
Strategies against competency obsolescence: the case of R&D-intensive organisations

Wolfgang H. Güttel*

Chair of Organization and Strategic Management
University of Hamburg
Von Melle-Park 5, D-20148 Hamburg, Germany
E-mail: guettel@econ.uni-hamburg.de
*Corresponding author

Stefan Konlechner

Department of Management
Institute for Human Resource Management
Vienna University of Economics and Business Administration
Althanstraße 51, A-1090, Vienna, Austria
E-mail: stefan.konlechner@wu-wien.ac.at

Florian Kohlbacher

German Institute for Japanese Studies (DIJ)
Jochi Kioizaka Bldg. 2F
7-1 Kioicho, Chiyoda-ku, Tokyo 102-0094, Japan
E-mail: kohlbacher@diptokyo.org

Beate Haltmeyer

R|M International
Fischhof 3/6, A-1010 Vienna, Austria
E-mail: bh@rmipartners.com

Abstract: The consequences of demographic change for firms are increasingly discussed in both academia and industry. However, empirical findings indicate that the correlation between an employee's age and performance is nearly insignificant. What matters most is the currency of employees' competencies. The Human Resources Management (HRM) literature offers suggestions about 'best practices' to keep competencies up to date. In this paper, we present empirical results from R&D-intensive organisations (non-university research). Based on qualitative empirical data, we identified configuration types that perform different strategies for keeping employees' competencies up to date. The differences result from the relation of an organisation's environment to its internal learning dynamics. Consequently, the appropriateness of Human Resource (HR) strategies, measures and practices to keep competencies up to date depends on the configuration type. 'Best practices' in one configuration type can be 'worst practices' in another. We show which HR strategies, measures and practices are employed in different configuration types and how they shape the learning dynamics in various environments.

Keywords: obsolescence; ageing workforce; R&D-intensive organisations; exploration; exploitation; ambidexterity.

Reference to this paper should be made as follows: Güttel, W.H., Konlechner, S., Kohlbacher, F. and Haltmeyer, B. (2009) 'Strategies against competency obsolescence: the case of R&D-intensive organisations', *Int. J. Human Resources Development and Management*, Vol. 9, Nos. 2/3, pp.124–148.

Biographical notes: Wolfgang H. Güttel is a Professor for Organization and Strategic Management at the University of Hamburg in Germany. He is also affiliated with the Department of Technique and Management at the University of Padua in Italy and with the Department of Management at the Vienna University of Economics and Business Administration in Austria. Previously, he was AIM Research Fellow at the Management School at the University of Liverpool, UK (2007), Professor at the University of Kassel, Germany and Assistant Professor at the Department of Management at the Vienna University of Economics and Business Administration (2002–2006). His main research interests are dynamic capabilities, ambidexterity (the relationship between exploration and exploitation) and replication.

Stefan Konlechner is a Research Assistant at the Institute for Human Resource Management at the Vienna University of Economics and Business Administration, Austria.

Florian Kohlbacher is a Research Fellow at the German Institute for Japanese Studies in Tokyo, Japan. He is also an Adjunct Research Fellow at the Institute for Technology and Innovation Management at the Hamburg University of Technology, Germany, a Fellow of the World Demographic Association and an Honorary Board Member of the International Mature Marketing Network. He teaches business and management at several universities in Tokyo and he is the author of *International Marketing in the Network Economy: A Knowledge-based Approach* (Palgrave Macmillan 2007) and the co-editor of *The Silver Market Phenomenon: Business Opportunities in an Era of Demographic Change* (Springer 2008).

Beate Haltmeyer is an HR consultant and partner at R|M International in Vienna, Austria. Previously, she was an Assistant Professor in the Department of Management at the Vienna University of Economics and Business Administration.

1 Introduction

The consequences of demographic change for firms are increasingly discussed in both academia and industry (DeLong, 2004; Dychtwald *et al.*, 2006; Leibold and Voelpel, 2006; Strack *et al.*, 2008). In the coming years and decades, demographic change will lead to a rapid increase in the percentage of elderly employees (Dychtwald *et al.*, 2006; Leibold and Voelpel, 2006). Currently, rapid technological progress has led to shorter learning cycles; similarly, competencies in many domains have become obsolete faster than ever. However, empirical results show that – especially as far as complex operations are concerned – age does not necessarily correlate with reduced performance ability (Sturman, 2003). Hence, particularly for knowledge-intensive organisations and

departments (e.g., consulting firms, research institutions, R&D departments), it is not primarily the age of experts (executives and highly qualified employees) that counts, but rather whether their individual competencies are up to date. By individual competence we mean both the ability as well as the willingness to react appropriately to environmental requirements (i.e., the requirements relevant to their position). The Human Resource Management (HRM) literature describes a number of measures that are meant to guarantee the long-term performance and productivity of employees. Organisations employ these good practices to different degrees and with varied effectiveness. In fact, some organisations seem able to keep their employees' abilities up to date, while others suffer from ageing problems (i.e., with respect to both the age of their employees as well as the obsolescence of their competencies).

In this paper, we present empirical results from an area in which up-to-date knowledge and competencies play an essential role: R&D-intensive organisations. Based on qualitative empirical data from non-university research organisations, we build a conceptual model that shows how different configuration types exist even within the R&D-intensive industry. The differences result from the relationship of an organisation's environment to its internal learning dynamics. Functional configurations are characterised by a good fit of the internal learning dynamics with the demands of the organisational environment. However, we also identified organisations in the R&D-intensive industry that fail to keep their employees' competencies up to date (dysfunctional configurations). As a result, individual competencies become increasingly obsolete in such organisations. In this paper, we present Human Resource (HR) strategies, measures and practices that are employed in functional configurations, and show how they shape the organisation's learning dynamics to be in accord with the environment. Therefore, we answer the following research question: *Which HR strategies, measures and practices are implemented in R&D-intensive organisations to prevent competence obsolescence?*

The paper is based on the Knowledge-Based View (KBV), which sees knowledge and competencies as a decisive foundation for the performance of organisations (Foss, 2005; Grant, 1996; Nonaka, 1994). Accordingly, the design of learning processes that improve the knowledge and competence base of the organisation plays an important role. This relates to the discussion of individual competencies, where factors that lead to the obsolescence of knowledge and competencies are discussed (Fossum *et al.*, 1986; Kozlowski and Hults, 1987; Kozlowski and Farr, 1988; Pazy, 1994; 1996; 2004). However, very few research-stream KBV studies deal concretely with the topic of developing individual competence (Casey, 2005; López *et al.*, 2006). In the context of R&D management, no explicit findings exist that discuss HR strategies, measures and practices for updating employees' competencies (even in papers where HRM aspects in R&D departments are discussed; see Bredin and Söderlund, 2006; Kim and Oh, 2002; McMeekin and Coombs, 1999).

Our empirical results extend the discussion of HRM in R&D-intensive organisations in two ways: First, we found evidence that, especially in R&D-intensive organisations, up-to-date competencies do not depend on the age structure of the employees, but on the organisation's ability to provide a suitable learning environment where employees receive incentives to keep their competencies current. We therefore shift attention away from an assumed but empirically unverified relationship between age and performance. Rather, we suggest HR strategies, measures and practices that contribute to the creation of an effective learning environment for employees.

Second, based on empirical data, we identified a correlation between external environment dynamics and internal learning dynamics, much like in the conceptual model proposed by Eisenhardt and Martin (2000). In their model, they proposed a relationship between environmental dynamics and the shape of dynamic capabilities, *i.e.*, those capabilities that determine the development of the organisational knowledge and competence base and, consequently, the ability to keep individual competencies up to date. In high-velocity environments, organisations are forced to develop mechanisms that guarantee a constant development of new knowledge in order to keep pace with novel situations. In moderately dynamic environments, organisations can draw on established and already proven knowledge. In the case of R&D-intensive organisations, the situation is similar. Where environmental dynamics are high (*i.e.*, rapidly moving), the organisation needs to facilitate continuous knowledge creation, discovery and innovation. In moderately dynamic environments, highly routinised operations are periodically interrupted by the updating of individual competencies. Moreover, we found R&D-intensive organisations that have two different such environments operating concurrently (*i.e.*, an ‘ambidextrous’ organisation). We therefore identified different configuration types that follow either the logic of exploratory learning or exploitative learning – or that perform both learning modes concurrently as in a complex, ambidextrous organisation (Birkinshaw and Gibson, 2004; Gibson and Birkinshaw, 2004; Gupta *et al.*, 2006; He and Wong, 2004; March, 1991; Tushman and O’Reilly, 1996).

The paper is structured as follows: In the first section, we review the literature on the relationship between age and performance. Subsequently, from the literature on keeping the competencies of employees up to date, we identify and cluster beneficial HR strategies, measures and practices. In the empirical part of the paper, we analyse learning activities in connection with different configuration types. In the conclusion, we conduct a cross-case analysis and present the managerial implications for each configuration type.

2 Ageing employees or ageing competencies: stereotypes and performance

Various studies dealing with the perception of the relation between age and performance show that elderly employees are often the victims of ageism (Sterns and Miklos, 1995). Moreover, compared with younger employees, weak performance or the failure of elderly employees tends to be more often attributed to their apparently stable and therefore unchangeable personal characteristics (Dedrick and Dobbins, 1991). As a consequence, elderly employees regularly receive less feedback about the potential for development and participate less in educational programmes and training (Perry *et al.*, 1999). Empirical data show that elderly employees tend to be evaluated wrongly by superiors (Cleveland and Landy, 1981); opportunities for promotion are also more limited (Cox and Nkomo, 1992). It is astonishing how these stereotypes can survive in the face of empirical evidence that shows there is no clear correlation between biological age and performance. Moreover, elderly employees are actually less prone to absenteeism and instability, and more loyal to the organisation (Perry *et al.*, 1999).

Meta-analyses of the relation between age and performance show that these age stereotypes are strongly anchored in business and society. The analyses either show insignificant differences between older and younger employees or, measured in terms of objective factors, that elderly employees actually perform better than their

juniors. Waldman and Avolio (1986) found that a slightly positive relation between age and performance can be detected if performance is measured in an objective way (e.g., through individual productivity measures). If it is measured in a subjective way (e.g., through the evaluation of superiors), a slightly negative relation between age and performance is found, which can partly be attributed to the age stereotypes discussed above. McEvoy and Cascio (1989) showed that age only affects performance in younger employees (i.e., because of experience or the lack of it), but that there is no similar correlation for elderly employees.

Age (as a demographic variable), in contrast to other factors (personal characteristics, motivation), can therefore be used only for explaining a very small percentage of performance variance. It is not the mere biological age of employees that is responsible for their performance, but rather the currency of their competencies. In this paper we therefore make an attempt to redefine the issue by focusing not on the biological age of employees, but on HR strategies – in this case measures and practices for updating and refreshing competencies – which are necessary to guarantee the performance of both younger and older employees in the long run.

3 Good practices for promoting up-to-date competencies: a literature review

Regarding HRM, the KBV argues that unique competencies and their embedded human resources are the source of competitive advantage (Boxall, 1996). Accordingly, in many organisations it is crucial for individual competencies to be up to date. The interaction between individual knowledge and organisational capabilities contributes decisively to performance, especially in knowledge-intensive organisations. In the domain of HRM, various good practices exist that are supposed to keep employees' competencies up to date (especially those of key employees, whom we shall call 'experts').

In this section these recommendations will be analysed systematically so that firms can develop different HR strategies in order to keep the existing competencies of employees up to date or to update/renew competencies that have become obsolete. In the following subsections, we will cluster and discuss the good practices that we found in the literature into three HR strategies for preventing competence obsolescence:

- 1 *Reflexive strategies* promote the structured analysis of organisational capabilities and individual competencies regarding the perceived requirements for competing successfully. For this purpose, strategic planning tools, intangible capital monitors or knowledge maps serve as a means to evaluate internal strengths and weaknesses in relation to external influences (market requirements, technological progress).
- 2 *Directive strategies* prove especially helpful if existing competencies and perceived requirements differ significantly and the further development of the employee's competency is deemed necessary. These directive strategies comprise curative measures, which deal mainly with the competencies of each individual employee directly.
- 3 *Contextual strategies* are particularly effective in preventing possible future competency deficits. These measures and practices tackle mainly the organisational level. They include changes in structures and processes (e.g., job redesign, flexible

team structures, career models) as well as changing guiding values and norms on the group and organisational levels (*e.g.*, learning and development standards of the organisational culture).

3.1 Reflexive strategies to promote up-to-date competencies

The quality of a firm's knowledge base should be central in strategy development, since organisational capabilities and related individual competencies are crucial to competitive advantage. Strategic planning (including the drawing up of knowledge maps) can serve as a means to direct the development of the firm's organisational capabilities. On the individual level, career and development talks or workshops and goal-setting procedures, as well as performance reviews in a Management-by-Objective (MbO) framework, can give a sense of how up to date employee competencies are. This is of particular importance in the case of elderly employees, as the data presented in Section 2 show that elderly employees receive less feedback on development opportunities than their juniors.

3.1.1 Analysis of organisational capabilities

In order to identify organisational capabilities, firms can draw on various measures, such as intangible asset monitors, knowledge maps or capability monitoring (DeLong, 2004). These tools can be used to systematically generate an overview of existing capabilities. The capabilities' value is dependent on the firm's environment. Scenario analyses and foresight reports, for example, can help anticipate the firm's development needs. Additionally, a comparison of the internal characteristics of the knowledge base with potential external demands along Strengths, Weaknesses, Opportunities and Threats (SWOT) lines can expose existing or imminent knowledge gaps. Even though this paper focuses on updating individual competencies, a more general organisational capability analysis is our means of evaluating the competitive ability of a firm and, as a result, individual development needs.

3.1.2 Analysis of individual competencies

Both the analysis of individual career opportunities as well as the evaluation of existing development and education options can be an integral part of regular goal-setting procedures in MbO systems (Antoni, 2005). Apart from the concrete planning of career opportunities and development activities, both executives as well as employees get the opportunity to reflect on the *status quo* of their competencies in the course of goal-setting procedures. Career and development talks and workshops may also serve as appropriate means to facilitate reflection on the individual level. These measures aim to support the process of reorientation and the definition of new career objectives. In career and development talks (*e.g.*, through potential analyses), experts analyse their opportunities together with their superiors or with the human resources staff and formulate measures for further career development. At career and development workshops, participants are encouraged to reflect on their previous and present career paths while exchanging experiences with other colleagues (Chen *et al.*, 2006). Similarly, systemic-constructionist coaching can contribute to a change of perception and action mode regarding one's own career (Feldman and Lankau, 2005; Kahnemann and Tversky, 1979).

3.1.3 Analysis of the knowledge base as a starting point for updating strategies

Such an analysis of the firm's knowledge base will reveal those capabilities and competencies that are potentially affected by obsolescence. This becomes the starting point for *directive strategies*, curative measures for reestablishing the competencies of (elderly) experts. An analysis of the knowledge base also provides information about individual competencies that are not yet threatened by obsolescence but which will need development in the future. In this case, *contextual strategies* (preventive measures) can be established.

3.2 Directive strategies to promote up-to-date competencies

Directive strategies to promote up-to-date competencies are recommended if competencies are threatened by obsolescence. If individual employee competencies are affected, training activities, job redesign or temporary leave (*e.g.*, sabbatical) are options for improving competencies. In cases where a certain department or even the entire organisation is affected by obsolescence problems, firms can react in a curative mode through personnel acquisition, retirement solutions and organisational development. There are both advantages and disadvantages to this. On the one hand, the exchange and fluctuation of personnel are promoted; experts with up-to-date competencies can be encouraged to enter the organisation. On the other hand, the organisation needs to calculate the trade-off between losing the experience and knowledge of elder experts and the costs of hiring and integrating new employees with 'new' competencies. Other curative methods involve a transformation of organisational capabilities to facilitate learning through development projects in order to change the behavioural norms and expectations of a firm (French and Bell, 1973; Balthazard *et al.*, 2006). While the exchange of personnel naturally leads to the development of a new organisational culture, organisational development activities strive to intervene in this development process more directly. However, while we imagine changes will occur in the HR structure of a department or of an entire organisation, organisational development activities are an example of a contextual strategy to promote up-to-date competencies (see Section 3.3).

3.2.1 Individual measures of the directive strategy

The threat of competency obsolescence can be countered through updating activities. However, these measures have different meanings for experts in different career paths. While education and training seem to be relevant for experts without managerial responsibilities, experience plays a much more important role for executives (Shearer and Steger, 1975; Pazy, 1996). Hence, training is the preferred method for experts, while for executives the accumulation of experiences through operative activities is more important (*e.g.*, through career planning and assignments to projects with heterogeneous team members; cf. also contextual strategies in Section 3.3.).

In the case of a concrete obsolescence threat, awarding sabbaticals can help reorient individual competencies (Dalton and Thompson, 1971). This might be especially appropriate for intrinsically motivated experts. Sabbaticals can weaken the influence of demotivating organisational context factors (*e.g.*, negative stress and work overload) for a few months, for experts to develop themselves independently. In this way, experts can update their qualification level based both on their personal motivation and the

organisational needs. The literature confirms the positive effects of sabbaticals in terms of 'refreshment', new impulses gained and higher creativity (Carr and Tang, 2005; Morison *et al.*, 2006).

3.2.2 *Organisational measures and directive strategy*

Immediately identified competency gaps can be filled by hiring new employees who can provide missing knowledge to the firm. However, the existing shape of the social structure determines how new knowledge is absorbed and how a new employee is integrated into the existing organisation. Accordingly, the process of integrating new employees into the organisation requires attention. If integration fails, employees might leave or withdraw into themselves, meaning that the acquired potential does not become effective for the organisation. Moreover, if new employees' knowledge does not connect with the existing stock of knowledge, the whole attempt fails in any case.

Furthermore, if those values and norms remain that have in the past led to the obsolescence of competencies, these new employees are essentially being integrated into a deficient environment. For example, if a high-potential employee enters a department with low performance norms, he/she might adjust to the low performance norms, *i.e.*, reduce his/her own performance to the group level – or he/she might leave the firm. Therefore, if both competency deficits and low performance norms exist, team or organisation development activities need to facilitate change according to the contextual strategies we describe.

Personnel selection is also perceived as strategically significant for avoiding competency obsolescence. Research reveals that the employees' level of education has a significantly positive impact on their learning behaviour. Education plays an important role when technological development advances quickly, while the experience of (elderly) employees is more important in moderately dynamic environments (Bartel and Lichtenberg, 1987). Moreover, empirical studies show that a high intrinsic motivation as well as a high need achievement correlate negatively with the obsolescence of competencies (Shearer and Steger, 1975). Apart from hiring new personnel, firms can also reduce the number of employees with obsolete knowledge – independent of their age – either through lay-offs or retirement regulations (in cases where activities for updating competencies do not seem profitable or practical). Flexible time regulations, reduction of working time or job sharing can also be effective measures (Rosen and Jerdee, 1989). The retirement of experts should already be taken into consideration in strategic planning (Opalka and Williams, 1987). Methods of knowledge retention can and should be used to preserve their knowledge within the firm (DeLong, 2004; Leibold and Voelpel, 2006; Kohlbacher, 2006; Parise *et al.*, 2006; Strack *et al.*, 2008). For example, accompanied knowledge transfer through a 'knowledge courier' (*i.e.*, a structured process to hand over information) from predecessor to successor (Elsik and Güttel, 2006) can serve as a means for senior experts to hand over knowledge to their successors.

3.3 *Contextual strategies to promote up-to-date competencies*

Contextual strategies aim to create a firm environment in which experts are encouraged to keep their individual competencies up to date. In such an environment, employees have the opportunity to develop their competencies in the context of their daily work. However, the creation of an appropriate context is not a quick-fix solution for updating existing competencies.

3.3.1 *Contextual strategy: structural measures*

On the organisational level, flexible structures and the use of project teams can prevent the obsolescence of competencies. To take advantage of this, a firm with a functional structure should switch to matrix or project-based structures. Empirical findings suggest that organisations with less standardisation of tasks and centralisation of decision making are more flexible (Kozlowski and Farr, 1988; Kozlowski and Hults, 1987). Research also shows a strong link between job design and motivation of experts: the more multifaceted the task, the higher the motivational potential of the job (Hackman and Oldham, 1980; Oldham and Hackman, 1981).

Organising the work of experts appropriately requires implementation of cross-functional and age-heterogeneous teams. Such an organisational structure increases the range of perspectives and supports mutual learning on the job, it is claimed (McMahan *et al.*, 1998). Moreover, team structures provide favourable conditions for unconstrained, informal learning – especially if the competencies of team members overlap only partially. Periodic formal meetings and informal talks can facilitate knowledge transfer (Pazy, 2004; Ron *et al.*, 2006). Furthermore, an exchange between the members of networks makes competency gaps visible and, therefore, provides information on future necessities in competency development (Campbell and Güttel, 2005; Parise *et al.*, 2006).

Usually, a conflict exists between organisational requirements and experts' expectations towards their work (Katz, 2005). While organisations seek to make optimal use of their experts' competencies, the experts themselves tend to look for opportunities to improve their competencies through their work and to act as representatives of their professions. Furthermore, empirical evidence shows that the likelihood of knowledge updating is high whenever experts experience an actual knowledge gap in carrying out a task. On-the-job training measures are appropriate when experts have the opportunity to learn something new by performing tasks they are assigned to (Pazy, 2004).

Job design can help encourage the learning behaviour of experts. New, diversified tasks, challenging work, autonomy and/or feedback can stimulate learning behaviour. If this cannot be achieved by means of job design (*e.g.*, if experts perceive their work as uniform and not challenging enough), another option is to foster extrinsic motivation via incentives (*e.g.*, adding training activities to pay for performance systems). However, so-called 'crowding out effects' need to be considered, since extrinsic motivation (to increase income, for example) generated by incentives can actually displace the intrinsic motivation to learn. These negative effects can be reduced by including a consensual goal-setting process within MbO systems (Kim and Oh, 2002; McMeekin and Coombs, 1999). Of course, it is difficult to identify the appropriate indicators and the right balance between operative business and learning. Trade-off decisions between both domains are tricky, as performance is important in the short term, while learning remains a long-term aim (Osterloh and Frey, 2000).

Job redesign or job transfer are other means to change an expert's work environment. The success or failure of such measures depends on the employee's attitude towards a project. Timely information and active participation of the people involved tend to reduce resistance (Anderson and Terborg, 1988).

The literature also emphasises balanced career models to avoid career plateaus, which can lead to stigmatisation of the employee (FERENCE *et al.*, 1977; McMeekin and Coombs, 1999; Bredin and Söderlund, 2006). Analysis of the effects of various career systems in knowledge-intensive organisations shows that the desired effect of dual-ladder career paths (technical and managerial career), *i.e.*, the optimal allocation of human resources according to interests and talent/competencies, seldom occurs (Katz *et al.*, 1995, pp.848–863). Accordingly, experts in the technical track report experiencing an imbalance that is to their disadvantage (Pazy, 2004). Flexible project structures can lead to faceted career paths, since a project management position does not have to correspond with a functional leadership position. At the same time, the competence of the project leader is challenged and further developed. Managerial careers can also benefit if executives have the opportunity to accumulate experience through various project assignments.

The assignment of new tasks, such as mentorship or internal consulting, can also add to experts' motivation to update their competencies (Rosen and Jerdee, 1989). However, it is important that mentors and internal consultants take on these functions only as long as their knowledge is up to date – and not when their competencies are becoming obsolete.

3.3.2 Contextual strategy: cultural measures

Organisational values and norms that stimulate employee learning are the best way to guarantee continued updating of competencies. As comprehensive studies on the correlation between organisational culture and learning show, individual learning behaviour can be strongly improved by encouraging employees' own initiative. This includes training leaves (awarded independently of age), the support of continuing education (*e.g.*, MBA) and time to pursue personal ideas and projects as well as to read professional journals (Kozłowski and Farr, 1988; Kozłowski and Hults, 1987).

The values and norms embedded in the organisational culture have a decisive impact on both performance and employee training efforts (McMeekin and Coombs, 1999). Group pressure leads to compliance with social learning norms, which may inspire employees to keep up with current developments (Ron *et al.*, 2006). A neglect of learning and development norms would entail negative sanctions or an exclusion from the group. A negative scenario where an organisational culture is too focused on stability (when change is actually necessary in order to keep up with the firm's environment) can impede the continuous adaptation of individual competencies. Additionally, since cultural norms and values are shaped by past experiences, they also mirror exactly the kind of individual learning behaviour that is necessary for the organisation's survival. When there is a significant change in the organisation's environment, one that requires a substantial adaptation of organisational capabilities and individual competencies (*e.g.*, a change of technology or the privatisation of public companies), the organisation faces a so-called lock-in situation (Leonard-Barton, 1992). Lock-in situations refer to capability traps, which occur if only success-generating capabilities are improved, and alternative development options are disregarded (*e.g.*, the improvement of analogue film processing at Kodak occurred at the expense of a more timely adjustment to the challenges of digital photography).

Organisations, however, are able to comply with new, dynamic circumstances only if the values and norms regarding learning and individual competence development also change. Organisational development can help readjust the organisational culture. This process requires dealing with the existing norms and values. The aim is to initiate a cultural change that enhances and facilitates learning behaviour that will secure the company's survival in the long run.

4 Methodology

An applied research project served as the starting point of this paper. The project was triggered by a large European multi-unit R&D-intensive organisation that wanted to identify measures that could promote the performance ability of elderly employees (the top management team tended to attribute lower performance ability to elderly employees). This high-technology firm, which we will call RCA from now on, consists of five departments (health technologies, materials technologies, information technologies, mobility and energy, and nuclear research), which are in turn subdivided into 15 loosely coupled divisions (*e.g.*, the department of health technologies is subdivided into the units biogenetics, life sciences, biomedical engineering, and radiation safety and engineering).

Currently, approximately 1000 employees are organised in about 60 groups (the data vary due to the long period of observation), which operate in different research (and service) areas and therefore within very different market structures. Each division holds strategic and operative control over its business. Even though RCA is partly controlled by the government (50%), it has to finance two thirds of its activities by itself, *i.e.*, by processing contract research, by conducting standardised laboratory research or by applying for basic research funding.

An initial organisational analysis at RCA showed that the various departments of the organisation dealt differently with the ageing phenomenon. We identified departments that conducted cutting-edge research with young employees, while other departments did the same with elderly employees; age was seemingly not a factor. In another group of departments in the same organisation, however, we identified performance gaps and age stereotypes. Why did some organisational units have 'ageing problems', while others did not? Our research strategy was to find patterns that explained the emergence of these differences. We used a case study research strategy (Yin, 2003) based on the use of various qualitative research methods (Kohlbacher, 2005).

In the first step, we conducted an embedded case study (Yin, 2003) at RCA in 2005/2006 and analysed different departments within the organisation. Interviews with personnel managers, members of the staff association of European R&D-intensive organisations (non-university research) and executives in various departments of the organisation served as the basis of our data. Additionally, we drew on data which we had collected for a strategy development project with the same organisation in 1999. Based on these data, we identified different configuration types (see Section 5) where we distinguished departments according to 'environmental dynamics' and 'learning behaviour'. In the second step, carried out during 2006, we validated our configuration types by conducting six additional case studies. In particular, we selected research-intensive organisations that are either specialised in one field (molecular pathology (160 employees), statistical analysis (900 employees) and child cancer (100 employees in nonhospital departments)) or acted as multiresearch organisations (three

organisations with 1900, 5000 and 12000 employees). The participating organisations were chosen through 'theoretical sampling' (Glaser and Strauss, 1967; Strauss and Corbin, 1998). Based on the preliminary results, we looked for comparable departments in other organisations and integrated them into our analysis. We continuously modified our configuration types in accordance with the guidelines for theory development provided by Eisenhardt (1989) and Glaser and Strauss (1967).

The characteristics of the topic led us to the decision to use problem-centred interviews for data collection (Witzel, 2000). As an initial question, we asked interviewees to describe the typical strategic planning procedure in their departments and for the entire organisation. Through this, we were able to obtain information on the environment and its internal capabilities, which was relevant for the rest of the interview. Later in the interview, attention was shifted from the organisational to the individual level when we asked for the employee to describe his/her participation in strategic planning. At this stage our questions dealt with the employees' current performance behaviour and development activities.

The interviews were transcribed and analysed by means of structured qualitative content analysis (Kohlbacher, 2005; Mayring, 2000; Titscher *et al.*, 2000). This method aims at filtering certain aspects out of the material and analysing them according to specific criteria resulting from prior analysis.

For quality assurance reasons, the research team consisted of the authors and two other researchers who participated in data collection and analysis (Corbin and Strauss, 1990). In a final workshop the results were presented to and discussed with the interviewees and the top management team. This allowed for both the clarification of the findings' relevance for the client and the confirmation of our results.

5 Presentation of results: strategies for competency updating

Within our case study analysis we identified three functional configurations for competency updating. The configurations differ in their ability to govern organisational and individual learning for the purpose of meeting environmental demands.

In a high-velocity environment, the continuous development and acquisition of new knowledge are perceived as the firm's most important activities. In contrast, in moderately dynamic environments, the repetition of routines and therefore the optimal use of existing knowledge dominates. Referring to March (1991), we use the terms 'exploration' (meaning innovation and the generation of new solutions) and 'exploitation' (meaning replication and the gradual optimisation of proven solutions) to describe the internal learning dynamics of the organisations and units. In functional configuration types, the learning dynamics are in line with environmental requirements.

We identified two functional configuration types: an exploration configuration in high-velocity markets (with learning behaviour directed towards the continuous updating of competencies) and an exploitation configuration in moderately dynamic markets (with learning behaviour following a punctuated equilibrium approach where competencies are updated only infrequently). Moreover, we identified a third functional configuration type where both exploration- and exploitation-logic guided learning behaviour. This is the case when routine activities are of equal importance as activities with a high demand for

innovation, as described by the concept of ambidexterity (Birkinshaw and Gibson, 2004; Gibson and Birkinshaw, 2004; He and Wong, 2004; Tushman and O'Reilly, 1996). In none of the three configuration types were either the biological age of employees in general (note that the age structure varied greatly among the organisations and units) or the age of individual employees regarded as a problem.

In contrast, we also identified dysfunctional configurations where a unit's competencies did not match environmental expectations. Such organisations and departments were not able to develop employees' competencies or to boost their performance ability. We identified two options for organisations in such situations. First, a strategic repositioning could serve especially well for formerly explorative organisations and departments. They could choose a market position that better fits existing competencies (*e.g.*, rearranging their service and product portfolios in order to address markets with lower environmental dynamics). Second and far more critical is the situation for organisations and units that already operate in an exploitation mode. They do not have the opportunity to reposition themselves in a more profitable environment since (low) cost rather than quality (innovation) is the decisive criterion for making profits. In such situations, high personnel costs and a lack of know-how frequently draw managerial attention to the age structure of the unit. However, we know from the literature (see Section 2) that, in such cases, the organisations have failed to create structures and an organisational culture conducive to preventing the obsolescence of competencies. Since strategic repositioning based on existing organisational capabilities and individual competencies is not suitable under these circumstances, cultural change remains the only option for changing the learning behaviour of such organisations or units.

We now turn to the strategies, measures and practices applied by functional configurations in order to prevent units from regressing into a dysfunctional configuration. In the course of our qualitative study, we could not find any best practices for competence updating that seemed to be valid for and applicable to all organisations. Within the three functional configurations, however, we were able to identify typical strategies, measures and practices which ensure that the learning dynamics match the environmental requirements. The following sections discuss the strategies, practices and measures for competence updating to be found in the relevant literature, with respect to their application and effects in different configuration types.

5.1 Results: strategies for competence updating in the exploration configuration type

Exploration units were scientifically oriented and specialised in learning and research. Since the top of the 'scientific community' was their reference environment, they focused mainly on basic research. In the exploration units, experts were continuously confronted with problems for which no standardised solutions existed. The strategic orientation focused on long-term and sustainable innovation. In an extreme example, one organisation did not renew contracts even with successful researchers (excluding top researchers/heads of department) in order to ensure innovation via continuous and planned fluctuation.

“If they are successful, it is possible to prolong them [contracts of successful scientists in leading positions] once after 5 years for another 3 years. After that they have to leave even if they perform successfully. This is because this is the only way for us to get ‘fresh blood’. Otherwise we would stagnate sooner or later...” (manager of an exploration unit on organisational structures)

With new employees, new topics and ideas enter the organisation. Thus, personnel selection played an important strategic role. The research domains were chosen by the top researchers, and not by the top management of the organisation. The scientific community served as a feedback mechanism, since the success and acceptance of research findings were rated on publications or on research grants. Consequently, the organisation – quasi automatically – got immediate and continuous feedback from the market (*i.e.*, the scientific community) on the currency of their competencies.

Exploration organisations were not faced with the problem of obsolescence. The organisational culture was characterised instead by a kind of Social Darwinism where only the best survived. Performance norms (values and norms of the organisational culture) were high; success was measured purely in terms of acceptance of research findings. Furthermore, since research was often done in teams, the effect was that individual performance norms were adjusted to the (high) group level. This also implied a pressure to further develop one’s individual competencies, though employees did not perceive it as external pressure. Intrinsic motivation was predominant and employees found their work intrinsically engaging.

“All extrinsic motivation systems are basically alien to them [scientists in exploration units]. They say they want to have their own labs and an appropriate infrastructure and enough people with whom they can interact well. That’s their motivation.” (manager of an exploration unit on intrinsic and extrinsic motivation)

There were also well-accepted selection mechanisms that strongly affected the transition from one career step to the next. Since even for successful employees, an internal promotion was often impossible, they made use of the good reputation of the organisation to advance their career in other organisations. Exploration organisations were able to use these networks for future collaborations and network enlargement efforts.

Teamwork was the predominant work model. Cooperation with top researchers (‘luminaries’) offered learning opportunities for younger scientists. Moreover, researchers were integrated into interorganisational networks quite frequently. Therefore, opportunities to learn from network partners arose; these networks also helped confirm the quality of one’s competencies.

In contrast, formal training was irrelevant. At best, this topic played only a marginal role in goal-setting processes or performance reviews. Learning took place on the job, through interaction with renowned scientists and with network partners, or through activities within the scientific community.

“Not in a formalized way. But in my view, scientific work usually means that people publish regularly, attend conferences, present their papers, their posters and listen to what others have to say, you know. It is a permanent training [process] – if you want [to think of it that way].” (manager of an exploration unit about formal training)

5.2 Results: strategies for competence updating in the ambidextrous configuration type

Ambidextrous units were characterised by a continuous interplay between research (reference system: the scientific community – work on new solutions) and service (reference system: commerce – repetitive application of approved solutions), which could be described as applied R&D. The challenge was to find a balance between research and service.

“In principle we have both independent research and contract research, you know [...] the independent research follows scientific logic, and operates in tune with technology politics; contract research uses customer satisfaction as its criterion. That means it is our aim to carry out projects in such a way that clients use us a second time as well and not only once.” (manager of an ambidexterity unit on strategic planning)

Synergies emerged from the co-orientation towards both reference environments. Conducting research intensively allowed organisations to remain state-of-the-art, even in domains that were characterised by repetitive activities. New theoretical and methodological findings were applied quickly in other domains. On the one hand, innovations were quickly transformed into service and product offerings. On the other hand, operative activities enabled the identification of practical problems that required the development of novel solutions through research. However, these units faced a vicious cycle in their business model: funding problems. They needed to acquire sufficient earnings in the service domain in order to finance research. Their one advantage in this respect was their integration with the scientific community, which served as a ‘unique selling proposition’ and a means to differentiate their organisation *vis-à-vis* competitors.

“There are simply new methods which displace old methods. If we were not that close to research we would continue with the old method as long as possible, of course. But we have the ambition to switch to the new method as soon as we know that there is a new way that delivers better and more accurate results.” (manager of an ambidexterity unit on the effects of changing standardised practices)

The research domain of this organisation was in close contact with the scientific community. Therefore, an adequate learning dynamic was necessary and crucial to success. In the service domain, the expectations of commercial clients were the priority. Trust in existing solutions, with a suitable balance of costs, was decisive. The organisation switched between ‘exploration’ (research: the development of new methods, of innovative solutions for new problems) and ‘exploitation’ (standardisation and optimisation of services) with services usually providing the financial basis for research.

“I strive to have employees who can live in both ways. And not sequentially, meaning spending the first five years in research and then losing what they learned during this time in the application afterwards [...] Every employee should be capable of doing both, publishing scientific papers and [...] interacting with the scientific community as well as carrying out highly applied projects in contract research.” (manager of an ambidexterity unit on the anchorage of employees within the scientific and the business/service context respectively)

Strategic planning was partly market oriented, partly resource oriented. While market trends were considered, planning was predominantly resource oriented (referring to the organisation's own competencies). Intangible asset monitors or intellectual capital reports were used not only for reflections about competencies but also to define the ambidextrous trade-off between exploration and exploitation, and to communicate it to internal and external stakeholders.

Usually, employees possessed qualifications in both domains (research and services). Since existing solutions had to be used, the development of a core staff that could have learning experiences with new clients in a routine way was essential. Selection procedures existed at the early career stage, and the best employees (generalists that could perform well in both research and service) were awarded a permanent employment contract (tenure position). The age structure of the core staff was determined and controlled by recruitment frequency. The organisation gained flexibility through the employment of young experts. Only some of them were awarded a permanent employment contract (tenure position) later on. Consequently, the organisation was able to benefit from their specific knowledge temporarily (*e.g.*, in certain projects). Similar to exploration organisations, young experts perceived this employment as a stepping stone. Consequently, while one part of the staff remained stable, the other part kept the organisation versatile and adaptable.

“...in general there are only one-year-contracts to start with; afterwards he or she will get a tenure position.” (manager of an ambidexterity unit on career prospects)

“...usually we send people back to the free hunting-grounds after they have completed their dissertation, because in research it is simply important to have a broad horizon.” (manager of an ambidexterity unit on career prospects)

The specialisation of employees in one domain (research or services) sometimes occurred, and presented a potential area of conflict in cases where there was little mutual understanding between employees of different domains. Therefore, one of the main challenges of ambidextrous units was to cope with diversity as demands for different governing mechanisms arose. In response, many ambidextrous units prevented the uniform specialisation of employees by using team-based working structures. Thus, job design and career management were important formalised decision artefacts in such configurations. These artefacts determined whether an expert had to be qualified only in one or in both domains (research and services). Moreover, by using career management systems, ambidextrous units decided whether an employee's focus should switch from exploration to exploitation (or vice versa) in the course of a career or not (*e.g.*, some experts started in research and over the course of their career switched to service). Furthermore, ambidextrous units decided carefully whether teams were to consist of employees with different professional specialisations (*i.e.*, focus on research or services), or with similar competence profiles. Obsolescence of individual competencies occurred in ambidextrous units primarily if employees lost track in both domains. The more the different domains drifted apart, the more likely obsolescence problems were to emerge, as mutual understanding collapsed and competencies were developed only single-sidedly.

In ambidextrous units, off-the-job training (*e.g.*, soft skills, project management) were more important than in the exploration configuration. In addition, on-the-job training efforts and conference participation were offered as updating activities. However, the main competency development activities resulted from the employee's regular

participation in research projects (exploration), along with his or her operative (exploitative) work. Since there were two kinds of governing logic, performance measurement took place according to different criteria.

“I believe that my employees rate their success on the following: on how they manage their talks at international conferences, on the acceptance of their papers in refereed journals, if they wrote a book or an article in a book. That means, they rate part of their success on their scientific performance [...] The second part of their success, I believe, depends on how they manage to carry out projects, what approval they meet, the client satisfaction.” (manager of an ambidexterity unit on indicators for success on the employee level)

Intrinsic motivation was an important trigger for performance in both domains. However, research was stimulated by motivation more strongly than service. The predominant mindset in the research domain was often similar to that of exploration organisations. Therefore, linking extrinsic and intrinsic motivation presented a major challenge. This linkage was achieved through goal-setting processes in MbO frameworks, which were perceived as highly relevant in ambidextrous organisations. MbO allowed for the planning of a time schedule for different tasks (*e.g.*, 70% of the available man-hours are used for research, and 30% for services), combined with the setting of diverse targets.

5.3 Results: strategies for competence updating in the exploitation configuration type

Exploitation units focused mainly on repetitive problem solving, like in the case of commercial R&D. Accordingly, a service orientation dominated their business model. Clients expected highly standardised and reliable services (*e.g.*, laboratory tests, consulting activities). Consequently, learning dynamics focused on exploitation in terms of the optimisation and standardisation of already existing procedures and methods. Substantial learning steps rarely occurred, since the replication of existing solutions was the priority. Strategic planning took place in a top-down mode. Intellectual capital statements or knowledge and competence maps were of low relevance as success and failure showed up immediately in the financial results.

This configuration type employed a high percentage of core staff and only a few experts with short-term contracts. Efficiency was largely due to employee experience, since employees usually worked on routine project tasks. Because of the high standardisation level in operative business, obsolescence problems in professional knowledge were easily identified.

“We hired them just in 2001, fresh from the university; [their knowledge] cannot become obsolete in this short period of time.” (manager of an exploitation unit on the possibility of knowledge obsolescence (ann.: interview date: beginning of 2006))

In the ideal case, long-term employee contracts led to higher customer loyalty because social relations were developed. Therefore, long-term employment models were perceived as useful in exploitation units. Exploitation units recruited mainly relatively young graduates with a long-term perspective. Predefined career paths guaranteed security in career development.

“As for a mix in the age structure, we try to recruit younger people, of course. But it is not possible for all positions. If a management position, for example, is vacant, we cannot hire someone young.” (manager of an exploitation unit on specific careers, life-long employment, and career planning)

Training for professional and social competencies were important for the development of individual competencies. In many cases, employees participated in special off-the-job training in order to meet organisation-specific requirements. Training ranged from soft skills seminars (*e.g.*, cooperation, communication), which were thought necessary because of the intensive customer contact, to management issues (*e.g.*, project management, acquisition, sales). Compared to the other two configuration types, planning of individual training activities was addressed more extensively in goal-setting procedures and evaluated in performance reviews. Teams were frequently heterogeneous in terms of age and experience.

“For many young colleagues, when they join the company, it is rather surprising that the older ones who do not have an academic degree, but have already done their job for decades, have something to contribute based on their experience and knowledge to share. And in some domains it works well if young and old come together. [...] The proportion is decisive. Graduates who join our company still have years of learning ahead of them.” (manager of an exploitation unit on the proportion between younger and more experienced employees)

“But in general we only hire younger employees and train them – that’s how they are integrated into our teams. We have six to eight people in each business domain and one or two novices can shadow. Thus, they get their training in-house.” (manager of an exploitation unit on diversity in team composition)

A lack of challenges sometimes led to a reduction in performance ability. Exploitative units tried to provide structures that countered less inspiring work environments (*e.g.*, by governing job requirements, giving feedback, improving task variety, using heterogeneously staffed teams with more experienced employees as mentors). In addition, exploitative organisations tended to use pay-for-performance systems to stimulate extrinsic motivation. Intrinsic motivation and reputation within the scientific community, in contrast, played a more subordinate role than in the other two configuration types. Accordingly, scientific success indicators (*e.g.*, publications or talks) were usually not of crucial relevance (a clear difference from exploration or ambidextrous organisations).

6 Discussion and conclusion

From a KBV perspective, the knowledge embedded in individual competencies and organisational capabilities is the basis for gaining and sustaining competitive advantage. Therefore, strategies and measures are necessary to keep employees’ competencies and organisational capabilities up to date. The HRM literature offers a variety of good practices for keeping individual competencies up to date. However, two issues require further discussion. First, an area where the highly specialised knowledge of employees is critical for the firm’s survival has been widely neglected: R&D management. Surprisingly, there are no analyses of R&D-intensive firms or units that explain how

competence obsolescence can be avoided. Second, there is also a lack of empirical and theoretical knowledge that specifies how HR good practices can be applied in different environments. We empirically investigated the strategies, measures and practices of R&D-intensive firms for preventing competency obsolescence. However, our study is not based on a quantitative analysis of the diffusion of good practices in R&D-intensive firms, but rather strives to explore the distinctions between organisations that perform in differently dynamic environments to prevent competency obsolescence in detail. Therefore, we chose a qualitative approach, drawing mainly on Yin's (2003) case study research strategy.

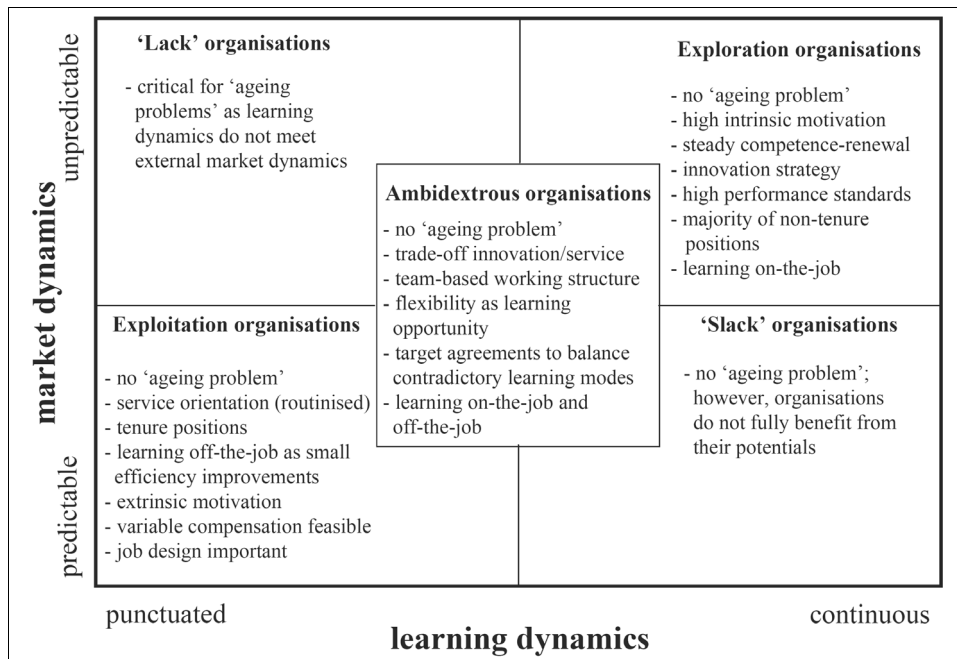
Our cross-case comparison shows three main results: First, we identify a connection between environmental dynamics and the necessary internal learning dynamics. In high-velocity market environments, organisations develop strategies, measures and practices that ensure the continuous updating of individual competencies on the job. In moderately dynamic environments, routinisation and the refinement of existing competencies are important issues. Consequently, we find support for the conceptual framework that Eisenhardt and Martin (2000) propose. They argue that environmental dynamics have an impact on dynamic capabilities, *i.e.*, a firm's ability to reconfigure their knowledge base in order to meet their environmental requirements. The organisation's ability to accomplish this task can be observed in whether employees' competencies are kept up to date or not.

On the basis of empirical data, we identify three functional configurations that perform different learning dynamics (*i.e.*, employ different dynamic capabilities) in order to meet various environmental expectations: exploration, exploitation and ambidextrous organisations (Figure 1). Exploration (research-oriented) configurations show high internal learning dynamics, which enable them to operate in a high-velocity environment. Exploitation (service-oriented) configurations exhibit moderate internal learning dynamics in order to meet environmental expectations defined by routinisation and consistency. The third configuration type identified performs in high-velocity markets (*i.e.*, research) and in moderately dynamic markets (*i.e.*, service) concurrently. Such ambidextrous configurations consider both types of logic – exploration and exploitation – in order to perform well in both domains. In their case, it is necessary to facilitate the continuous development of employees' competencies both in research and in service. However, we discover two configuration types where learning dynamics do not meet market dynamics. While 'slack organisations' do not fully benefit from their potential, 'lack organisations' suffer severe obsolescence problems as their learning dynamics do not meet external market demands. As a result, the employees' competencies are predominantly obsolete and the performance deficits are apparent.

Second, our results support the results from studies of other industries, which found that the currency of individual competencies and the employee performance are not dependent on employee age. Biological age does not matter in organisational configurations where the organisations' cultural values and norms enable the establishment of high performance standards and a learning orientation that prevents competency obsolescence by constantly meeting external environmental requirements. The important role of organisational culture and HRM in establishing a performance orientation in R&D is highlighted by McMeekin and Coombs (1999). We also find mechanisms of self-regulation within functional configurations that prevent competency obsolescence. Exploration configurations develop employment policies where employees have to leave the organisation when they do not meet certain performance standards.

Furthermore, some exploration configurations do not even offer long-term contracts (tenure track), even if employees perform successfully. Thus, they assume that a continuous (ex)change of staff is necessary to innovation. Consequently, there is only a limited hazard of competency obsolescence in this configuration. Nevertheless, a dramatically changing environment could devalue competencies, such as when there is radical technological change.

Figure 1 Good practices of different configuration types



In ambidextrous configurations, employees are able to switch from research to service if their knowledge gained by experience (exploitation) is more in demand than their ability to create new knowledge (exploration). However, such a career change needs support from the organisation. Otherwise, demotivation and decreased performance can follow. In the case where both research results are appreciated by the scientific community and consulting activities are valued by the market, but the firm enables a single orientation, employees can choose to stay either in research or in the consulting (service) business. However, in such cases the organisation runs the risk that a lack of understanding between employees of different departments emerges, making cooperation more difficult. MbO, performance appraisals, career paths and job design are important structural elements for enabling a balance between research and service. Competency obsolescence occurs if no mechanisms are established to prevent situations in which employees do not meet the standards of both fields.

In exploitation configurations, the hazard of competency obsolescence is high, as standardisation, routinisation and the reuse of existing knowledge are particularly important for performance. Intrinsic motivation decreases with highly routinised activities. Therefore, feedback mechanisms regarding market performance are important, as they provide information concerning individual and team performance. Furthermore,

such feedback mechanisms make information available for pay-for-performance systems. Such organisations also offer opportunities for individual learning activities and self-improvement in order to support individual competency development (*e.g.*, through sabbaticals or a number of guaranteed training days per year). Competency obsolescence occurs if internal learning dynamics fail to meet external environmental dynamics.

Third, we explain why the strategies, practices and measures that were used by the firms in order to avoid competency obsolescence diverged in different configuration types. Competency evaluation occurs continuously in exploration configurations through the scientific community's feedback concerning individual (or team) research results. On the other hand, market positions are of strategic importance to exploitation configurations. Consequently, their evaluation activities are focused more on market demand than on actual competencies. Performance reviews and MbO systems are used in order to reflect on individual performance and competency development. Finally, intangible asset monitors or intellectual capital reports on the organisational level, and performance reviews and MbO systems on the individual level are considered highly important in ambidextrous configurations. These reports provide information to internal and external stakeholders regarding the trade-off between research and service. Furthermore, they are used to legitimise an organisation's strategic orientation as well as its performance, especially if the organisation has to compete in both research and service environments.

As for directive strategies, exploration configurations conduct learning almost exclusively on the job. In contrast to the other functional configurations, training is not important, as employees in exploration organisations or departments strive to be part of the knowledge elite. Bredin and Söderlund (2006) also discovered the low impact of training activities on business R&D units in general. Our more detailed results, based on a model that distinguishes between three functional configurations, show a different appraisal of training. Exploitation configurations emphasise off-the-job HR development activities (*e.g.*, training, coaching, sabbaticals) as they do not expect new knowledge to be created through routinised tasks. Formal training activities are needed as an external incentive for competency development. Ambidextrous configurations adopt mechanisms from the scientific community and from traditional HR development in order to expand individual competencies. Individual training activities are governed through their integration into MbO systems and through staff appraisals in exploitation and ambidextrous configurations.

Further differences between the exploration configuration and the other configurations can be found in their employment policy. Exploration units use non-tenure-track career models in order to acquire new knowledge (with both elite researchers and novice researchers). Nevertheless, even non-tenure-track positions are attractive for employees, as they are able to use the good reputation of exploration organisations to increase their employability at other institutions and business firms. Exploration organisations sometimes use these networks for future collaboration and network enlargement efforts. Both other configurations aspire to a more stable employment structure and, as a result, run the risk of increasing competency obsolescence.

The values and norms of the organisational culture in exploration configurations are based on high performance. Specific structures in exploitation configurations (working in teams and within interorganisational networks, autonomous work, career models with

short-term contracts) foster organisational flexibility and the intrinsic motivation of employees. Ambidextrous configurations face the trade-off of balancing research and service. Revenues from service domains are needed to fund research projects. In exploitation configurations employees have to be extrinsically motivated because tasks are routinised and autonomy is limited. Therefore they employ pay-for-performance systems, training and career systems that are predominantly tenure track. Empirical studies on compensation issues in the R&D industry paint a similar picture. Pay-for-performance systems are most common in commercial R&D but rarely found in applied and basic R&D (Kim and Oh, 2003).

Depending on the domain, different (almost contrasting) good practices make sense. A good practice in one domain can be a bad practice in another. The advantages in one domain may cause disadvantages in another, because issues of legitimacy (*e.g.*, equality of employees) may impede the differentiation of practices within an organisation. Organisations that perform different learning modes simultaneously (both exploration and exploitation) face the challenge of internal differentiation. They have to create stimulating environments for updating the competencies in two different domains: research and service.

Finally, it has to be mentioned that our results originated from a small sample of organisations in the R&D industry. The results may therefore not be statistically generalised, even though analytical generalisation is possible (Yin, 2003). Further research is needed to investigate competency obsolescence in other industries, and to analyse the different configuration types in greater depth.

Acknowledgements

The authors would like to thank four anonymous reviewers and the participants of the Annual Meeting of the European Academy of Management (EURAM) 2007 in Paris and of the Annual Meeting of the German Academic Association for Business Research (VHB) 2007 for their valuable criticisms, comments and suggestions. Furthermore, they are indebted to the Vienna University of Economics and Business Administration (WU Wien) for its financial support.

References

- Anderson, R.L. and Terborg, J.R. (1988) 'Employee beliefs and support for work redesign', *Journal of Management*, Vol. 14, pp.493–503.
- Antoni, C. (2005) 'Management by objectives – an effective tool for teamwork?', *The International Journal of Human Resource Management*, Vol. 16, pp.174–184.
- Balthazard, P.A., Cooke, R.A. and Potter, R.E. (2006) 'Dysfunctional culture, dysfunctional organization: capturing the behavioral norms that form organizational culture and drive performance', *Journal of Managerial Psychology*, Vol. 21, pp.709–732.
- Bartel, A. and Lichtenberg, F. (1987) 'The comparative advantage of educated workers in implementing new technology', *Review of Economics and Statistics*, Vol. 1, pp.1–11.
- Birkinshaw, J. and Gibson, C.B. (2004) 'Build ambidexterity into your organization', *MIT Sloan Management Review*, Vol. 45, pp.47–55.
- Boxall, P. (1996) 'The strategic HRM debate and the resource-based view of the firm', *Human Resource Management Journal*, Vol. 6, pp.59–75.

- Bredin, K. and Söderlund, J. (2006) 'HRM and project intensification in R&D-based companies: a study of Volvo Car Corporation and AstraZeneca', *R&D Management*, Vol. 36, pp.467–485.
- Campbell, D.F.J. and Güttel, W.H. (2005) 'Knowledge production of universities and firms: the "scientification" of business R&D', *Int. J. Technology Management*, Vol. 31, pp.152–175.
- Carr, A.E. and Tang, T.L. (2005) 'Sabbaticals and employee motivation: benefits, concerns, and implications', *Journal of Education for Business*, Vol. 80, pp.160–164.
- Casey, A. (2005) 'Enhancing individual and organizational learning: a sociological model', *Management Learning*, Vol. 36, pp.131–147.
- Chen, T., Chang, P. and Yeh, C. (2006) 'The effects of career development programs on R&D personnel in Taiwan', *Asia Pacific Journal of Human Resources*, Vol. 44, pp.318–341.
- Cleveland, J.N. and Landy, F.J. (1981) 'The influence of rater and ratee age on two performance judgements', *Personnel Psychology*, Vol. 34, pp.19–29.
- Corbin, J. and Strauss, A.L. (1990) 'Grounded theory research: procedures, canons, and evaluative criteria', *Qualitative Sociology*, Vol. 13, pp.3–21.
- Cox, T. and Nkomo, S.M. (1992) 'Candidate age as a factor in promotability ratings', *Public Personnel Management*, Vol. 21, pp.197–210.
- Dalton, G.W. and Thompson, P.H. (1971) 'Accelerating obsolescence of older engineers', *Harvard Business Review*, Vol. 49, pp.47–57.
- Dedrick, E. and Dobbins, G. (1991) 'The influence of subordinate age on managerial actions: an attributional analysis', *Journal of Organizational Behavior*, Vol. 12, pp.367–378.
- DeLong, D.W. (2004) *Lost Knowledge: Confronting the Threat of an Aging Workforce*, New York: Oxford University Press.
- Dychtwald, K., Erickson, T. and Morison, R. (2006) *Workforce Crisis: How to Beat the Coming Shortage of Skills and Talent*, Boston: Harvard Business School Press.
- Eisenhardt, K. (1989) 'Building theories from case study research', *Academy of Management Review*, Vol. 14, pp.488–511.
- Eisenhardt, K. and Martin, J. (2000) 'Dynamic capabilities: what are they?', *Strategic Management Journal*, Vol. 21, pp.1105–1121.
- Elsik, W. and Güttel, W.H. (2006) 'The knowledge courier from a political perspective', Paper presented at the *Annual Meeting of the European Academy of Management (EURAM)*, Oslo, 17–20 May.
- Feldman, D. and Lankau, M. (2005) 'Executive coaching: a review and agenda for future research', *Journal of Management*, Vol. 31, pp.829–848.
- Ference, T., Stoner, J. and Warren, E. (1977) 'Managing the career plateau', *Academy of Management Review*, Vol. 2, pp.602–612.
- Foss, N.J. (2005) *Strategy, Economic Organization, and the Knowledge Economy. The Coordination of Firms and Resources*, Oxford/New York: Oxford University Press.
- Fossum, J.A., Arvey, R.D., Paradise, C.A. and Robbins, N.E. (1986) 'Modeling the skills obsolescence process: a psychological/economic integration', *Academy of Management Review*, Vol. 11, No. 2, pp.362–374.
- French, W. and Bell, C. (1973) *Organization Development: Behavioral Science Interventions for Organization Improvement*, Englewood Cliffs, NJ: Prentice-Hall.
- Gibson, C.B. and Birkinshaw, J. (2004) 'The antecedents, consequences, and mediating role of organizational ambidexterity', *Academy of Management Journal*, Vol. 47, pp.175–192.
- Glaser, B. and Strauss, A. (1967) *The Discovery of Grounded Theory. Strategies of Qualitative Research*, London: Wiedenfeld and Nicholson.
- Grant, R. (1996) 'Towards a knowledge-based theory of the firm', *Strategic Management Journal*, Vol. 17, pp.109–122.
- Gupta, A., Smith, K. and Shalley, C. (2006) 'The interplay between exploration and exploitation', *Academy of Management Journal*, Vol. 49, pp.693–708.

- Hackman, J.R. and Oldham, G. (1980) *Work Redesign*, Reading, MA: Addison-Wesley.
- He, Z. and Wong, P. (2004) 'Exploration vs. exploitation: an empirical test of the ambidexterity hypothesis', *Organization Science*, Vol. 15, pp.481–494.
- Kahnemann, D. and Tversky, A. (1979) 'Prospect theory: an analysis of decision under risk', *Econometrica*, Vol. 47, pp.263–292.
- Katz, R. (2005) 'Motivating technical professionals today', *Research Technology Management*, Vol. 48, pp.19–27.
- Katz, R., Tushman, M. and Allen, T. (1995) 'The influence of supervisory promotion and network location on subordinate careers in a dual ladder R&D setting', *Management Science*, Vol. 41, pp.848–863.
- Kim, B. and Oh, H. (2002) 'Economic compensation compositions preferred by R&D personnel of different R&D types and intrinsic values', *R&D Management*, Vol. 31, pp.47–59.
- Kohlbacher, F. (2005) 'The use of qualitative content analysis in case study research' [89 paragraphs], *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* (Online Journal), Vol. 7, No. 1, Art. 21, <http://www.qualitative-research.net/fqs-texte/1-06/06-1-21-e.htm>.
- Kohlbacher, F. (2006) 'The year 2007 problem in Japan: Dealing with lost knowledge and knowledge retention issues', Paper presented at the *5th Asia Academy of Management Conference*, Tokyo, 19–21 December.
- Kozlowski, S.W. and Farr, J.L. (1988) 'An integrative model of updating and performance', *Human Performance*, Vol. 1, pp.5–29.
- Kozlowski, S.W. and Hulst, B.M. (1987) 'An exploration of climates for technical updating and performance', *Personnel Psychology*, Vol. 40, pp.539–563.
- Leibold, M. and Voelpel, S.C. (2006) *Managing the Aging Workforce: Challenges and Solutions*, New York: John Wiley.
- Leonard-Barton, D. (1992) 'Core capabilities and core rigidities: a paradox in managing new business development', *Strategic Management Journal*, Vol. 13, pp.111–125.
- López, S., Peón, J. and Ordás, C. (2006) 'Human resource management as a determining factor in organizational learning', *Management Learning*, Vol. 37, pp.215–239.
- March, J.G. (1991) 'Exploration and exploitation in organizational learning', *Organization Science*, Vol. 2, pp.71–87.
- Mayring, P. (2000) 'Qualitative content analysis' [28 paragraphs], *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* (Online Journal), Vol. 1, No. 2, <http://www.qualitative-research.net/fqs-texte/2-00/2-00mayring-e.htm>.
- McEvoy, G. and Cascio, W. (1989) 'Cumulative evidence of the relationship between age and job performance', *Journal of Applied Psychology*, Vol. 74, pp.11–17.
- McMahan, G.C., Bell, M.P. and Virick, M. (1998) 'Strategic human resource management: employee involvement, diversity and international issues', *Human Resource Management Review*, Vol. 8, pp.193–214.
- McMeekin, A. and Coombs, R. (1999) 'Human resource management and the motivation of technical professionals', *International Journal of Innovation Management*, Vol. 3, pp.1–26.
- Morison, R., Erickson, T. and Dychtwald, K. (2006) 'Managing middlecence', *Harvard Business Review*, March, pp.78–86.
- Nonaka, I. (1994) 'A dynamic theory of organizational knowledge creation', *Organization Science*, Vol. 5, pp.14–37.
- Oldham, G. and Hackman, J.R. (1981) 'Relationships between organizational structure and employee reactions: comparing alternative frameworks', *Administrative Science Quarterly*, Vol. 26, pp.66–83.
- Opalka, D.B. and Williams, J.B. (1987) 'Employee obsolescence and retraining: an approach to human resource restructuring', *Journal of Business Strategy*, Vol. 7, pp.90–97.

- Osterloh, M. and Frey, B.S. (2000) 'Motivation, knowledge transfer, and organizational forms', *Organization Science*, Vol. 11, pp.538–550.
- Parise, S., Cross, R. and Davenport, T.H. (2006) 'Strategies for preventing a knowledge-loss crisis', *MIT Sloan Management Review*, Vol. 47, pp.31–38.
- Pazy, A. (1994) 'Cognitive schemata of professional obsolescence', *Human Relations*, Vol. 47, pp.1167–2000.
- Pazy, A. (1996) 'Concept and career-stage differentiation in obsolescence research', *Journal of Organizational Behavior*, Vol. 17, pp.59–78.
- Pazy, A. (2004) 'Updating in response to the experience of lacking knowledge', *International Review of Applied Psychology*, Vol. 53, pp.436–452.
- Perry, E.L., Kulik, C.T. and Zhou, J. (1999) 'A closer look at the effects of subordinate-supervisor age differences', *Journal of Organizational Behavior*, Vol. 20, pp.341–357.
- Ron, N., Lipshitz, R. and Popper, M. (2006) 'How organizations learn: post-flight reviews in an F-16 fighter squadron', *Organization Studies*, Vol. 27, pp.1069–1089.
- Rosen, B. and Jerdee, T.H. (1989) 'Retirement policies: evidence for the need of change', *Human Resource Management*, Vol. 28, pp.87–103.
- Shearer, R.L. and Steger, J.A. (1975) 'Manpower obsolescence: a new definition and empirical investigation of the variables', *Academy of Management Journal*, Vol. 18, pp.263–275.
- Sterns, H.L. and Miklos, S.M. (1995) 'The aging worker in a changing environment: organizational and individual issues', *Journal of Vocational Behavior*, Vol. 47, pp.248–268.
- Strack, R., Baier, J. and Fahlander, A. (2008) 'Managing demographic risk', *Harvard Business Review*, February, pp.119–128.
- Strauss, A.L. and Corbin, J. (1998) *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, London/Thousand Oaks: Sage.
- Sturman, M.C. (2003) 'Searching for the inverted U relationship between time and performance: meta-analyses of the experience/performance, tenure/performance, and age/performance relationships', *Journal of Management*, Vol. 29, pp.609–640.
- Titscher, S., Meyer, M., Wodak, R. and Vetter, E. (2000) *Methods of Text and Discourse Analysis*, translated by B. Jenner, London: Sage.
- Tushman, M. and O'Reilly, C. (1996) 'The ambidextrous organization: managing evolutionary and revolutionary change', *California Management Review*, Vol. 38, pp.8–30.
- Waldman, D. and Avolio, B. (1986) 'A meta-analysis of age differences in job performance', *Journal of Applied Psychology*, Vol. 71, pp.33–38.
- Witzel, A. (2000) 'The problem-centered interview' [27 paragraphs], *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* (Online Journal), Vol. 1, No. 1, <http://www.qualitative-research.net/fqs-texte/1-00/1-00witzel-e.htm>.
- Yin, R.K. (2003) *Case Study Research, Design and Methods*, 3rd ed., Newbury Park, Thousand Oaks: Sage, Vol. 5.