CHAPTER 4

MANAGING THE CREATION OF PROPRIETARY KNOWLEDGE

In this chapter, I will turn to the last research question (section 1.2), which is formulated as: how to manage the creation of proprietary knowledge? Based on discussions about changes in the approach of R&D management and in the technological regime of the pharmaceutical industry, two basically different modes of activity in the first stage of IP management (creation) are constructed.

This inquiry into managerial activity will be described in terms of the soft systems methodology (SSM) which is based on such concepts as 'holons', purposeful activity, roles, appreciation, contingency, learning, communication and control. It is based on the realization that all problem situations feature human beings in social roles trying to take purposeful actions. SSM facilitates inquiries into organizations on the basis of tasks and issues rather than on perceived means and ends. Furthermore, SSM provides tools for the articulation of participants’ interpretations in order to support, for instance, group decision-making. In this chapter, however, these interpretations are produced on the basis of logical consistency in positions taken in the controversies which were discovered in the pilot project and in debates in the literature.

The chapter starts with a recapitulation of the problem situation and management issues from the previous chapters. These issues are the inputs to the activity systems, presented in the schemata lateron. Sections 4.2 and 4.3 distinguish two modes of IP management which are elaborated and discussed. Section 4.4 discusses the question of IP management as a real-world problem, also extending to the previous chapters. Finally, conclusions are drawn about the validity and use of the schemata as presented in this chapter.

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A  See subsections 1.2.3 and 3.1.1.

B  As discussed in 1.2.3 and 1.3.3, and applied in previous chapters.
4.1 ISSUES

Generally, the problem of managing knowledge concerns dealing with the flux of interacting events and ideas which unrolls through time. Some of these events and ideas have an external origin and are contingent upon previous events and ideas, others have an internal origin and are intended. Many ideas originate from social interaction within and between (parts of) organizations in all kinds of ways. Such interaction may be of the following forms:

- unsystematic and undirected communication, like coincidental meetings and public announcements of a discovery or business event;
- unsystematic and directed communication, like peer review and counseling;
- systematic and undirected communication, like patents and articles;
- systematic and directed communication, like targeted data or (proto) information distribution and regular meetings.

Sometimes ideas follow from the receptive observation of (serendipitous) events or from mere chance which are often attributed to individuals. Even in such cases, question is to what degree social interaction contributed to the conception of the event or idea. Definitely, judgment and decision as mental activities of individuals are part of the social process. They depend on the net of communication which, according to Vickers (1965: 15), "is meaningful only through a vast, partly organized accumulation of largely shared assumptions and expectations, a structure constantly being developed and changed by the activities which it mediates". In other words, the mental activity and the social process are indissoluble. Therefore, the openness to and further development of an idea in an organizational context depend on or result from above-mentioned forms of social interaction. Particularly, the shared assumptions will be embedded in the tacit knowledge of the individuals concerned. The degree of openness of the organization and of the research within it refers to the prevalence of the values shared (this subject will be returned to later on).

The further development of an idea refers to the process of articulating knowledge in order to acquire proprietary rights pertaining to it and to be able to test and build on the idea(s) preceding it. In order to appropriate rights to the organizational knowledge base, management will have to control the flux of interacting events and ideas, for instance, by intervening in the social interaction within and between research organizations. Other than meetings of researchers at conferences and the like, interactions between researchers from different organizations are considered managerial issues. For instance, the definition of collaborative projects and,
especially, its intended results are generally considered to be part of managerial authority. Since managers are integral part of this interaction, the tasks and issues they are concerned with need to be considered. Typically, their tasks involve the production of knowledge and information, for instance, by:

- gathering and interpreting data,
- deciding about research programs and resource allocations,
- communicating decisions and information, and
- designing information structures.

Given such generally defined managerial tasks, IP management should be considered as a filter in the information flow about research and its outcomes involving the social and environmental conditions for the appreciation and appropriation of ideas and inventions (both internally and externally created knowledge). Consequently, the issues IP managers are involved in are of a strategic nature. To illustrate this proposition: at the outer context, public science and knowledge are so widely disseminated and useful spillovers can come from so many different directions that it is almost impossible to keep track of all possibly relevant scientific developments for any individual researcher, research group or even research organization. Given limited resources and, therefore, research capacity of the organization, the technological trajectories that can be kept track of must be selected. Strategic choices have to be made because, in establishing the external communication structures and necessary information systems and in developing capabilities and competence in any such field, large amounts of resources and time need to be spent. Consequently, changes in technological strategy take huge lead times and resources, and require long-term consistency. Such problems of scale and capacity in research relate to the issues of diversification versus retrenchment and differentiation versus specialization to be dealt with at the corporate and business level of management. A Decisions on such matters affect the boundaries of the organization in which IP management as a system is located. Demarcation is also one of the first steps in modeling. B Therefore, a strongly

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A See table 3.3.

B See also endnote 1.19.
Figure 4.1 THE APPRECIATIVE SYSTEM IN RESEARCH

see figure 3.1

IP managerial activity

- shared values
- attributions

- invention
- proprietary knowledge

- law and business

1 = appreciation
2 = appropriation

public science

organizational resources
A model for managing the creation of proprietary knowledge
A simplified depiction of research and its internal and external relations concerning the building blocks of IP management, appreciation and appropriation, forms figure 4.1.

Since the social and environmental conditions, as created by public science, law and business, are not only subject to appreciation in the research process but also to appreciation in the strategy process, IP management is considered an aspect of both systems involved. Prioritization in early stages of the pipeline (programming) is reflected in input (resources) to the creative process in research. In later stages, past priorities are reflected in features of the organizational knowledge base (capabilities and competences). These competences and capabilities are then considered to be attributes of the resource mix. These organizational resources not only include human resources, constituting the research capacity, but also the information and communication systems, constituting the information processing capacity. The ability to produce knowledge from (external) information, successfully combines the two capacities already referred to as the absorptive capacity. The attribution of meanings to events and ideas from either public and corporate resources results from judging on the basis of the shared values of the researchers. Consequent interpretations are, to a certain extent, communicated throughout the research organization and to the outside (scientific) world to enhance its reputation. Resulting external attributions characterize all actors involved in the research process, not only researchers but also functional (program) managers and support staffers. In the previous chapter, the problem with established organizational reputations (competence) has been discussed in connection with the acquisition of technologies. An established reputation in field X of firm A can block the further development of newly entered technological trajectories by firm A in field Y, because candidates for the outlicensing of a certain piece of technology in field Y by firm B will be selected on the basis of established reputations in field Y. Internal attributions are translated into the firm’s research programs and its mix of organizational resources and research projects (competence development). Finally, the combination of managing the flux of interacting events and ideas in the organization and the programming of research is supposed to result in inventions. From the perspective of IP management, this transformation process will be aimed at maximizing the number of proprietary positions to be extracted from the organizational knowledge base. Consequently, the filtering of the organizational knowledge base on the basis of proprietary conditions is integral part of the social process of creating knowledge. The creation of proprietary knowledge is therefore considered as the primary goal of IP management. Given the difference between the stages of creation and exploitation in the TLC and our priority focus on the first, our

\[A\] Given the prevalence of matrix structures in (pharmaceutical) R&D organizations.
problem definition is:

*How to manage the creation of proprietary knowledge?*

In the strategy process, corporate and business managers produce technological expectations based on their analyses of the innovation environment, competitors, existing patent positions and (therapeutical) market attractiveness. In doing so, the opportunities and capabilities are defined. Outcomes highly determine the perceived input to the typical managerial tasks of prioritization, resource allocation and the evaluation of programs and projects. The dynamics of social interaction in decision-making in the pipeline\(^A\) causes the temporal nature of perceptions and interpretations of the opportunities and capabilities involved in the research process. Consequently, it is not just the scientific and technological flux of interacting events and ideas that influences the organization’s research process, it is also the managerial flux of interacting events and ideas that influences decision-making in research. In the interaction between these realms,\(^B\) strategic learning can be developed or, at least, should be pursued. In this interaction, interpretations about the environment are built up and, by filtering them through the shared values and norms, attributed to parts of the organization and its processes. From a managerial perspective, the identification of tasks and issues in this dynamic process functions as the setting of the organizational agenda.

Summarizing the problem situation, in modeling the whole of tasks and issues, IP management is not only divided into sequential stages (creation and exploitation) but also into the organizational levels of strategy formation (the layers of corporate, business and functional management). In other words, a time and an organizational dimension have been distinguished in this problem. Combining the two,\(^C\) I conclude that creation is mainly a functional and business management activity and exploitation is mainly a business and corporate management activity. This asymmetry follows from the simple fact that one depends on individuals to produce ideas, but one needs (large) organizations to materialize and market them. Therefore, managing the creation of proprietary knowledge is per definition a multi-level...
organizational activity.

As indicated in table 3.3, each level of management will be concerned with specific issues (in terms of SSM; the subsystems’ emergent properties). For instance, a single (NCE) patent can have implications for the programming of developmental projects (functional layer), the degree of product differentiation (business layer), or even diversification (corporate layer), etc. Given such an inner organizational context and returning to interaction in the research process, the different ways in which knowledge development can be perceived and the variety of meanings that can be attributed to specific research results from so many 'points of interest’ (roles) increase complexity in managing the creation of IP. Moreover, management’s value judgments further complicate the IP decision-making situation. To illustrate this proposition: Given the strategic importance of a technological advantage, management will tend to judge the performance of their research organization by underscoring a lack of proprietary positions. Therefore, managers will try to stimulate researchers to critically assess their ideas, knowledge and information in relation to that of others within their field of expertise\(^A\) in order to be able to appropriate inventions. After all, appropriation leads to the protection and demarcation of positions in technological trajectories and therefore affects the future business scope.

Our analytical framework has provided us with a few notions for reducing the complexity of our problem. Given the building blocks of appreciation and appropriation, attention now will be paid to the organizational characteristics and issues of IP management. IP management is regarded part of the strategy process as well as part of the research process. And managerial activity in all of the organizational parts of these processes can be analyzed using the concept of the appreciative system. An appreciative system concerns a process whose products – cultural manifestations – condition the process itself. But the system is not operationally closed in a conventional sense. It is operationally closed via a structural component (the flux of events and ideas)

\(^A\) In the public as well as in the private domain.
A model for managing the creation of proprietary knowledge
which ensures that it does not through its actions reproduce exactly itself (Checkland & Casar 1986: 5). On the basis of figure 1.6, figure 4.2 depicts the composition of the appreciative systems in the strategy and the research process.

Managers of the functional layer participate in both appreciative systems in order to purposefully influence appropriation in the research process of which they are part. At the corporate level, managers will have to support this linkage by providing the appreciative systems with heuristics derived from (strategic) analyses and corporate strategic decision-making. For instance, in the early stage of project (proposal) selection, the qualification of technical knowledge as being appropriable or not will depend on bibli, patent and other analyses of the external organization of the firm’s R&D (perception). Because, even before patenting, researchers will make value and reality judgments of their work relative to (their value and instrumental judgments of) the work of other researchers. After patenting, researchers will want external review of their work from parts of the public domain which are relevant to them. And then they will gather reality judgments from IPR support staff about their work in order to valuate its attractiveness for appropriation. In other words, researchers must appreciate the necessity and value of keeping informed of competitor’s patenting activity in relation to their own and related fields of knowledge (EIRMA 1988: 27). Information from the technologically relevant environment requires corporate orchestration and business and functional level processing. But the use of such information requires dissemination to and acceptance by the recipient. Management’s influence will focus on producing heuristics and reducing biases in this information acceptance, meaning attribution and consequent use; appreciation and appropriation. As can be learned from figure 1.7, section 1.2.3 and figure 4.1, the difference between appreciation and appropriation in the research process is the institutional environment it relates to; public science respectively law. Given these institutional environments and their characteristics, appreciation and appropriation differ in the degree of variance in the social process of meaning attribution. Law as a regulating force is very unambiguous and therefore has a relatively low degree of variance in meanings that can be attributed to an (on the basis of case law) ordered set of alternatives in IP decision-making. Science and, therefore, its resulting scientific knowledge (which also accumulates in a serendipitous way) is very ambiguous and has a relatively high degree of variance in meanings that can be attributed to (often many) possible, but highly uncertain, alternatives in IP decision-making. One of the managerial activities in this decision-making is the filtering and tuning of the sets of values actors refer to in their judgments. The researcher will tend to use his professional values. The functional manager will be part of both systems and will, from his ‘point of interest’ or role, refer to the organizational values. And the support staffer
will translate the standards and norms of the law and business. Another possibility of influencing IP decision-making is to manipulate the perception of actors in controlling the information flow. Managerial control of this appreciative system can, for example, be translated into

- (re)design of information systems, data access and information distribution or staff training to influence researchers’ perceptions;
- the use of symbols, role models, motivation, communication or education concerning values to influence the researchers’ judgment; and
- budgeting, targeting, rules, explicit expectations or remuneration to influence the researchers’ range of possible actions.

It is up to management to organize the production of knowledge under the strategically set proprietary conditions and to coordinate activities in order to build consistency between outcomes from the appreciative systems involved. This consistency is of importance because, as Roos (1995) claims in his essay on ‘corporate epistemology’,

"similarity in basic patterns of interaction, re-occurring at distinct aggregational levels within the firm, is one of the key features of powerful knowledge development (creation) and of management systems in general."

In relation to coordination one should think of the afore-mentioned forms of interaction. Such consistency also extends to the cultivation of these typical forms of human activity, not only in the organizational design but also in the physical design of research facilities.¹

I now continue modeling by returning to the tasks and issues as mentioned in table 3.3 and figure 4.2, which were defined as being of concern to both business and functional management in influencing the appreciative systems:

- prioritization (project selection and programming),
- IP auditing and project evaluation,
- capability analysis and competence,
- bibliometric analysis and publishing,
- patent data analysis and patenting,
- external and internal communication,
- IP information systems, and
- IP and research performance analysis.

If management would not pay attention to these issues, they could easily become
sources of conflict that relate to such organizational situations as resource sharing, interdependence of work activities and ambiguous task boundaries (Duke 1995). Effectiveness of organizational control needs to include awareness of the potential conflicts which may exist within the research organization. Confirming our analysis, Duke’s empirical study revealed some issues for discussion typically related to research management concerns affecting the functioning of the appreciative systems:

- the origin of the technology (concerns the NIH-syndrome);
- the relationship of the technology with the organization’s main activity (concerns the competence-capabilities debate affecting research programming, project selection and the knowledge base);
- the ‘deliberateness’ of the discovery (concerns plannability and serendipity in the research programming-actions-result relationship);
- the protectability of the technology and provisions for exclusive rights (concerns the IP audit and appropriation actions); and
- the nature of the technology as product versus process.

Question is whether opposing views in such matters lead to different positions on the use of management methods and instruments in controlling the creation of proprietary knowledge? Regardless of the outcome of a debate on this question, observed controversy over such issues is in our view a reflection of a basic difference in perceptions of the controllability of research. Returning to our overall problem definition, the focus is now on the way relationships between the appreciative systems should be organized. The line of argument on relationships between organizational items in two opposite views of the research process is based on subsection 1.2.3, empirical and rational drug discovery, and formulated as follows:

If one does not believe that the accumulation of knowledge and the technological regime can be controlled, research planning on the basis of output targets will logically be considered impossible or, at least, useless. The dominant mode of control in the research organization is in such a case expected to be intrinsic. It is characterized by the creative system as the controlling organ. If management uses the instruments available for IP strategy analysis, as described in figure 3.2, the resulting information will not be distributed systematically outside the planning system into the creative system. For, the general belief would be that if one did, it would not lead to the acquisition of the targeted proprietary positions. If management does not use such instruments of analysis at all, it would not be able to know what proprietary positions are taken in selected technological trajectories and, consequently, which should be aimed at. This
would be the ultimate laissez-faire approach in research management.

If one does believe that knowledge development can be purposefully influenced (controlled), planning on the basis of output targets will be considered the start for steering the creative system. The dominant mode of control in the research organization can be referred to as extrinsic. It is characterized by the planning system as the controlling organ. Management will use the instruments for IP strategy analysis and systematically exchange information between the appreciative system in the strategy process and the appreciative system in the research process in order to enhance the learning (absorptive) capacity. The general belief will be that assessment and valuation of internal and external proprietary knowledge by the appreciative system is part of the strategic learning process.

On the basis of these two basically different positions, the following typology of control concepts and characteristics of the relation between the planning and creative system has been constructed:

The root definitions of IP management as the 'holon' are described on the basis of the overall problem and its two basic views:

Mode 1

*A system to manage IP by facilitating the research process in order to attain as many proprietary positions as possible.*
Mode 2

*A system to manage IP by steering knowledge in order to attain as many defined proprietary positions as possible in certain technological trajectories.*

<table>
<thead>
<tr>
<th>control</th>
<th>perspective</th>
<th>coupling</th>
<th>strategic planning</th>
<th>planning basis</th>
<th>strategy</th>
<th>orientation</th>
<th>information flow</th>
<th>steering</th>
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<td>process</td>
<td>tight</td>
<td>explicit</td>
<td>capabilities</td>
<td>intended</td>
<td>pro-active and interactive</td>
<td>bottom up</td>
<td>by output</td>
<td>group (info systems)</td>
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<td>implicit</td>
<td>tight</td>
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On the basis of these rootdefinitions the activity systems need to be specified. SSM developed the CATWOE procedure for this purpose. CATWOE is an acronym consisting of the features in table 4.2, typically describing the relationships between the elements of the relevant social system(s), our building blocks for the activity system to be modeled. In our case, they refer to the appreciative systems in the strategy and research process, figures 4.3 and 4.4. The CATWOEs form the basis for specification of the relationships between the activities conducted by these social systems.

Given the discussion on the technological regime in pharmaceutical innovation and perceived changes in knowledge-intensive organizations (Arora & Gambardella 1992, Della Valle et al. 1992, Gibbons et al. 1994, Timmerhuis 1996), the world view needs to be defined twofold. The world view can be considered as the set of basic assumptions on the nature of the relation with the environment, human activity, reality, time and space, etc. (Schein 1987: 14). As indicated in the previous section, the effects of the
### Table 4.2 CATWOE - MODE 1

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<th>customers</th>
<th>program managers</th>
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<td>actors</td>
<td>researchers &amp; support staff</td>
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<td>transformation process</td>
<td>knowledge base – facilitating – proprietary knowledge</td>
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<td>world view</td>
<td>impossible to steer knowledge for appropriation</td>
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<td>owners</td>
<td>corporate managers</td>
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<th>environmental constraints</th>
<th>outer context</th>
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<td>1. business</td>
<td>1. appropriation</td>
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<td>2. public knowledge</td>
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<td>3. law</td>
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### Table 4.3 CATWOE - MODE 2

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<td>transformation process</td>
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<td>possible to steer knowledge for appropriation</td>
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<th>environmental constraints</th>
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<td>1. business</td>
<td>1. appropriation as a ‘conditio sine qua non’ for project selection</td>
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<td>2. public knowledge</td>
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<td>3. law</td>
<td>2. budgets</td>
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difference in world views are supposed to manifest themselves in the concepts people have about reality, human nature and human (purposeful) activity. This world view develops in the light of different interests as they are established in the science and the business communities.

On the basis of these CATWOEs, for each mode an example of an activity system is described in sections 4.2 and 4.3. The issues and tasks, as described in the previous section, will return in schemes that indicate theoretically expected relationships between them. The criteria for defining an issue or task as an activity are logical contingency, verbal expression and a limited number of activities. If the system would become too complex in terms of the number of activities to be defined in the system, aggregates should be created. This means that activities can be divided into components. One cell could then be decomposed into another activity system. For instance, activity number 11 in the next section can be decomposed. The analysis of opportunities is a composite of analyses of the innovation environment, market attractiveness, competitor’s technologies, etc.

4.2 MODE 1

Figure 4.3 is an example of an activity system based on the first rootdefinition. The creative system dominates IP management. The planning system depends on the ability of program managers in the creative system to purposefully influence researchers to appropriate ideas. Analysis of developments in public science is an activity conducted by researchers who select and attribute meaning to ideas from publications, whether or not in discussion with colleagues, in order to develop them into projects that would lead to inventions. Communication concerning appropriability is largely directed but unsystematic. Since management does not believe that the process of knowledge creation can be controlled, appreciation focuses on the researchers’ values. Program managers will translate the expectations of corporate and business management into the proprietary conditions to be set for every individual project plan. For instance, researchers will be supposed to formulate opportunities for patenting in their research proposals. Outcomes of projects will be compared to analyses of existing patent positions of competitors. These analyses will be produced by support staff (a task of the library and the patent department). Communication on proprietary positions (both patents
Figure 4.3 ACTIVITY SYSTEM

1. explicate shared values
2. analyze publications
3. attribute meanings to ideas
4. define projects
5. appropriate inventions
6. analyze patents (portfolios)
7. define measure of performance
8. monitor 1 - 5
9. evaluate projects
10. prioritize research programs
11. analyze opportunities
12. analyze capabilities
13. define expectations
14. monitor 1 - 9
15. allocate resources

Figure 4.3 ACTIVITY SYSTEM
MODE 1
and articles) will largely be systematic but undirected. If the invention can be appropriated, support staff will take the initiative for writing the patent application in collaboration with the inventor(s). On the long term, performance of research programs will be appreciated in future planning cycles attributing a higher priority, resulting in an increase of resources allocated to projects in the field. In that sense, the planning system facilitates research.

4.3 MODE 2

Figure 4.4 is an example of an activity system based on the second root definition. The planning system dominates IP management. Internal and external analyses are composites of activities conducted by managers from the business and functional level in close collaboration with support staff. Developments in public science are analyzed in the appreciative system of the strategy process with the aid of bibliometric analyses and IP audits. Communication of their outcomes will largely be systematic and directed, possibly using and (re)designing detailed IP information systems. Thereby, gaps in existing and prospected proprietary positions are analyzed involving the appreciative system in research by having it indicate priorities and capabilities to be developed. Consequently, technological trajectories can be defined and capability programs for future research can be developed. On the basis of activity number 5, project proposals will be prioritized and ideas for projects will even be suggested by support staff specialists in lateral communication with researchers. It is the IP audit that could be the source for ideas when special sessions in the appreciative system of research would be dedicated to it. The ratio programmed/unprogrammed research could then become an issue for research management. Such pro-active planning would have consequences for budgeting if additional resources would have to be acquired for the outsourcing of research capacity or inlicensing. Control action will mainly involve the development of IP information systems in order to improve the absorptive capacity of the planning system itself. The creative system’s role would mainly be to feed back information on their appreciations to the planning system. The definition of performance measures will be based on assessment of patenting behavior of researchers. Attritions of their individual capabilities could be compared to their past performance, thereby setting individual appropriation targets.
Figure 4.4 ACTIVITY SYSTEM MODE 2

1. analyze internally
2. analyze externally
3. define mission
4. appreciate IP gaps
5. define technological trajectories
6. prioritize projects
7. develop capability programs
8. allocate resources
9. acquire/absorb knowledge
10. define measures exp. propr. positions
11. monitor 1 - 9
12. take control action
13. monitor the design of IP info systems
14. define measures
15. monitor 1 - 13
16. appreciate ideas
17. appropriate inventions
Though this more tight form of coupling between research and planning activities involves a high degree of coordination, it seems inevitable as a means to overcome the tendency of researchers to misjudge and, sometimes, underestimate the appropriability of their ideas. Developments in information technology, like groupware, intranet, data warehousing and neural networks, in our opinion provide arguments for a redefinition of the roles in performing the tasks and issues of IP management. The information processing capacity in research and planning definitely has increased and increasing capabilities of managers in developing and using above-mentioned technologies gives rise to this proposition. Some of the real-world problems of IP management are discussed in the following section.

4.4 IP MANAGEMENT MODEL: A REAL-WORLD PROBLEM?

Managers are part of the system as much as researchers and strategic or legal (IPR) support staffers are. The difference is that management as an institution has an exclusive role in defining and changing organizational parameters and in any action to be undertaken with IP affecting its ownership status. Therefore, the exploitation of IPRs is considered a complex of activities that differs in many respects from the activity system involved in the creation of IPRs. To start with, the subject of management would not be as elusive as knowledge. In the stage of exploitation, individual knowledge will already have been materialized and developed into a specific product or process technology to which one or more IPRs pertain. And the appreciative systems involved would not include research management, but marketing management or a more extended combination of support staffers (legal, strategic, and technical). The elusiveness of knowledge production in which the research process is supposed to result, is what makes IP management so controversial. Consequently, the view of all actors involved in the appreciation of knowledge and information determines their attitude towards the desirable degree of control of the research process. This controllability question logically determines the manageability of IP. Whether management has a reactive, active or pro-active approach towards outcomes from the research process would make a huge difference in modes of IP management to be favored and found in the real world. But whatever mode favored, the following signals of concern over the researchers’ attitudes towards IP were reported by management in our case study:

1. an ambiguity concerning IP;
2. a tendency to leave appropriation to the IPR specialists (the patent and licensing departments);
3. a persistent (negative) prejudice on the appropriability of ideas and discoveries; and
4. incomplete information on the existing proprietary positions in technological trajectories.

An ambiguity concerning IP:
This ambiguity seems caused by the following dilemma: The public dissemination of proprietary information concerning research outcomes is a means of establishing or improving a reputation. But the firm’s interest also lies in a need to keep information secret (an isolating mechanism) in order to exclude competitors from utilizing research results (the free riding problem). Publication is the major indication of the scientists’ awareness concerning priority rights to be derived from research in the public domain. An institutionalized example of this need for recognition is the Science Citation Index. The systematic use of (possibly) all public sources by patent offices to assess the novelty of an idea/invention, is an indicator for the awareness of scientists concerning property rights to be derived from research in the private domain. Because scientists are trained in the public domain, publication – whether or not as an incentive – motivates and trains researchers to articulate their knowledge. Articulation in patenting with the purpose of excluding others from the materialized results that might be developed from this knowledge is 'another world'. Know-how in this activity comes from the IPR specialist. In publication release procedures, this aspect is checked. Responsibility for it is a typical IP management affair.3

Basically, the ambiguity stems from the two levels of (mutual) interest concerned with intellectual property. The individual is dependent on the company’s resources in order to make a living and conduct research. Therefore, results from intellectual activity in corporate research are appropriated to the company by contract on the forehand. And many small biotechnological companies with positions in biomedical trajectories need the large pharmaceutical companies’ resources for developing, marketing or investing in their technologies.

A tendency to leave appropriation to IPR specialists:
There is a difference in articulation (and materialization) practices which is of interest in R&D. Concerning the communication on appropriability and the formulation of claims with regard to exclusion, researchers need to be able to articulate their ideas and judgment on (the value of) one another’s work. Particularly in joint research efforts and (interorganizational) research cooperation, this capability will determine the success of appropriation.

The scientist’s principal goal is a published paper; an information good. The technologist’s or engineer’s goal is to produce a (new) physical good. This difference
in orientation has profound implications for those concerned with supplying information to either of the two activities.

**Prejudice on the appropriability of ideas and discoveries**

Meaning to be attributed to an idea (individual knowledge) however can be quite problematic. Under proprietary conditions the knowledge must be articulable. If it is not, the knowledge might have to be isolated (protected by secrecy), because the idea will only be communicable by replication of the research action. The risks associated to the transfer of articulated knowledge can be perceived being too high if external peer judgment is concerned. But this need for peer judgment might make appropriation unnecessary if the idea appears to have been appropriated already. Perception then is the problem in appreciation. And given a fundamental uncertainty about appropriability, information systems are the prime organizational resource to be designed for a reduction of the need for external peer judgment. IP information systems are based on the gathering of huge amounts of proprietary information to support in-house judgment. If this IP information system is unfit for this purpose in the eyes of the users (researchers), mistakes in appropriation will persist. Needless to say that the legal consequences can be costly.

**Incomplete information**

A systematic in-house dissemination of information on patents, licenses and publications is possible nowadays, given the developments in information and communication technology. The conception of knowledge management in the field of informatics explains the use of computer systems for this information function in the appreciative system. The availability of the external proprietary information will not be the problem, but the systematic use of it in the appreciative system. Decision-making in this subsystem will be improved if the information available to the technology and business intelligence and planning function would also be available at the earliest within the appreciative system. As a question it addresses the organization of the appreciative system. Whether or not the appreciation function is facilitated by systematic information supply, will depend on the managerial view on the function of and role division within the appreciative system. In other words, controllability is first of all considered a matter of perspective.

The dominant managerial control mode in the research process has been charac-
The claim in this section is that the conventional control mode in research organizations is of an intrinsic nature but, given the changing technological regime in pharmaceutical innovation and in management, an extrinsic control mode in pharmaceutical research is gaining ground. For the time being, the extraordinarily dynamic world of scientific discovery that has led to so many serendipitously conceived inventions, still obstructs a rational approach to drug discovery that would allow for a planning mode in IPR strategy formation, based on predetermined output specification. Though indications for a slow, but radical change in the controllability of the innovation process have been found, inventive activity in pharmaceutical innovation will remain dependent on the individual’s creativity in combining information into new knowledge that would have to lead to proprietary positions in the innovation race. This dependence on the individual knowledge and perception and the (in)ability of the scientist to articulate his knowledge, does not preclude a planning approach to the management of information in the research organization in such a way that it optimizes the exploitation of articulated knowledge under proprietary conditions. After all, it would be an oversimplification to stress this conflict between the needs and culture of pure science and the demands of pure business (Burgelman & Sayles 1986: 18).

4.5 CONCLUSIONS

The model is not intended as a means of depicting parts of the real world, but to facilitate debates on changes perceived necessary in the real world. That means that adequacy or validity of the model cannot be checked against whatever image of the real world. The systems produced are models of that real world and principally equally valid. But this does not mean that all models are equally useful. The ultimate criterion of usefulness of such models is the efficacy as perceived after a structured debate on the subject the model relates to. Therefore, it might help managerial thinking about the relationship between the planning system and the research system as far as the purpose of attaining property rights to the organizational knowledge base is concerned. Based on debates about changes in modes and methods of drug discovery, the knowledge production process in general and the technological regime in the pharmaceutical industry, a change in the way management handles intellectual property was presumed to make a more systemic approach an issue.

Whether managers involved in any part of the creation or exploitation of IPRs

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A See subsection 1.2.3.
recognize the tasks and issues related to IP management in this study, remains open to discussion. The model presented would definitely support such a discussion.