in approach in developing strategies and setting policies. Only the presented model of strategic positioning combines these two approaches and can therefore predict the new mode3, next to the well-known mode1 and mode2.

The model can easily be applied to analyse relationships between the researcher and the company in which he is appointed. The company is seen as the societal environment in which the researcher positions himself. Take Google as an example. Google allows its researchers to spend 20% of their work time on projects of their interest, projects that are not necessarily in their job descriptions (Google Jobs, 2007). The researchers set their research goals autonomously at the same time being employees of the company. Very often these projects become Google commercial products after all. This is a positioning close to the mode3 positioning. The researcher working in industry can, like the researcher working in academia, position himself in different modes; have different degrees of organisational autonomy in different projects. This can be a positioning like the mode2 researcher (in development) or the mode3 researcher (as in the example of Google).

Given the definition of the researcher and his societal environment this model is applicable to all situations in which the researcher is involved.

Research entrepreneur and academic entrepreneurship

The concept of the research entrepreneur is distinctly different from the concept of academic entrepreneurship described in depth in the literature (eg Louis *et al.*, 1989; Balazs, 1996; Leydesdorff and Etzkowitz, 1998). The difference between these two concepts originates from the methodological approach. Given his goals, the research entrepreneur is predicted from an analytical model (being by definition a deductive model), as are the other modes. This model not only describes the relationship between the research and its societal environment but also analyses the parameters of such a relationship and results in observables of different modes. The concept of academic entrepreneurship is a product of a purely descriptive (ie inductive) model.

The concept of academic entrepreneurship is elaborated in the triple helix model (eg Leydesdorff and Etzkowitz, 1998; Etzkowitz and Leydesdorff, 2000) in terms of relations between entrepreneurial university, industry and government, and their dynamics. The entrepreneurial university is then described as “independent of state” but “interacting

with other spheres” (Etzkowitz, 2003a), following directions when making connections with business for research contracts and transferring knowledge to society, and creating innovations (eg Etzkowitz, 2003a, 2003b). Etzkowitz’s description of the entrepreneurial university is based on a typology using the following dimensions: independence of state and the interaction with other spheres. However, independence of state is a specific aspect of organisational autonomy because it implies the relationship with the government only, leaving out other partners such as research institutes, whereas the dimension of organisational autonomy does not exclude any partner. The interaction with other spheres is a specific aspect of strategic interdependence as it does not address a joint effort in doing research by sharing heterogeneous resources. These dimensions of the entrepreneurial university are also aspects of the general dimensions because this model concerns only one level of aggregation: the university level. The model of strategic positioning introduced in this paper analyses the researcher at different levels of aggregation. In this respect the dimensions of independence of state and the interaction with other spheres are a subset of the general dimensions we use as the general dimensions are translated to the university level.

Moreover, Etzkowitz defines as the most important characteristic of academic entrepreneurship “that the problem definition comes from outside sources as well as from within the university and scientific disciplines” (2003a). As argued in this paper, the problem definition is important but is only one aspect of the positioning that indicates the position in autonomy of the researcher.

As the dimensions of Etzkowitz are specific aspects of organisational autonomy and strategic interdependence, our model of strategic positioning is able to predict not only mode1, mode2 and mode3 but also the entrepreneurial university as described by Etzkowitz. The entrepreneurial university has then a different position than mode3 in the continuum of modes of strategic positioning. In the entrepreneurial university the researcher interacts with his environment but the model does not address the sharing of heterogeneously distributed resources. The position of organisational autonomy is not as high as for the research entrepreneur. This being the case, the triple helix researcher will be positioned in the mode3 quadrant, but closer to the mode2 quadrant (see Figure 2) than the research entrepreneur.

In the literature other concepts of academic entrepreneurship are also discussed. Academic entrepreneurship is characterised as obtaining research funds from companies willing to buy research results, generate supplemental income and create commercial value that results in patents and start-ups (eg Louis *et al.*, 1989), or as commercialisation of the intellectual resources of the researcher (eg Oliver, 2004), or as “the attempt to increase individual or institutional

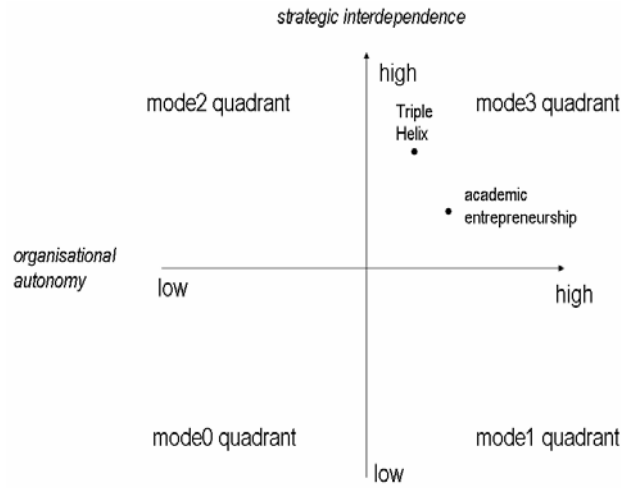


Figure 2. The position of triple helix and of academic entrepreneurship on the continuum of strategic positioning

profit, influence, or prestige through the development and marketing of research ideas of research-based products” (Louis *et al*, 1989). The research entrepreneur as a mode of strategic positioning is the result of the positioning leading to the attainment of the goals of the researcher. As strategic positioning includes making choices, the research entrepreneur mode is a choice of the researcher. The research entrepreneur refers to an entrepreneur in research — the researcher strategically managing the research enterprise. (The research enterprise is defined as an individual researcher or a group of researchers performing activities contributing to scientific research which adds to the production of knowledge.) The concept academic entrepreneurship does not include these aspects. This concept can be, however, explained by the model of strategic positioning. The academic entrepreneurship will be positioned in the mode3 quadrant (see Figure 2) as it has, as defined before, a position of high strategic interdependence and of rather high organisational autonomy, but not as high as the research entrepreneur.

Furthermore, the notion of mode3 we present differs from the mode3 presented by Huff (2000), and Huff and Huff (2001) in that these authors describe their mode3 in terms of final scientific products rather than explaining what determines the creation of such products. In the mode3 proposed by Huff the behaviour of the researcher is characterised by the modes of knowledge production (according to Gibbons, 1994; Huff and Huff, 2001). Hodgkinson *et al* (2001) propose a typology to study the researcher’s behaviour using the dimensions: “theoretical and methodological rigour” and “practical relevance”, while Stokes (1997) with the dimensions of “fundamental understanding” and “consideration for use” is different. The dimensions used by Hodgkinson and Stokes are specifications of the general dimensions of organisational autonomy and strategic interdependence used in this paper because Hodgkinson and Stokes limit their discussions to the research environment, that is, to research and results of this

research only, without considering restrictions on this research imposed by its societal environment.

Furthermore, as these approaches are based on limited aspects of the dimensions of strategic positioning they result in different modes characterising different types of research rather than modes of strategic positioning. The degrees of “theoretical and methodological rigour” or “fundamental understanding” are aspects of organisational autonomy. This is because the researcher chooses which methodology or theory to use as well as whether he is willing to give up his autonomy and let his societal environment direct theoretical and methodological rigour in a joint research project. Organisational autonomy includes theoretical and methodological choices but those are not the only ones to be made in a collaboration. “Practical relevance” and “consideration for use” are both aspects of strategic interdependence because it is again the choice of the researcher to share his scientific product with his societal environment and to commercialise it.

Analysis of the strategic positioning of the researcher

Organisational autonomy and strategic interdependence measure the positioning of a single actor but can be observed only in the relationship with the other partner. Therefore, to identify the positioning of the researcher we will analyse his relationship with his societal environment. Following Gibbons, any social relationship, especially the relationship between the researcher and his environment, is “an agreement built on trust which sets out the expectations of the one held by the other, and which — in principle — includes appropriate sanctions if these expectations are not met” (1999). This goes back to Talcott Parsons (1963).

To analyse this relationship we lean explicitly on the generalised media of interchange that were systematically explored for the first time by Parsons

(1963) and later by Habermas (adding law as an additional medium; 1987) and Luhmann (adding truth and love; 1995). The main idea is that social actors having a goal to attain interact in a structured way. Goals drive actors to make choices and then perform subsequent actions. These choices and actions are organised in a social system. Knowledge about the organisation of actions allows us to predict actors' behaviour in any other situation. This can be used in developing an analytical and at a further stage a predictive model. The use of these ideas implies that we consider science and also society at large as social systems in which researchers act as social actors.

The researcher making choices is being influenced by other partners: his research environment and his societal environment. By analysing the relationship between the researcher and his environment we can actually measure how the choices of the researcher are influenced by his environment.

The researcher starts establishing a relationship with a goal in mind that he strives to achieve. This goal is expressed in his intentions and situation. The researcher then confronts his own intentions and situation with the intentions and situation of his environment. The intentions, but not the goal, are negotiable. The negotiation process ends with an agreement that is an expression of intentions and situations of the partners including incentives as positive sanctions and negative sanctions. These sanctions could be used if the partners deviated from situations and intentions they had agreed upon. The agreement is then the enactment of the negotiation. The choices the partners make afterwards are executed in terms of positive or negative sanctions included in such an agreement. The choices of the researcher result in his position in organisational autonomy and in strategic interdependence, which he accepts in this specific relationship. We can then observe positions in organisational autonomy and strategic interdependence in potential sanctions on which the partners agreed. An analysis of contracts between research and environment will result in a partial reconstruction of this negotiation process.

The negotiation on the research direction is usually a direct act between the researcher and his societal environment. Even if research contracts are entered at the institute level, it is the researcher who makes the choices. Various institutions such as technology transfer offices and lawyers function as support of the researcher but are not directly involved in the negotiation to decide on the research directions.

In a social relationship, partners affect each other's intentions and situations by using positive or negative sanctions. The partner then controls and changes the situation in which another partner is placed, independently of that other partner's intentions; or the partner affects another partner's intentions, independently of changes in his own situation (Parsons, 1963; Robertson, 1968; Parsons and Mayhew, 1982; Geurts, 1992). This makes the other partner a dependent one. In practice, both partners

affect both the intention and the situation of each other in a relationship by using the same sanction. In the analysis of a relationship between the researcher and his environment, a positive sanction refers to the reward that a dependent partner of a relationship can gain, for example, the value created in research benefiting both partners. A negative sanction refers to conditions of a contract that must be met by the dependent partner. If the dependent partner acts in ways contrary to the contract, that contract and the relationship are broken.

Intentions of the researcher refer to scientific aspects of the research enterprise including directions of research and management of research, the acquisition of scientific information, exchange of scientific information between the partners, and the dissemination of scientific information to the societal environment. Intentions of the societal environment refer to research results this environment is able and willing to apply. The situation of the partner (the researcher or his societal environment) refers to organisational aspects of the research enterprise.

A relationship between the researcher and his environment is then analysed in terms of four types of behaviour as proposed by Parsons (1963). These types of behaviour are used by the partners to get the other to comply with their demands.

Table 1 presents the types of behaviour and concomitant currencies of exchange (in brackets). To be able to compare different relationships established between the researcher and his societal environment we translate the types of behaviour of these partners to these currencies. A currency of deterrence is power. In a relationship between the researcher and his environment, the environment has power, for example, to terminate a research contract (negative sanction) and therefore to affect the situation of the researcher. A currency for persuasion is influence. To influence others, a partner uses his prestige, reputation. The higher the reputation of the person, the easier it is to persuade others.

The researcher influences his societal environment when he offers (positive sanction) to create a new scientific product, for example, a new theory that will supersede an existing one (affecting intentions of the users). When the partner in a relationship wants to induce the other to do something he

Table 1. Types of partner's behaviour towards another partner and currencies of exchange

	Intention	Situation
Positive sanction (incentives)	Persuasion (influence)	Inducement (money)
Negative sanction	Activation of commitments (commitment)	Deterrence (power)

Source: Parsons, 1963: 44

Note: Currencies of exchange are shown in brackets.

The difference between relationships is in the balance in sanctioning and being dependent: the partner who sanctions the other in a relationship has a stronger flow of currency

may use money. Money is not always 'money' in the literal sense. Money has no value in itself; it is rather a symbol for value. It can be symbolic capital, such as information, or a physical product which is being exchanged. It can be any scalable added value. Another way to get one partner to comply with demand is to commit him to the system of values and norms of the other partner. The researcher being a part of his research environment is committed to conforming his research to high scientific standards, as discussed by Merton (1973) in his normative structure of science. In a relationship with his environment, the researcher engages his environment in line with the values and norms of the research environment, to a different extent in different relationships.

The balance in currencies of exchange

The exchange of currencies between actors on whatever level of aggregation results in a dynamic equilibrium. In principle, there are always four currencies exchanged by the partners within a social system, thus in a strategic relationship. The difference between relationships is in the balance in sanctioning on the one hand and in being dependent on the other hand. On balance, the partner who sanctions the other in a relationship has a stronger flow of currency; the one who is dependent has a weaker flow. This can be applied to all four types of behaviour and therefore to all four currencies of exchange used by partners. In studying relationships we are investigating this balance in the currencies as this balance indicates the positioning and behaviour of the researcher in his environment.

Moreover, we analyse the flow of currencies in relationship between the researcher and his societal environment, not relations between the currencies. Therefore we look at the currencies separately.

As mentioned above, currencies of exchange indicate the position in both organisational autonomy and strategic interdependence. These dimensions are measured on ordinal scale ranging from zero to total organisational autonomy or strategic interdependence, assuming transitivity and with the range determined by research under study. A position of high strategic interdependence means that the partners share resources. This being the case, money and commitment are being exchanged. A position of low

strategic interdependence means that money and commitment are not exchanged directly. If a relationship has been established then organisational autonomy can be measured. The difference between the modes of strategic positioning is then in the difference in balance of currencies exchanged by the partners. High organisational autonomy in terms of currencies means that the researcher can sanction his societal environment. Low organisational autonomy means that the researcher is dependent on his societal environment in the relationship.

In mode0 there is no exchange between researcher and societal environment. The position of organisational autonomy and of strategic interdependence is low by definition. This means that there is virtually no strategic relationship and therefore there are no dependent partners. Therefore this mode will be taken no further into consideration.

In mode1 there is a position of high organisational autonomy combined with a position of low strategic interdependence. Therefore there is no direct flow of currencies of exchange between these two parties. However, money and commitment are exchanged indirectly. In mode1 the research institute of the researcher and external institutions exchange money. These institutions do not directly connect money with research tasks and do not influence research directions (eg lump sum financing of universities). In such a situation, the researcher is accountable not to his societal environment but to his research environment, meaning that he has to comply with the norms of this research environment. He has to produce knowledge according to agreed standards without being constrained to specific, externally set research goals. Furthermore, the researcher in mode1 does not produce knowledge that can be applied directly and can so influence his societal environment. As mentioned before, the difference between the modes is in the balance of the use of sanctions. In mode1, on balance, there is a stronger flow of power and influence from the researcher. The researcher makes use of power and influence only within his research environment. In the mode1 situation, the researcher does not sanction his societal environment but only his research environment and vice versa.

Mode2 is characterised by a position of low organisational autonomy combined with a position of high strategic interdependence. Thus, there is an exchange of currencies between the researcher and his societal environment. In such a relationship the environment sanctions the researcher. The researcher is accountable to his environment, which is able to set specific research goals for the researcher. His societal environment will ask the researcher to deliver a specific commitment dedicated to a specific research task. This does not necessarily comply with high scientific standards, but must comply with the demand of his environment. Furthermore, next to setting research goals the environment influences the researcher and his research. The environment has

also power in the mode2 relationship. On balance, there is a stronger flow of power and influence from his societal environment than from the researcher. The research directions proposed by the environment can hardly be influenced and researchers have to match their own directions of research.

In mode3 the balance in power and influence is positive for the researcher. In a mode3 relationship both the researcher and his societal environment are strong enough to sanction each other even if they differ in competences. On balance, there is a stronger flow of power and influence from the researcher than from his environment. The most important characteristic of the research entrepreneur is that he influences research management and directions including research goals in such a way that he creates demand for the scientific results he wants to deliver. The research entrepreneur influences his environment by creating demand for the scientific products he produces. Even being an equal partner in the collaboration the research entrepreneur is still accountable to his societal environment, but to a certain, negotiated degree. This degree depends on how much autonomy he agrees to give up in return for reaching his goals. Moreover, the exchanged commitment in the mode3 relationship is more general than in the mode2 relationship as it deals with more general issues such as ethical issues, for example, genetically modified food or cloning (Van Steendam *et al*, 2006), as will be seen below. Commitment is then not connected to specific research tasks and the researcher himself directs deliverables.

First empirical results

To test the feasibility of the model of strategic positioning presented in this paper, a study on the MESA+ Institute for Nanotechnology was executed. The research question addressed in this particular study is: What mode of strategic position does the researcher establish in a relationship with his societal environment?

As mentioned before a strategic relationship is defined as a deliberate and established collaboration in which one partner sanctions the other who depends on him. One of the ways in which to observe sanctions is to analyse formal documents such as contracts. Contracts are seen as expressions of desired intentions and situations. They in fact show the positions the partners want to establish with respect to each other and the needs of the partners that had to be resolved explicitly to establish the relationship. According to the model of strategic positioning, we look at sanctions in order to assess the use of currencies of exchange and then to determine the mode of a position. Therefore, in the empirical study we carried out content analysis of contracts of research projects at MESA+. Most of the contents of contracts usually deal with standard issues, but focusing on the non-standard, unique issues gives insight into what has been the core of the

negotiation and therefore indicates the positioning of the researcher in a relationship.

Contracts show the variety of collaborations the researcher has. The researcher can establish different relationships with different partners. In different relationships he can position himself differently and accept a different balance in the exchange of currencies. This can even be the case with the same partner but in separate research projects. The added value in the project may well differ in different relationships.

The societal environment of MESA+ is represented by NWO (Dutch National Science Foundation), STW (Technology Foundation), Senter (an agency of the Dutch Ministry of Economic Affairs for implementing policies on innovation, energy and climate, and environment and spatial planning), FOM (a research foundation related to NWO), the European Union (EU framework programmes), and industry. The sample to obtain preliminary findings consists of five contracts, signed with: STW, Senter, two with the EU, and one with a company.

These contracts were studied to analyse clauses indicating the presence of observables for strategic interdependence and organisational autonomy. More specifically, clauses dealing with sharing resources with the environment including research funds, research facilities, scientific information and scientific products, and collaboration were examined to find potential sanctions that would indicate strategic interdependence. Clauses about management and organisation of the project and research were examined to find indications for organisational autonomy. These clauses were evaluated in terms of the use of currencies of exchange.

A four-step analysis was applied. The first step is to assess if there is a sufficient position in strategic interdependence in terms of resources and capabilities being exchanged. The second step is to assess a position in organisational autonomy — which partner sanctions the other affecting his intentions and/or situation. The third step is to decide which currencies are being exchanged between the partners. The fourth step is to decide which of the modes of positioning is predominantly represented in the contract.

Some preliminary results are highlighted in an example of the relationship between MESA+ and industry as described in a contract with a company. This contract shows positive and negative sanctioning by the contract company, as presented in Table 2. The researcher appears to sanction only negatively.

Table 2. The exchange of currencies between MESA+ and a company (IN 00301)

	Intention	Situation
Positive sanction	<i>Influence</i>	<i>Money</i> • Company
Negative sanction	<i>Commitment</i> • Company • Researcher	<i>Power</i> • Company

The company sanctions positively (offers payment) changing the situation of MESA+ (organisational aspects of research):

(Company) wishes to engage the university in the carrying out of a certain study in this field; and the university is willing to arrange for such a study to be carried out.

This citation indicates the use of money by the partners with a stronger flow of money from the company.

The company sanctions negatively (can terminate the contract) and in fact can change the situation of MESA+ (organisational aspects of research):

(Company) shall not unreasonably withhold its consent to the publication of (company) information and/or results pursuant to clause (n), but may request the university to delete certain (company) information and/or results or to delay publication for a period.

This example shows the use of power with a stronger flow of this currency from the company.

The company again appears to negatively sanction MESA+, which is intentionally dependent (wants to publish) on the company:

(Company) recognises that the research associate and the supervisors may wish to publish some or all of the results, together with any relevant (company) information, as a paper within the university or in the open literature. Before any such publication the university shall arrange for the paper to be passed to (company) for examination and comment.

At the same time, the researcher can sanction negatively the company, affecting its intentions, if he wants to publish the scientific results. This exchange of sanctions shows that the balance in terms of commitment is in equilibrium between the partners.

The analysis of this relationship shows that the partners both possess resources: "The university possesses expertise in a field." The company has financial resources and information that can be used in the research and may exchange them (money and commitment). It can be concluded that the partners are highly strategically interdependent. The use of positive and negative sanctions by the company shows that the researcher is dependent. On the other hand, he can also sanction the company. However, on balance there is a stronger flow of power, money and commitment from the company. The position in organisational autonomy is not very high for the researcher. We can conclude that this collaboration with this specific company is not mode1, and is more mode2 than mode3. Collaboration with other companies may well yield a different relationship depending on the specific arrangements made.

Table 3. The exchange of currencies between MESA+ and the EU (NoE 01302)

	Intention	Situation
Positive sanction	<i>Influence</i> <ul style="list-style-type: none"> • Researcher 	<i>Money</i> <ul style="list-style-type: none"> • Societal environment • Researcher • Researcher in relationship with the collaborators
Negative sanction	<i>Commitment</i> <ul style="list-style-type: none"> • Societal environment • Researcher 	<i>Power</i> <ul style="list-style-type: none"> • Researcher in relationship with the collaborators • Societal environment

The next example shows the relationship between MESA+ and the European Union under the 6th Framework Programme (FP6). According to this contract, MESA+ builds a network of excellence together with other research universities and institutes. The results of the analysis on this contract are shown in Table 3.

A few citations will be presented to illustrate Table 3 and our way of analysing this contract. The researcher can sanction positively his environment offering new scientific products and business units which will disseminate these products and he tries to change the societal intentions by creating a demand for his products:

Knowledge generated and spread through (the network) is expected to lead to the development of marketable new technologies, processes, tools and devices that will in turn have great impact on science, industry and society,

and "Special attention is paid to the formation of business cases and to the establishment of an integrated European curriculum for life sciences related nanotechnology." This example indicates a positive balance of influence for the researcher.

By offering research funding (positive sanction), the EU changes the situation of the researcher. At the same time, MESA+ offers to change the position of European research in nanotechnology (positive sanction):

We aim to leverage the potential and existing quality of some of the best groups in nanotechnology that Europe has to offer, in order to create opportunities for Europe to lead in one of the relevant areas within nanotechnology.

In this case, the EU exchanges money.

The EU requires special treatment of animals used in experiment: "Two members of the (network) will face ethical issues in the sources of cell and animals used in all parts of the proposed work" (this

limitation to the research method to be applied is specified in the contract). Requiring this, the EU sanctions negatively the researcher and can affect the researcher's intentions. This combination of the two dimensions shows the use of activation of commitment by the EU.

MESA+ is obliged by the EU to deliver progress reports; otherwise it can lose its reputation and it can change organisational aspects of research (situation): "The project co-ordinator MESA+ will organise an annual assessment meeting ... with all parties and the Commission's representative(s)", and "Final versions will be provided before the end of each year for assessment review by the European Commission." In this case, the EU exchanges power.

The analysis of the relationship between MESA+ and the EU shows that the partners exchange money and commitment. This means, according to the model of strategic positioning, that the partners are strategically interdependent. Furthermore, both partners can sanction one another. On balance, there is a stronger flow of influence, money, power and commitment from the researcher. This indicates that the researcher is highly autonomous. On the basis of this analysis we can then conclude that this collaboration is predominantly mode3. These results are consistent with the EU charter on the FP6 according to which the FP6 supports the researcher to be autonomous in strategically managing research, that is, choosing the directions of the research (EU, 2002). It supports the researcher behaving as the research entrepreneur, which should result in "a durable restructuring and reshaping of the way research is carried out in Europe in a given area" (EU, 2002).

Summary and conclusions

In this paper the concept of strategic positioning is being applied to the relationship between the researcher and his environment. On the basis of this concept, a new, analytical model of this relationship is developed. The model is built on the assumption that the researcher has goals and to achieve these goals he positions himself in his societal environment. The second assumption is that he establishes a relationship with this environment when positioning, and such a relationship is seen as a strategic alliance, joint venture, merger or acquisition. The model

results in different modes of strategic positioning. These modes depend on the researcher's choices and on his goals. The model is able to deal with the researcher at different levels of aggregation ranging from individual researcher to research institute or research at large.

Next to the modes well known from the literature, model — ivory tower and mode2 — strategic research, the model predicts a new mode3 — the researcher entrepreneur. The research entrepreneur, as distinct from the other modes, is highly autonomous and at the same time fully intertwined with his environment. This additional mode of strategic positioning is claimed to be the answer to the need, as articulated by Gibbons, for a new social contract between research and its societal environment requiring research to "enter the agora and participate fully in the production of socially robust knowledge" (1999). To paraphrase Gibbons (1999), the research entrepreneur speaks to his societal environment and this environment not only speaks back but also listens to the researcher as he directs his environment.

The model of strategic positioning can be used as an instrument for the analysis of the position of the researcher working in the research enterprise. This model can also serve as an instrument for strategy development by the researcher as it takes the view of the researcher interacting with his societal environment. In distinction from research policy approaches, the model analyses the choices of researchers and their institutes as reactions to changes of policy and developments in the environment such as social and technological change and change in government policy. In this context, it allows the researcher to translate research policies into his behaviour and to analyse whether these policies are relevant and what they indeed mean for the researcher. At the same time, the model allows the societal environment to analyse the positioning of the researcher. This allows the environment to develop appropriate strategies or policies in its interaction with the researcher.

Policy studies take a different view on the relationship between the researcher and his environment. Policy studies generally start from the environment, being in this case the government imposing restrictions on research goals and on the heterogeneous distribution of resources to which the researcher has to react. As stated, in our model it is the researcher who develops strategies to influence his dynamic environment. These restrictions can be certain research programmes financing only application-driven research or restrictions on doing certain research such as ethical issues mentioned before. The model of strategic positioning can predict the new mode3 — the research entrepreneur — as it combines an inside-out approach in developing strategies with an outside-in approach in developing strategies and setting policies.

In this paper we present the results from the preliminary study of contracts that MESA+ closed with its partners. These results show that the researcher

The research entrepreneur speaks to his societal environment and this environment not only speaks back but also listens to the researcher as he directs his environment

establishes in his negotiations different strategic positions in different relationships with different partners. The position depends on the strategic goals of the partners and on how much of the resources the partners are willing to share and how much autonomy is necessary to retain in order to attain each partner's goals. MESA+ in its relationship with the EU positions itself more as the research entrepreneur and, at the same time, in its relationship with a company, positions itself more as the mode2 researcher. This is an example of a relationship of two strong partners who are strategically interdependent on each other resulting in a joint goal and an exchange of resources to attain this goal and, at the same time, the researcher is autonomous enough to influence his societal environment and the EU as its representative. This relationship is typical mode3. On the other hand, MESA+ can be dependent on a partner such as a company who wants the researcher to deliver a solution to a set of certain research goals only. This relationship is a typical mode2 relationship.

These empirical findings confirm the feasibility of the proposed analytical model; the model can create observables for the different modes of strategic positioning of the researcher. Further research focused on predicting the performance of research tasks such as the acquisition of scientific information by the researcher as determined by strategic positioning will be reported in future. Other research based on the presented model may deal with studies on the researcher's career or the research institute's performance and sustainability.

Contracts are not the only method of confirming the feasibility of the model. Contracts are used because they report objectively on intentions, situation and potential sanctions at the moment of the negotiation. Another method that will be applied in

our research is the method of structured and in-depth interviews. Interviews will collect information additional to that obtained in the contract analysis. However, for this model to be tested it requires further development. This development will lead to expanding the model to a predictive model.

The relationship between the researcher and his environment resulting in joint research projects has been seen as a strategic alliance, joint venture, merger or acquisition. The two dimensions of organisational autonomy and strategic interdependence analysed in this paper are the relevant dimensions to look at these relationships at different levels of aggregation. As we have shown in this paper, these dimensions are equally relevant to look at the relationship between researcher and societal environment. The model not only predicts the well-known modes of strategic positioning of mode1 and mode2, but also predicts a new mode3 — the research entrepreneur.

The model is able to predict positions in organisational autonomy and strategic interdependence that the researcher most probably is likely to accept, given his goals. Therefore it is able to predict the mode of strategic positioning the researcher decides to establish, under the assumption that the researcher behaves like a rational actor and other conditions being equal.

The researcher will in the long term strive to achieve a position of highest possible organisational autonomy and lowest possible strategic interdependence. Along the path to achieve this desired strategic position, the researcher may encounter the need to compromise on positioning in mode2 or in mode3. But at the end of the day mode2 and mode3 will only be intermediate positions necessary to attain the desired mode1 position.

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