Strategy Processes in Research and Development Organisations: Why Knowledge Management is still more isolated than integrated

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Abstract

In the last few years one could observe a fundamental shift from strategy content to strategy process research. The change from a market- to a resource- or knowledge-based view of strategy can be seen as an underlying driver of this shift. In our study we concentrate on research and development organisations (R&D organisations). We aim to understand if in these knowledge-based organisations the nature of strategic processes considers the specifics of the knowledge production process and therefore stand in line with the knowledge management process. Interestingly, the results of our study show that the majority of the examined R&D organisations follow a very classical, formal and inflexible strategic planning process in the tradition of strategy content research. The imperatives of planning reliability and strategic control play a major role. There seems to be very little space for strategic learning and the evolution of emergent strategies.

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1. Introduction

The knowledge-based view of the firm considers that knowledge management must be seen as an integrated part of the strategic process of an organisation, leading to innovation, growth and sustainable competitive advantage (Penrose, 1959; Drucker, 1964; Winter, 1987; Nonaka, 1991; Grant, 1996; Spender, 1996). Only a strong connection between knowledge management and the strategic process of an organisation ensures that knowledge management is embedded in the core processes of the company, which in turn ensures that the value of knowledge management can be fully utilized (Darroch, 2005; Spender, 2006). Therefore, a strategy process based on the principles of the knowledge-based view is a prerequisite for an effective knowledge management system (Ruggles, 1998; Zack, 1999; Zollo and Winter, 2002). This is especially true for knowledge-based organisations such as public research and development (R&D) organisations (Leitner and Warden, 2004; Pike et al., 2005).

We know little about strategic processes and knowledge management in R&D organisations. There are a few studies dealing with the diffusion of strategic planning instruments in general in R&D organisations (e.g. Arnold et al., 1998; Kim et al., 1999; Hales 2001) but do not investigate in more detail aspects of different strategy making modes. Other studies are more interested in knowledge management processes and tools without connecting them deeply enough to the strategy process (e.g. Armbrecht et al., 2001). Some studies (Abernathy and Brownell, 1997; Cardinal, 2001; Godener and Söderquist, 2004) have investigated the role of management control systems and performance measurement for R&D but hardly consider the relationship with knowledge management processes in the organisation. Kerssens-Van Drongelen et al. (1996) and Liyanage et al. (1999) are amongst those authors which proposed normative frameworks for managing knowledge in R&D settings and stress the importance of explicitly formulating a knowledge strategy to support the exploration and exploitation of knowledge in an increasingly networked environment by means of internal knowledge transfer, knowledge sharing or the creation of linkages to external knowledge sources. However, empirical evidence about how R&D organisations in general and public ones in particular respond to the demand for a strategically managed knowledge processes is still rare.

Any investigation of knowledge-oriented strategy formulation and implementation within R&D organisations has to address its specifics. R&D activities are risky by nature, the outputs are often hard to measure and input-output relationships difficult to assess. In particular, it is

difficult to estimate which investments in different resources or activities contribute to the outputs (Pike et al., 2005). Thus, R&D organisations struggle with causal ambiguity. Strategic management has also take care not to confine individual autonomy too strongly which could prevent creativity (Amabile, 1997). In addition, public R&D organisations, which are specifically addressed in this paper, pursue more complex goals as private R&D labs or departments and very often they have to serve public as well as private (e.g. industry) interests or needs which further complicates strategic knowledge management. Hence, obviously important assumptions for applying classical 'rational' strategic management instruments are only partly given (Ouchi, 1979).

Considering these characteristics and the necessity to generate, develop and diffuse knowledge within and between organisations we argue that strategic management of knowledge creation must be flexible, highly participatory and enable organisational learning. Based on this proposition we aim to investigate the strategy process of R&D organisations. We therefore examined four public and semi-public R&D organisations in Austria and Germany: Austrian Research Centers (ARC), Austrian Research Institute for Chemistry and Technology (OFI), Fraunhofer-Gesellschaft (FhG), and German Aerospace Center (DLR). These R&D organisations specialize in applied research in various scientific fields and are publicly and privately funded. They are important strategic players in the market, carrying out contract research, offering different knowledge based services, and serving mainly industry needs. Results of the study are based on extensive literature research and interviews with top managers and researchers from these organisations.

In the following we develop first the theoretical framework for our study based on the extant knowledge management and strategy process literature. Thereby we refer to the taxonomy of Idenburg (1993) which is combined with the knowledge management process spiral of Nonaka and Takeuchi (1995) to classify different strategy making modes for managing knowledge. Subsequently we are discussing possible relationships between knowledge management and the strategy process. We proceed with the description of the case study approach and the results. Finally, we are summarizing our findings and pointing out implications for future research.

2. Strategy Process Research

Research on strategy development has provided many frameworks and taxonomies which describe different strategy making modes (e.g. Mintzberg, 1973; Chaffee, 1985; Hart, 1992; Idenburg, 1993). These approaches reflect firstly the empirical findings about the nature of the process gained in industry, secondly the organisational and environmental context in which influences strategy formulation and implementation process happens, and thirdly the increasing need to foster organisational learning.

According to Mintzberg (1973, 1978) and Idenburg (1993) we divide the strategy process research in two fundamental dimensions: structured vs. non-structured strategic planning and top-down approaches vs. bottom-up approaches. This leads us two four views of the strategy development process, cast in figure 1:

Figure 1 about here

The rational planning approach

Based on the seminal work of Ansoff (1965) and Andrews (1971) and others the strategy process was conceptualized as a rational planning process. Strategy therefore is the result of a rational choice process starting with a deep analysis of the company and its environment. The rational planning approach assumes that managers act in a structured and rational manner. They have the best knowledge and strategic abilities to derive a strategic concept and goals out of the strategic analysis process. The derived strategic goals are the important driver to implement strategy top-down inside an organisation and strategically control the outcomes. This rather mechanical understanding of strategic work is still the most common in theory in practice.

The balanced scorecard approach

Criticism on the rational planning approach in connection with the rise of the resource-based view leads to a more bottom-up approach which we call the balanced scorecard approach (e.g. Kaplan and Norten, 1992, 1993; Idenburg, 1993 termed this approach "logical incrementalism"). This approach is still very goal-oriented but transfers the responsibilities of the goal searching process to the bottom of the organisation. This follows the theoretical understanding that there exists a knowledge asymmetry between the top and the bottom. This is especially true at the level of the strategic relevant knowledge. In a knowledge-based economy there is the challenge of top management to have all the relevant knowledge for

strategic goal stetting at the top present. This is, as we all know it today, rarely the case. Therefore there is an immanent need to include the whole organisation into the strategy development process, which is still very rational, formalized and planning oriented. As with the rational planning approach still this is a structure follows strategy view but the organisational structure also impacts the strategy development process in the way that the efficient organisation of information and communication structures seems to be very important for the quality of the derived strategic goals.

The guided learning approach

"In the experience of many companies, the mere formulation of strategic plans is an insufficient guarantee of behavioural change by managers. Their mental models generally do not reflect the complexity of the world, as analyzed in or during the preparation of strategic plans. The guided learning-process approach to strategy development attempts to introduce these mental models of reality, so that they may be discussed. In this view on the process of strategy development, a common image of reality, a common language and the joint acquisition of new insights is just as important as the definition of exact goals for a desired future." (Idenburg, 1993: 134) The communication of a common vision and mission are tools of initiating a strategic development process in a guided learning manner. Also the scenarios technique could facilitate this process (De Geus, 1985). In this view learning processes are not only of a single loop nature as it is often the case in the goal-oriented approaches, but could lead to a double loop character (Argyris and Schoen, 1978), where the continuous adaptation of strategic goals leads to a strategy as process view. Nevertheless this guided learning approach is guided by the top of the organisation which means that top management is responsible for the facilitation of the process and its results (Senge, 1990).

The emergent learning approach

According to Mintzberg (1978), an important part of strategy process research is the emergent strategy, which means that are regularly overtaken by developments, react in a non-structured manner and learn by their mistakes. In this approach strategy clearly follows the structure of the organisation. In contrast to the guided learning view learning can not be facilitated or controlled by the top of the organisation. *"This view leaves the door wide open for all kinds of irrational mechanisms, wishful thinking, ignorance and conformism."* (Idenburg, 1993). There are no techniques, tools or programmes that can help managers to manage or control this process. Strategy is not neither the outcome of a well structured process nor the outcome

of a guided learning process but the structural outcome of the organisation in the context of its environment.

3. Knowledge Management and Strategy Processes Combined: Towards a Dynamic Theory of Strategy Making

Aim of our research is to explain how knowledge is strategically management in R&D organisations. Therefore we firstly have to discuss the question of the relationship of strategic management and knowledge management. As you can see in figure 2, one can divide the literature into four approaches (Albrecht, 1993; Gueldenberg, 2006):

Figure 2 about here

The first approach sees knowledge management as completely separated from strategic management. In this approach knowledge management can be understood as an operational management tool to enhance the efficiency of an organisation through systematic knowledge creation, transfer, documentation and application. This understanding comes very close to many IT based knowledge management approaches in theory and practice.

The second approach views knowledge management as a direct consequence from strategic management. Therefore the knowledge management process and knowledge strategy follows directly the strategic management process and overall company strategy. This approach comes very close to the traditional market-based model were strategy can be created independently of the companies own resources, its strength and weaknesses. It's also very close to the "structure follows strategy" paradigm. In this approach the main task of knowledge management is to identify strategically relevant knowledge gaps and to close them (see e.g. Zack, 1999).

The third approach is the exact opposite of the second approach and therefore deeply embedded in the strategy follows structure paradigm. According to the resource-based view of strategy the resource endowment of a company should be the starting point of every strategic management process. Strategy therefore is a direct consequence of the existing knowledge base inside the company.

The above three approaches have in our view major disadvantages. They are deeply embedded in a rational view of strategic planning and neglect the possibility of strategic learning process which mean the generation of new knowledge during the strategic management process. In knowledge intensive organisations it is hard to imagine that knowledge management processes and strategic management processes are completely independent or follow each other. In these organisation there is a need for a very close interconnection between strategic processes and knowledge management processes because of there incomplete or very explicit knowledge about strategic relevant issues. Therefore strategic management can not be seen independent of the knowledge management process and knowledge management itself is heavily influenced by the strategic management process which leads us to our fourth approach where knowledge management and strategic management create an interconnected feedback loop, which means that they both influence each other vice versa.

To look deeper into this dynamics we want to combine the well-known SECI-process model of knowledge creation by Nonaka/Takeuchi (1995) with our four different types of strategic management derived from literature (see figure 3):

Figure 3 about here

The *rational strategic planning* process is from a knowledge-based view only possible, when there is perfect explicit knowledge about the cause-effect relationships and the key success factor of strategy. Otherwise a strategic analysis understood as combining explicit knowledge on the top of the organisation would make not much sense or leads to very fuzzy results. As better the knowledge base about a certain industry as better is the possibility to plan a strategy. This is in knowledge-intensive organisations like R&D organisations rarely the case.

The *balanced scorecard approach* does not need an explicit knowledge base but at least the assumption that this knowledge exists inside the organisation mostly in a tacit way and has to be externalized by the balanced scorecard process. More generally speaking this could also be the case in any management by objectives process facilitated by the top. The aim of this way of managing strategy is to externalize the tacit knowledge through the strategic planning process in form of goals, measures and action plans.

The *guided learning approach* goes along with the assumption that there is at least an implicit understanding at the top of the organisation where the organisation should head for. This is most often the case in young start-ups where a young entrepreneur follows a vision and his or her intuition. In this case the goal of the strategic management process is to transfer this strategic vision to the company in an implicit way. Internalization of this implicit knowledge takes place in form of organisational routines, values and application.

The *emergent learning approach* should be in our view the most common in knowledge-based companies where there is a very imperfect knowledge about the important cause-effect relationships and the key success factor of strategy. In these circumstances strategic relevant knowledge has to be generated through practice which means that socialization as the most important part of the whole knowledge management process will lead to new implicit knowledge about strategic opportunities and risks which can be formalized afterwards.

In our view there is no either or choice. All elements have to be present at the same time as Nonaka/Takeuchi (1995) proposed in their SECI-model of knowledge creation. In the first of these four phases, the *socialization* phase, different people share tacit knowledge with each other. In the second phase, personal, usually tacit knowledge is converted into explicit, communicable knowledge (articulation or *externalization*). In a third phase, the knowledge communicated in this way throughout the organization is combined to form new knowledge (*combination*). Finally, the experiences gained from using this explicit knowledge are themselves internalized and incorporated into our existing tacit knowledge bases (*internalization*). This re-triggers the knowledge spiral and the whole process starts anew, this time at a higher level.

4. Strategic Processes in Research and Development Organisations

4.1 Empirical Framework

We have used the case study approach to investigate the strategy development process and its relationship to knowledge management in some German and Austrian public R&D organisations. We have focused on this specific type of organisation as it can be expected that its nature of business, namely creating new technological knowledge, innovative solutions and novel products and techniques, requires a sophisticated strategic management approach, which, in turn, enables efficient and effective knowledge production. Moreover, in the past

few years these organisations have been challenged by increased international competition (Kreuzberg and Muyzenberg, 2000), new expectations expressed by its shareholders, new research funding models (Hales, 2001) and new modes of knowledge creation (Gibbons et al., 1994). Thus, there is a strong need to integrate strategic development and knowledge management processes.

We have chosen the case study approach as appropriate methodology since it is a research methodology which allows to understand the dynamics present within single settings (Eisenhardt, 1989). The case studies combined multiple data collection methods and included semi-structured interviews with managers and managing directors responsible for strategic development, which lasted between 60 and 120 minutes. In addition, we used information provided by the companies themselves such as mission statements, internal strategic documents, annual reports, etc. The data gathering process was part of a larger research project conducted by both authors and was complemented by experiences gained by one of the authors in consultancy projects with some of these companies.

Our interview guideline operationalised the theoretical framework presented aiming to explore the nature of strategic development and knowledge management and to classify it according to the proposed four types of strategy/knowledge management processes. Thereby we asked in detail for the scope and process of strategic planning and the way it is formalized and structured. The characteristics of participation across different levels and areas of an organisation in this process were highly relevant for us. We also covered the question to which extent strategic management and knowledge management tools (e.g. scenario techniques, balanced scorecard, performance measurement, learning circles) were used. Such methods could either enable or restrict a specific strategy development process. Finally, we asked for ways to integrate strategy and knowledge management processes in order to understand their relationship.

4.2 Results

In the following, the results of the strategy process of four R&D organisations - studied between 2004 and 2005 - are presented. As mentioned, we have chosen two German and two Austrian R&D organisations. A common feature of these organisations is that the majority of their shares are owned by the public and that they are all, to a large extent, funded by the public, too e.g. by a basic research budget or by competing for research funds. However, at

the same time, these organisations are increasingly carrying out contract research for various customers and thereby provide innovation solutions for industrial firms and public organisations which clearly increased the demand for strategic management of this type of organisations. All four organisations focus on natural and technical sciences and mainly carry out applied research. This type of organisation, which is also frequently labelled as Research Technology Organisations (RTOs), is a common type of R&D organisation in many European countries (Hales, 2001). Their main mission is to enable the knowledge transfers between explorative research in universities and exploitive industrial research and product development within the industry. In the following the strategic management and knowledge management processes in the four organisations investigated are presented based on our theoretical framework.

Case A: German Aerospace Center (DLR)

The German Aerospace Center (*Deutsches Zentrum für Luft- und Raumfahrt* - DLR) is Germany's largest single research company. It is organised in 27 institutes with individual heads and employs more than 5,100 people in eight locations. The DLR is funded by a basic research budget provided by the Helmholtz Society, which, in turn, is financed by the German Ministry for Education and Research. This research budget is allocated for specific research programmes in different scientific areas for a time span of four years and negotiated between the DLR and the Helmholtz Society. This programme budget covers about 60% of all expenses. The success of this programme is evaluated based on a set of agreed indicators between the DLR and the Helmholtz Society, which at the same serve as framework for strategic development of the DLR and some of the internal strategic indicators. About 40% (so-called *Drittmittel* – third-party funds) are earned by performing R&D projects funded by research funds, industrial companies, public organisations and international institutions such as the European Space Agency (ESA).

At first view DLR's strategy development process can be described as classical, rational and linear approach and has a cycle of three years. The process starts with the analysis of the external and internal environment which delivers the foundation for the definition of corporate goals and strategies. These corporate goals describe the future development related to the research topics – so-called programmatic goals – and, with respect to the corporate development, – so-called corporate goals. The latter ones prescribe the more generic goals, for instance related to internationalisation, co-operation and the improvement of the internal

administrative processes. The first ones define the research aims for all 27 institutes which are formulated together with the heads of institutes. Moreover some important strategic measures are defined for the entire organisation within this process. However, the strategies and goals developed in these two areas serve mainly as strategic framework and it is the responsibility and task of the heads of institutes to further concretise and realise these strategies and aims. In particular, it is the task to plan the research programme for the coming years. The strong communicating of the corporate vision with various media and the organisation of a "competition for visions" amongst all employees in 2004 is another method which should enable bottom-up processes and strategic discussion across the entire organisation.

To operationalize and control the corporate strategy the DLR has implemented a scorecard which follows the idea of the Balanced Scorecard but modified it for the specifics of the organisation (see also Ortner und Süß, 2006). This scorecard was implemented in 2003 and has six dimensions: 1. research, service and production of public goods (science), 2. economic situation, 3. relationships, 4. people, 5. processes and organisation, and 6. infrastructure and information technology. Thereby, the first dimension has the top priority while the other five dimensions are assessed insofar they allow to support the achievement of this primary goal. Based on the formulated corporate strategy and goals set of indicators have been developed to measure the implementation and success of the strategic goals. During this process members of the top management as well as the institutes participated in the selection and definition process. The biannually monitoring of the indicators allows the definition of necessary measures and an adoption of the strategy, if required. Moreover, since 2003 a management by objectives approach between the top management and the institutes has been formulated which serves as base for the budgeting process. In addition, various internal reports addressing different functional departments and management levels help to communicate the strategies and goals across the whole organisation.

With reference to our strategic typology we would assess the strategy process of the DLR is combining some aspects of the rational planning mode and the balanced scorecard strategy process. Even though the DLR uses a scorecard for strategic control, we would not see this primary as a tool for bottom activities or method for making emergent strategic initiatives deliberately but rather as a tool for implementing strategy. From the knowledge management perspective the process within DLR aims to externalize knowledge generated in the individual institutes, to a lesser extent the combination of different knowledge elements is supported.

However, the institutes' heads have considerable scope to bring in their ideas within the definition of the corporate strategy with various feedback loops.

DLR has also implemented some tools for managing knowledge such as databases and an external reporting system which focus on the externalization of knowledge assets. Therefore the DLR has started to prepare an Intellectual Capital Report in 2000, where also specific "knowledge goals" have been formulated (see also Leitner and Warden, 2004). However, later this report has been labelled as 'Research and Corporate Results Report' and thereby the scope of the report has been widened, it covers now all activities and is not only limited to the strict definition of knowledge assets. Thus, obviously the explicit perspective on knowledge has been incorporated in the overall strategic management process. Overall, this report serves as an external communication instrument where some information about the achievement of corporate goals and strategies is disclosed.

Case B: Fraunhofer-Gesellschaft (FhG)

FhG is the organisational umbrella of a research network consisting of 58 research institutes with about 13,000 employees in total. These institutes are performing applied research and product development in various natural and technical sciences, mainly for the industry's needs. Like the DLR the FhG has an institutional research funding provided by the public (Federal Government und states) which covers about 30% of the total budget of the FhG. The bulk of this basic research funding is allocated according to a selected set of performance measures such as the share of acquired research grants, while 20% of the basic funds is allocated for strategically defined research programmes. 70% of the earnings are gained in competition, this are either contract research projects on behalf of the industry or funded by national or international research and technology funds. The total annual research budget of FhG is about 1.2 billion Euros.

The research institutes have a high degree of autonomy and thus a large leeway for strategic development. The strategy process consists of two processes; one defines the strategy on the corporate level, the other one on the institutions' level. The strategy development process on the level of the institutes is roughly prescribed and starts with the analysis and definition of the core competencies. Moreover, the trends in the external environment are anticipated by developing a roadmap for the main research themes to be addressed in the coming five to eight years. The result of this exercise is a strategic plan which is reviewed by an external

advisory board each institute has. It is in the full autonomy of the institutes to implement this strategy. In practice the institutes apply additionally strategic instruments and define various indicators to support their strategic decision making. Usually, this is a participatory process, too, as there are various researchers involved. However, there is no detailed process defined by the executive board for developing the institute's strategy.

For the strategic development of the entire society the executive board organises regularly workshops with representatives from the 58 institutes. These representatives are the heads of the so called 'research associations' (*Verbünde*), which are clusters formed of the 58 institutes and cover eight coherent R&D areas. During the workshops the institutes and associations suggest new research themes and generic topics for the discussion, which can be interpreted as bottom-up stream. It is the task of the executive board to take up these issues, to concretize and synthesize it and to formulate a strategic plan incorporating new initiatives, research programmes and measures. This strategic plan is discussed with the various boards of the FhG such as the senate, the presidential council (with representatives from the institutes) and the scientific and technical council. The defined corporate strategy serves then again as framework for the institutes which have to operationalize and implement the strategic plan. It is the duty of the institutes' heads to take initiatives and measures to realize this strategy.

The strategy process of the FhG clearly tries to integrate top-down and bottom-up processes. On the corporate level the strategy process serves as kind of co-ordination mechanism of the institutes' strategies. It is up to the head of the associations to "sell" their ideas to the executive board. They are the interface between the top management and the institutes. However, there is no comprehensively defined strategy process which defines exactly the development and implementation of the corporate strategy and thus there exists a large leeway for designing its own processes. In the context of our strategy/knowledge process typology FhG's strategy process lies in between the guided learning and the emergent learning mode. By designing the strategy processes as loose framework which fosters the identification and co-ordination between initiatives emerging in the individual associations and institutes. By this way potential knowledge sources are socialised amongst the whole group. At the same time, FhG actively incorporates various external experts (e.g. each institute has a scientific and technical council) in their strategic management and decision processes which bring in important external views and hence further enables guided learning.

Case C: Austrian Research Centers (ARC)

ARC is the largest applied research organisation of Austria with public and private owners and run as a private limited company. Like the other organisations studied in this paper the company performs an transfer function between basic research at universities and applied research and development performed in companies. More than 900 employees are working on public-funded research projects and industry-funded applied R&D projects. The basis budget from the Ministry for Transport, Innovation and Technology covers about 50% of all expenses; the remaining budget is funded by contract projects for various national and international organisations.

ARC has gone through a reorganisation process in the last years caused by the new objectives and expectations articulated by the public (Federal Ministry) and the private owners (industrial companies). This also led to the appointment of some new managing directors within a couple of years that clearly hampered the implementation of a stable strategy process. The company is organised in different institutes and subsidiaries which have a relative large autonomy. The question of the strategic orientation of the whole organisation and also the extent to which research topics should be defined top-down were controversially discussed in the last few years within the management and between the management and the owners. Within this dynamic environment no consistently defined strategy process emerged. In general, the strategic development starts with the analysis of the external and internal environment (core competencies, strengths, weaknesses) which delivers the base for the formulation of the strategy which is developed by the top management team and discussed with the heads of institutes. This strategy serves as framework for the strategies which have to be developed by the institutes. However, the key performance indicator for strategic control and the budgeting process is the amount of third-party funds. In general, an important strategic steering factor is the allocation of the basis research funds obtained by the Federal Ministry. These resources are allocated according to a set of criteria which are in line with the corporate strategy and are accorded with the strategic plan of the institutes.

ARC has also implemented an Intellectual Capital (IC) Report already in 1999 which served as a reference model for the IC Report of the DLR, too (see above). Therein knowledge goals have been formulated in those areas where specific skills, structures and relationships should be built up or increased to ensure that the corporate strategy can be put to work. These goals form the framework for the utilization of the intellectual capital at ARC, which is composed

of structural, human and relational capital. These intangible resources, or intellectual capital, are the input for the knowledge production process of ARC, which, in turn, is manifested in different kinds of projects carried out in the firm. The IC report, which is prepared annually, mainly aims to communicate with the external stakeholders and thus discloses information about the research performance and future potential of the company. As organisation which receives considerable amount of public funds this reporting instrument responds also to the increasing call for accountability and to legitimize the invested R&D funds.

However, only a set of the IC indicators is used for internal strategic management control and knowledge management and thus complements the key financial steering measures such as the amount of third-party funds. The bulk of indicators is monitored which serve as kind of leading indicators and support strategic decision making in different areas such as for human resource development. Interestingly, the knowledge goals which have been defined in the course of the development of the IC reports in the first years prescribing the development for the knowledge-based assets (e.g. human capital and relational capital), are not used any longer. Like in the case of the DLR the underlying intentions behind an explicit knowledge management were to some extent incorporated in the general strategy process as these topics have been now integrated in some corporate strategic goals. At the same time within the IC report the scope and focus of the strategic goals presented have been changed which in the meantime define in more detail the research oriented goals, research themes and research programs. Despite the lack of a stable, formalized strategy process observable over the years we would assess this strategy making mode as rational process.

Case D: Austrian Research Institute for Chemistry and Technology (OFI)
The OFI is a research institute which specialised its research activities on plastics, environmental technology and material sciences. OFI is performing applied research, testing and technical consultancy. The major customers served by OFI are Austrian small and medium-sized enterprises which often do not have the necessary research infrastructure. The majority of the income is generated by testing orders and R&D projects for companies. The OFI is organised as a society; its members are about 300 industrial national and international firms which sponsor the research to a very small extent, too. OFI consists of 11 research institutes and employs about 140 researchers.

The organisation is certified according to the ISO 17025 standard which is an accreditation as Calibration and Testing Laboratory. This obviously delivered a strong incentive for standardisation of the management processes and reflects also the corporate culture of the organisation. The strategy making process of the OFI is defined formally and a highly standardised process. The core of the strategic process is a two days lasting annual strategic meeting with members of all institutes. In a first step the executive board makes a draft proposition for the adaptation and development of the corporate strategy. Ideas gathered by the employee suggestions schema deliver an important starting point for the strategic management meetings. These ideas are valued by the management team and enable a specific form of strategic emergence and participation. Portfolio analysis, SWOT analysis and the definition of core competencies are the standard repertoire for the definition of the strategy. An explicit treatment of knowledge assets or the employment of knowledge management instruments cannot be observed within this process. The output of this strategy meeting is a "business plan" which also prescribes the strategic goals of OFI. In addition, the evaluation of the goal achievement of the last few years is an important part within this annual strategic exercise.

The goals of the business plan are the starting point for the budgeting process and the subsequent strategic implementation by the institutes. Therefore the strategic goals are broken down and negotiated between the head of institutes and the executive board. How these strategic goals are realised is the duty of each institute's management. Moreover, the institutes also apply a financial incentive system for their employees based on criteria derived from the strategic goals. The achievement of the strategic goals of the institutes is controlled by the top management, too.

Apart from this vertical oriented strategy development, monthly meetings are organised involving the directors of the research institutes and the executive board. Aim of this 'steering group' is to further co-ordinate the strategic initiatives and to exploit synergies between the different research areas. These regularly discussions allow also the "issue selling" and are an important element for merging bottom-up and top-down initiatives. This also overcomes the classical planning-implementation dichotomy to some degree. The outputs of these meetings are synthesised in a strategic paper.

To respond strategically to the changing and increasingly competitive R&D environment, OFI adopts a rational planning approach which is nevertheless combined with the idea to adopt information generated during carrying out the daily business, too. The possibility that the head of institutes promote their own issues at the beginning of the annual strategic meetings indicates this intention.

5. Conclusion

The aim of our study was to look more closely at the nature of strategic processes in R&D organisations and considering their interrelationship with knowledge creation processes according to the SECI-model of Nonaka and Takeuchi (1995). One would assume that in R&D organisations the strategy process is organised around learning and knowledge. Interestingly, we found that this was in no way the case. Surprisingly, the results of our study show that the majority of the examined R&D organisations follow a very rational, formal and inflexible strategic planning process. This is also reflected in figure 4. This matrix summarizes our findings by positioning the strategic and knowledge management practices of the four R&D organisations using framework constructed for this study. This assessment of the individual processes is based mainly on considering the instruments and standardized processes used by the organisations. The position expresses the main focus of the strategic and knowledge management process of an organisation.

Figure 4 about here

In the majority of the examined R&D organisations there is strict division between strategic planning and strategy implementation. The imperatives of planning reliability and strategic control play a major role. There seems to be very little space for strategic learning and the evolution of emergent strategies. While we observed some bottom-up processes during strategic formulation and even some integration of external stakeholders in this phase, this is more often a reaction to resource dependency and knowledge asymmetries at the top rather than an active integration of internal and external stakeholders.

All four R&D organisations studied have implemented some indicator-based measurement system such as Balanced Scorecards or Intellectual Capital Reports to support the implementation of strategy and even manage knowledge-based resources more systematically; surprisingly enough these methods are not used within the organisations to

support strategic learning. Moreover, in all companies the linear logic and separation of strategy formulation and implementation is pursued. Our findings are partly in line with findings from a study on Korean R&D organisations. Kim et al. (1999) compared three public and three private R&D organisations and found that the top management in public organisation is more engaged in 'external roles' than in private ones. For instance, they spend more time to attend formal meetings with external interest groups and governing boards. Kim et al. (1999: 298) thus conclude that top managers are mainly concerned with accountability rather than with efficiency and innovativeness of R&D processes. In addition, the strong outside orientation might also explained by their aim to produce public goods and the necessity of all science-driven organisations to promote their prestige.

In this paper we argued that due to the difficulty to measure outputs, goals and prescribing cause-effect or input-output relationships in R&D organizations, strategy making processes are implemented which foster learning and emergent strategy making. However, we found little support for our thesis as institutionalized strategic learning processes are very rarely to be found. One main reason for this rather orthodox implementation of strategic management might be that it is mainly perceived as an instrument for legitimization and stakeholder communication and to a lesser extent as a learning tool for fostering the knowledge production process in a reflexive manner within the organization. On the other hand, there are some indications that the self-perception of the responsible persons about their degree of influence might be stronger than is really the case. In particular during strategy formulation, we found some innovative elements which are vital examples of a more learning-based approach to strategic development. However, institutionalized ex-post strategic learning processes are very rarely to be found. It is therefore no coincidence that most knowledge management projects in R&D organisations still fail to attract the degree of top management attention and commitment they deserve.

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	structured	non-structured
top-down	**Rational Planning Approach**	**Guided Learning Approach**
Strategic Direction		
bottom-up	**Balanced Scorecard Approach**	**Emergent Learning Approach**

structured   *non-structured*

Degree of Strategic Planning
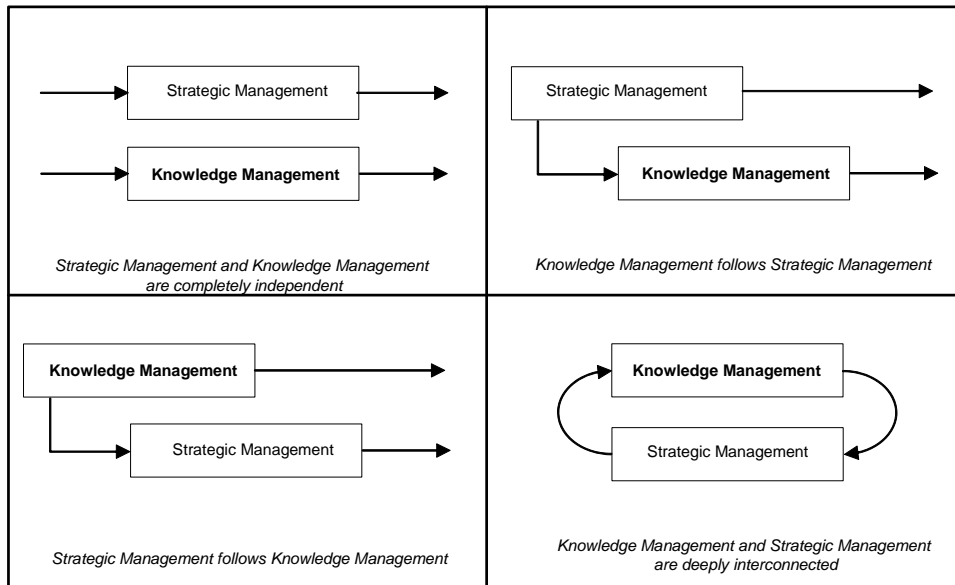
Figure 1: Four Types of Strategy Development Process

Figure 2: Strategy and Knowledge Management Process Combined

	structured	non-structured
top-down	**Rational Planning Approach** *Knowledge about* *strategic cause-effect relationships* *and key success factor* *is already explicit* ➔ **Combination**	**Guided Learning Approach** *Knowledge about* *strategic cause-effect relationships* *and key success factor* *is implicit at the top* ➔ **Internalization**
Strategic Direction **bottom-up**	**Balanced Scorecard Approach** *Knowledge about* *strategic cause-effect relationships* *and key success factor* *is implicit at the bottom* ➔ **Externalization**	**Emergent Learning Approach** *Knowledge about* *strategic cause-effect relationships* *and key success factor* *has to be created* ➔ **Socialization**

Degree of Strategic Planning
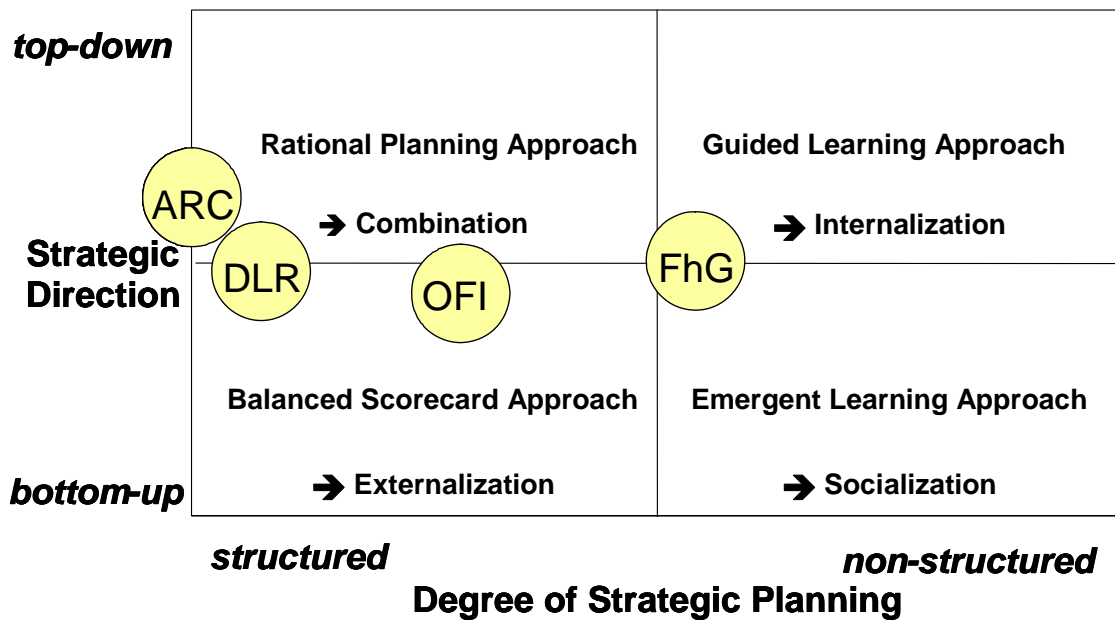
Figure 3: Strategy and Knowledge Management Process Combined

Figure 4: Modes of Strategy Making in R&D Organisations