



# Factors influencing knowledge creation and innovation in an organisation

Knowledge  
creation and  
innovation

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## Abstract

**Purpose** – The purpose of this study is to gain a better understanding of the factors that influence the innovative power of organisations. The concept of innovation and innovative power was examined by analysing the relationship between the construct of the learning organisation, knowledge organisation and innovative organisation, and has resulted in an innovation process model. This model consists of three processes: knowledge creation, innovation and learning to learn. The factors that might influence this cycle are: added value for stakeholders, leadership, climate, structure and strategic alignment.

**Design/methodology/approach** – This is an exploratory study that was conducted at Océ Technologies in The Netherlands. The case study consisted of a qualitative and a quantitative stage and comprised a selection of two innovation projects separated in time. The purpose of the first phase was to collect information about the innovation spiral, through interviews with members of three divisions in each innovation process. After this, a survey was designed and sent to all employees and managers of the three divisions involved in the two innovation cases.

**Findings** – On the basis of a data analysis, factors explaining variance in terms of innovation, learning and knowledge creation were identified. If innovation is discontinuous, the innovation spiral is not valid; if innovation has a strength in critical reflection on cases from the past to mould the future, the model has some explanatory power.

**Research limitations/implications** – Using a survey technique to retrieve data from a current innovation experiment has a set of possible risks like maturation, forgetting, selection and a different context. Reflection and reconstruction, however, are the only possible means to achieve this. A case study does not guarantee generalisation of results.

**Originality/value** – By studying the model and the factors that can influence them, organisations understand that it is necessary to integrate their initiatives in organisational learning, knowledge creation and innovation for the benefit of the organisation, to find a better way to adjust to discontinuous change and finally gain innovative power.

**Keywords** Innovation, Learning organizations, Knowledge management, Critical thinking, The Netherlands

**Paper type** Research paper



## 1. Theoretical framework

Becoming the most economical competitive society in the world in 2010 is one of the targets of the European Union. This target is based on the optimistic planning ideology that within ten years knowledge and expertise can be organised in such a way that added value can be created at the macro, meso and microlevel of the Union, states and companies. Producing intelligent products, and producing them in an intelligent way

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as a reaction to mass production has focused very much on the use of information technology to become creative and smart. Knowledge creation is therefore perceived as one of the major assets of innovative organisations, and innovative organisations are defined by knowledge creation. It seems that innovation and knowledge creation are defined by themselves. Nonaka and Takeuchi (1995) in their study of knowledge creation, as well as the earlier studies of Bell (1976) and Drucker (1969), focused very strongly on the production of new knowledge in the perspective of a knowledge economy. To Lindley (2003), the knowledge society is a long-run structural change in the economy; the production, dissemination and use of knowledge will play a prominent role as a source of wealth creation and exploitation. Learning is critical to such a society in terms of accommodation, assimilation and transformation, dependent on issues, context and conditions, and to individuals, organisations and nations in terms of new skill formations (Illeris, 2002; Lindley, 2003; Nijhof, 2000) to be able to produce new knowledge. On many occasions, and also in the work of Nonaka and Takeuchi, retrieving insights from prior learning is important, together with sharing this knowledge in a company, sometimes in the form of new combinations of existing knowledge. The example of designing a new car, based on specifications related to flexibility, ease and volume, leads to the physical conception of an egg as a basis for a new car design. One could call this tacit knowledge; for some it is stolen knowledge, and for others it is prior knowledge stored in the memory and retrieved after many years of formal schooling. The important point to make here is if it is possible in work organisations to configure work-learning environments in which processes of knowledge retrieval, new knowledge combinations (Edquist, 1997) and knowledge sharing can happen. The research question that accompanies this is whether it is possible to understand, explore and explain the conditions under which knowledge creation and innovation occur. In the next section, we will try to find some building blocks for setting up a research model. These building blocks are recent theoretical approaches by innovative organisations, knowledge organisation and learning organisations.

### *1.1. Innovative organisations*

The concept of innovation has a long history and different meanings (Hoeve and Nieuwenhuis, 2003; Merx-Chermin, 2003), mainly based on competition between companies and the different strategies that can be used to compete. Since the 1950s, different strategies have been used to compete, such as efficiency approaches (e.g. lean management), quality movement (e.g. quality circles and standards), flexibility and, finally, innovativeness (Bolwijn and Kumpe, 1998). Innovation covers the whole organisation – from the first ideas right through to the introduction of a product or service onto the market. The alignment between R&D, production and market is vital (Cobbenhagen, 1999); indeed, the design and implementation of new production lines, plants, labour conditions and missions are part of the whole process of innovation to deliver added value to the stakeholders of the company through valuable knowledge. Knowledge is – in the words of Davenport and Prusak (1998) – “a fluid mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knower. In organisations, it often becomes embedded not only in documents or repositories, but also in organisational routines,

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processes, practices, and norms". The creation of explicit out of implicit knowledge is one of the key principles of organisational knowledge creation (Nonaka and Takeuchi, 1995), understood as a social and cyclical learning process. In the last four decades, many changes have taken place based on competition. Bolwijn and Kumpe (1998) describe four key concepts of innovative organisations: the efficiency approach in the 1950s, the quality approach in the 1970s, the flexibility approach in the eighties, and the innovative approach in the nineties and onwards. Nowadays, the combination of efficiency, quality, flexibility and innovation is essential. Innovation is more than technical-organisational, it also demands a social policy. Successful innovation means therefore more than research and development; R&D must be transformed into products and services that will be sold in the market and will lead to added value for stakeholders. The alignment between R&D, production and marketing is crucial and might lead to new designs of production and work processes, offices and plants. Innovation is a process in which valuable ideas are transformed into new forms of added value for the organisation, customers, employees and stakeholders. This transformation process is now a learning process for the organisation as a whole to safeguard continuity on the basis of innovation based on creativity.

Creativity is often seen as a personal asset, and in many cases it is. For organisational innovation, however, it is not enough when every employee as such wants to be creative. Creativity should be perceived as a collective process to raise the level of innovation potential of the organisation. This fine-tuning between individual and collective transformation is crucial for organisational innovation.

### *1.2. Learning organisation*

Since the 1990s, renewed interest has emerged in organisational learning, in knowledge creation and innovation, and in critical reflection (Van Woerkom, 2003). Concepts like learning organisations, knowledge-creating companies (Machlup, 1962; Nonaka and Takeuchi, 1995) and innovative organisations were heavily promoted. All these concepts and models are based on one idea: to facilitate organisations on the basis of their own learning potential to stay ahead of the competition through innovation (Senge *et al.*, 1995). In learning organisations, individual and collective learning processes can be distinguished; the quality of a learning organisation is apparent when individuals have an impact on one another. Mutual processes of interactions leading to behavioural changes – mostly in the form of scripts or collective routines, leading to innovation to learning – are the power of the learning organisation. This means that if these learning processes have the quality of metacognitive learning, or learning to learn strategies, the learning potential of the organisation can be improved. The real focus of the learning organisation is improving this potential. The cycle of learning processes based on single-loop, double-loop and deuterio or metalearning or critical reflection, are typifications of different innovation learning processes, like improving efficiency (single), innovation (double-loop), and reflection (deuterio): improving the problem-solving capacity or creative power. In this sense, the orientation of Machlup (1962), Drucker (1969) and Bell (1976) on knowledge and knowledge creation is a consequence of technological and economic innovation. The focus on knowledge creation as a process and product as an industrial tool and industrialisation of knowledge (De Wilde, 2000; Nijhof, 2004) has culminated in a discussion of types of knowledge (application, or fundamental research) and the role of knowledge societies,

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companies, R&D centres and universities. With the focus on companies here, the industrialisation of knowledge in a knowledge organisation seems to be important.

### *1.3. The knowledge organisation*

Nonaka and Takeuchi (1995) are perceived as the founding fathers of the concept of the knowledge-creating company. As we have seen, in the 1950s, Machlup (1962) and others started studies on the economic assets of knowledge industries. The phenomenon of knowledge production was evident in the 1950s and 1960s; learning to understand the process of knowledge creation in a company is an asset of Nonaka and Takeuchi and the members of the Massachusetts Institute of Technology. Nonaka and Takeuchi indicate that western concepts like the learning organisation focus on the importance of knowledge. The phenomenon of knowledge creation as such was not studied, even Senge (1990) with his focus on systems thinking as the key factor between rationality and intuition does not focus on knowledge creation as a process. The main points of critique of theories of the learning organisation summarised by Nonaka and Takeuchi are:

- knowledge creation is the basis of organisational learning; this point is missing in theories of the learning organisation;
- organisational learning is perceived as a metaphor for individual learning; the consequence is that collective learning is not seen from the right perspective;
- organisational learning is seen as an adaptive change process, based on historical experiences and focused on routines and memory of the organisation; this blocks understanding of knowledge creation; and
- double-loop learning is perceived as a separate instance of learning, and is not integrated into the continuum of knowledge creation, based on daily reconstructions of perspectives and frames.

Reflection on the role of subjective, kinaesthetic and tacit aspects of knowledge is not visible, and this is the main point of critique of the learning organisation, not so much of the concept of the learning organisation as such. This is also the motive for Nonaka and Takeuchi to think about the process of knowledge creation, leaning heavily also on the work of Polanyi(1997) on personal knowledge. Indeed, the creation of explicit knowledge out of implicit knowledge is one of the main principles of their work. Explicit knowledge has an innovative and exclusive function for organisations as a collective good; this knowledge or expertise is not easy for other organisations to copy (Hall, 1992; in Lahn, 2002). If an organisation wishes to benefit from invisible knowledge, this knowledge must be elicited, shared and codified into explicit knowledge. Universities and R&D centres do it by publications, dissertations, licences, and patents. Companies do it by socialisation processes (then it will remain tacit); by externalisation (then there will be a translation and codification problem); by (new) combinations (explicit routine combinations), and by internalisation (from external to intuitive knowledge). These processes and studies about elicitation make clear how complex these processes are in retrieving information from memory, mostly learned in an informal way (Eraut *et al.*, 2000).

In the sections above, an attempt has been made to analyse three concepts: innovative organisations with the key concept of innovation and innovation process as a learning process. This process is basically seen as a transformation process of

valuable knowledge into added value for stakeholders, thus mainly an economic perspective. The learning organisation is perceived to facilitate organisations on the basis of their own learning potential to stay ahead of the competition through innovation. The focus on learning is central, but the accent on meta-learning seems somewhat disconnected from the continuous learning process as connected to innovations.

The knowledge-creating organisation is a differentiation of the learning organisation. The focus is here on knowledge creation as a process, the missing factor in theories on learning organisations. This process is depicted in one dimension: explicit (or codified) knowledge to implicit (or tacit) knowledge, and four processes (socialisation, externalisation, internalisation and combination).

Although the three groups of organisations differ in some aspects, there are common elements: learning processes and overlap. All organisations strive for innovation, competition, profit and added value, but they differ in the type of underlying learning processes. When innovation is seen as the transformation of valuable knowledge into added value for stakeholders, knowledge generation is a necessary condition for the innovation process. If both processes are to be optimised, learning to learn or critical reflection is needed. Information created by the other two processes will be transformed into new knowledge or combinations of knowledge. The learning process of the organisation will be a necessary condition for knowledge generation, and this whole process of knowledge creation, innovation and information transformation (learning to learn) can be depicted as a cyclical and continuous process.

The conclusion is that individual and social learning at the workplace, knowledge creation and innovation build a core triangle of learning processes that can be depicted as an innovation spiral model. The learning process is, in essence, critical and reflective learning to learn. The transformation of existing information into knowledge is the key process. The knowledge creation process is oriented towards constructing new knowledge as social capital, and the innovation process is the transformation of valuable knowledge into added value (economic value) for the organisation and the stakeholder: three different but intertwined serial and cyclical processes (see Figure 1).

The basic assumption now is that these processes really exist in innovative organisations, that knowledge creation is a prerequisite for the innovation process, and that both processes will lead to reflection and learning to learn, and so on. Following this cycle of learning processes in an organisation might improve innovative power or ability, on the basis of which economic and competitive advantage could be organised. Although it might look like a completely internal process, the impact of the outside world is clear. New knowledge will be induced – directly and indirectly – from outside into the processes of knowledge creation and innovation.

The key question of this study is whether the innovation spiral does occur. And if so, under which conditions? To study such an innovation spiral, the processes will be influenced by different factors, both external and internal to the organisation. The organisation influences the environment through the output of innovations or new added value for its stakeholders. On the other hand, the external environment influences the organisation, by creating new knowledge and information out of the environment indirectly by the learning to learn process. The internal factors to the organisation may be classified into employee characteristics, such as creativity and

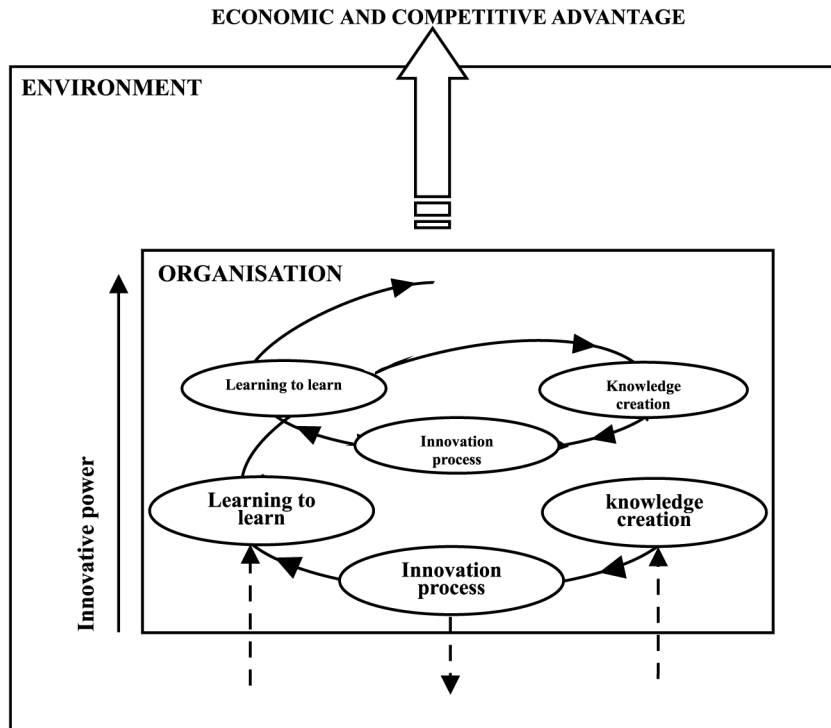


Figure 1.  
Knowledge  
creation-innovation-  
learning spiral model

motivation; leadership, and organisational characteristics like climate, structure, systems and procedures, and strategic alignment (Merx-Chermin, 2003).

In order to gain a better understanding of the factors that influence the innovative power of organisations, the following three questions form the basis of this study:

- (1) Does the innovation spiral occur in the organisation?
- (2) What factors influence the innovation spiral?
- (3) What is the validity of the innovation spiral?

## 2. Research design and methodology

To answer these questions, an exploratory case study was conducted within Océ Technologies BV, one of the top technology firms in The Netherlands, with a long tradition dating back to 1877. Océ has grown from being a local company into a world player, active in 80 countries, with about 22,000 employees, 50 per cent of whom are employed in sales, maintenance and services. Its headquarters are located in the Netherlands, where research and development, production and international marketing and strategic planning are concentrated.

In order to improve sales and profit, Océ bases its strategy on a pro-active technological and commercial strategy, with the intention of strengthening its position in the document management market. At the same time Océ aims to be a good

employer. The market for Océ is very unstable and characterised by frequent, dynamic changes, based on IT developments and demands by clients.

The company has changed its strategy from being a producer of hardware to becoming a professional service and provider of complete solutions in document management. This includes the change from stand-alone solutions to network approaches, at the same time going from being a national to a world player.

Océ can be divided into three sectors: R&D, production, and marketing and strategic planning, led by managers. The new strategies demand that managers lead employees in a professional way and organise a work setting in which employees like to work and develop, be creative and stimulate innovative power.

### 2.1 Cases

To study the questions as formulated above, the selection of two innovative cases was essential; both cases were also essential for Océ.

Case A focused on hardware (apparatus) designed in 1996, the first digital copier in the world, which turned Océ into a world player and a major competitor for other firms. After two years, however, competition became fierce: more providers of apparatus with the same functions, but lower prices. At a certain moment, the different strategies to cope with the competition no longer worked. The question was then what the best solution was for the future, how to strengthen its competitive position in the market, and how to find new niches in the market.

Case B – the successor to A – is based on the same technology, but intended for a market of document production centres and the commercial world. The added value that is perceived is related to complete solutions for the business process, based on expertise, service and software.

Cases A and B are connected, following one another in chronological succession, but are disconnected, as a result of technology and market changes. Knowledge creation, however, and innovation were crucial in both cases, as well as learning processes, to make the most of this sequence and the new market conditions.

The study consisted of both a qualitative and a quantitative stage. The purpose of the first phase was to collect information about the innovation spiral, using semi-structured interviews ( $n = 12$ ) with members of three divisions in each innovation process. The focus was on retrieving diverse processes with the innovation spiral for the specific case (A and/or B). Some employees took part in both, others in just one.

We wanted to know whether employees recognised in some form the character of the innovation spiral and the factors that played an important role in this. A total of 12 interviews were held, spread over the cases and over the divisions; these were taped, coded, analysed and evaluated.

Interviews were dispersed over cases and departments (Table I).

Working in	R&D	Production	Marketing and strategic planning
A	1	1	1
B	1	1	1
Both	2	2	2
Total	4	4	4

**Table I.**  
Number of interviewees  
in different departments

On the basis of the analysis of these data, a survey was designed and sent to all the employees and managers of the three divisions involved in the two innovation cases ( $n = 350$ ). The questionnaires were designed to collect quantitative data about the “innovation spiral” and the factors that influenced this spiral. While it was not easy to measure these factors directly, perception measures were taken. The factors and variables were derived from the literature and related to the innovation spiral model as depicted in Figure 1. The factors and variables were operationalised in questions and statements. Table II provides an overview of the factors and variables.

While the one innovation followed the other in succession and they might have had an impact on one another ( $A \rightarrow B$ ), a comparison of the two cases could also add new insights to the impact of the success story (A) on knowledge creation and innovation as a process to B.

Qualitative analysis, descriptive statistics, one-way analysis and regression analysis were conducted to analyse the results of the research questions. The reliability of the scales was analysed using Cronbach’s alpha. The reliabilities were inserted in the table based on data analysis.

Factor	Variables	Cronbach’s $\alpha$
Strategy	Participation	0.73
	Information	0.79
	Formalisation	-
	Decision making	-
Total		0.82
Structure	Degree of individual autonomy	0.76
	Definition of functions (strictness)	-
	Centralisation (horizontal/vertical)	0.69
	Layers in the organisation	-
Total		0.70
System and procedures	Focus of systems and procedures	-
	Connectivity of procedures and systems	-
Leadership	Vision	0.67
	Stimulation role and motivation	0.74
	Coaching	0.77
	Modelling	0.66
	Expertise	-
Total		0.91
Organisational climate	Focus	0.62
	Stability	0.64
	Communication and interaction	0.71
	Control and tolerance	0.68
Total		0.78
Personal characteristics	Motivation	0.72
	Creativity	0.61
	Individual learning capability	0.78
	Expertise	0.68
Total		0.88

**Table II.**  
Factors and variables  
influencing the  
innovation spiral and  
reliability

### 3. Results

#### 3.1 Selection of respondents

To be able to find employees involved in either case A or B or both, databases of all the controlling departments were searched. These figures are depicted in Table III.

Questionnaires were sent to a representative sample ( $n = 357$ ) of all employees and managers.

The response was as follows:

- 36 per cent from R&D ( $n = 102$ ), of whom 22 were managers;
- 79 per cent from production ( $n = 45$ ), of whom seven were managers; and
- 44 per cent from marketing and strategic planning ( $n = 4$ ) – no managers.

The volume of response from the production department was very high: possibly, answering the questionnaire immediately after receiving it might have helped to reach this score.

A non-response study showed that time lag, participation in other studies or not being a member of the target group were the main reasons. In some cases, employees of case A were not able to remember some items after seven years. The response was checked for age effects. The age group of 25–34 is overrepresented in the production department and underrepresented in the R&D department. In marketing and strategic planning, there is no representation of this age group at all; there is some bias to older age groups of 35 and above. For case A, this might be expected due to the time lag of seven years. One-way factor analysis of variance shows that age, years of work and education display significant differences between cases. Multiple regression analysis, however, shows no effect of these variables on knowledge dissemination within case B.

#### 3.2 Relevant factors

Strategic alignment, which is seen as a crucial variable in innovation, does not show any significant difference between A and B; while participation scores lowest, information, decision-making and formalisation do not show any significant difference. Structure was analysed in a similar way. The project matrix organisation type is the most dominant pattern used in both cases; at the same time, this type of organisation does not have a significant effect. The scores related to other elements of structure, however, reflect a difference between cases A and B. Structure was defined as a configuration of four dimensions: autonomy, centralisation, layer and strictness in jobs. The number of layers in the organisation especially shows significant differences. Case B shows a mean of 2.89, with a standard deviation of 0.90, versus 3.47 and an sd. of 0.60. This is a significant difference according to an ANOVA analysis ( $F(2,121) = 5.01, p < 0.05$ ). Organisational climate was studied for the dimensions of

Case/department	R&D	Production	Marketing and strategic planning	Total
A	335	12	4	351
B	258	37	8	303
Both	98	27	2	127
Total	691	76	14	781
Supervisors	29	12	5	46

**Table III.**  
Population in Case A,  
Case B or both

flexibility, communication, stability and orientation. Significant differences in orientation and stability could be concluded from an ANOVA analysis in favour of case A ( $F(2,1214) = 4,41, p < 0.05$ ). The thesis was, however, that case B would be more focused and unstable.

The fourth category, leadership, was studied based on the perceptions of supervisors and non-supervisors. Supervisors scored substantially higher on all variables (modelling, coaching, motivation, vision and mastery) than did employees. Between cases A and B, the scores of employees relating to leadership differed significantly in favour of case A. With the supervisors, however, this relationship was reversed, with B doing better. On the basis of ANOVA, personal mastery was significantly lower in case B.

Interaction was the last category to be studied for cases A and B related to questions of scope within and outside the project and cooperation with clients and external partners. No significant differences could be detected.

In general, the conclusion is that case B scored lower in almost every dimension than case A, which is the older case. Is there no learning to learn process from A to B?

### *3.3 The processes of knowledge creation, innovation and learning*

To study the processes of knowledge creation, dissemination of knowledge, innovation and learning, the factors from the innovation spiral (see Figure 1) were studied, based on open questions in interviews and a series of closed questions in the survey. This scale consisted of 72 items, with an alpha score of 0.92. Knowledge creation as a process is supported by knowledge sharing and learning on the job in both cases, building social capital even when this knowledge could easily be bought elsewhere, but the differences within the different sectors (R&D, production, etc.) are not significant. Knowledge dissemination shows a significant difference with case A for all sectors. R&D scores systematically higher than production, with the exception of learning on the job.

The innovation process was studied by using both open questions and the survey. The questions covered issues such as the usefulness of new knowledge, added value and, finally, the question of whether the competitive position of the company had been stimulated. No significant differences are found between cases A and B, or between the different sectors.

The learning process component of this study concerns the question of whether case A had influenced case B through reflection, new forms of testing knowledge creation and innovation, feedback on existing innovations, retrieving information (tacit knowledge) from employees, dissemination of expertise and information. Again, no significant differences could be detected between cases using ANOVA analysis. Correlations were calculated to explore the relationship between the different processes. The correlation between learning and knowledge creation in case B was 0.60 and significant ( $p < 0.05$ , two-tailed). The relation between innovation and learning was slight. But within case A, the relation between innovation and knowledge creation was about 0.59,  $p < 0.05$ .

This might indicate an innovation spiral between case A and B for those working within both cases. When asked about the contribution of A to B, these employees were quite positive in their scores; the learning process, however, in their view, was not converted into concrete actions. Reluctance to take risks might be one of the causes.

The conclusion might be that the learning process is substantially based on hardware solutions. The level of metalearning, or learning to learn has not been reached.

In fact, two separate cycles of learning processes took place: one within A and one within B.

### 3.4 Impact of organisational factors

To understand the impact of the independent variables, such as strategic alignment, structure, climate, systems and leadership, a multiple regression analysis was carried out.

From the analysis (see Table IV), we learn that strategic alignment explains 27 per cent of the variance in B of the total innovation spiral; in case A even more so (38 per cent). For the knowledge creation process, strategic alignment in B is again dominant, explaining 17 per cent, while the personnel and systems factors explain 40 per cent.

The variance in the innovation process is explained by structure, strategic alignment and climate. The conclusion was that strategic alignment plays a dominant role in the key processes and especially in the innovation spiral. Learning in terms of critical reflection and learning to learn strategies are not explained in case A, and in B mainly by organisational climate and negatively by personnel.

## 4. Conclusions and discussion

The combination of a qualitative interview stage and a quantitative survey was an effective approach to study knowledge creation, innovation and learning in a company, using two cases separated in time.

The combination has a set of possible risks when taking case A, which has a longer history, like maturation, forgetting, selection and a different context. The newer case B was pressurised by globalisation issues, a very competitive market, and the pressure to come up with added value. This may harm entrepreneurship and creativity. In any case, the learning processes, defined as learning to learn strategies, were barely visible and may have been conditioned by strategic alignment and organisational climate.

Dependent variable	Adjusted $R^2$	Independent variable	$\beta$
<i>Case A</i>			
Total innovation spiral	0.38	Strategic alignment	0.36
Knowledge creation process	0.40	Personnel	-0.49
		Systems/procedures	0.30
Innovation process	0.48	Personnel	-0.37
		Strategic alignment	-0.25
		Organisational climate	0.37
		Leadership	-0.47
<i>Case B</i>			
Total innovation spiral	0.27	Strategic alignment	0.55
Knowledge creation process	0.17	Strategic alignment	0.44
Innovation process	0.39	Structure	0.25
		Strategic alignment	0.25
		Organisational climate	0.33
Learning process	0.24	Personnel	-0.31
		Organisational climate	0.63

**Table IV.**  
Results of the multiple  
regression analysis

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This means that the role of supervisors and managers seems to be paramount in avoiding risks, technological dominance and reluctance to learn, while at the same time striving to achieve total solutions and soft skills. This seems to be a paradox.

In general, in comparison to case B, case A has a lower score on the innovation spiral model, and on a number of factors. A, however, was a real success story at the time. The participation factor, which is assumed to be crucial for innovations, was low for A, as it also was for B.

The most important factors in the creation of new knowledge seem to be knowledge sharing and reflective learning on the job, which is in line with recent studies on critical reflection (van Woerkom, 2003) and studies on workplace learning and innovation (Hoeve and Nieuwenhuis, 2003). Knowledge creation by working together with customers seldom appears, which might be a missed opportunity for innovation.

The rotation of valuable employees seems to be one of the most effective strategies for knowledge sharing and dissemination.

The learning process takes place in both cases, but no meta-level of learning has been reached. This means that no spiral takes place, just that two single learning processes occur. One of the possible reasons is that strategic alignment was relatively low in case B (explained variance 27 per cent), while in case A this went up to around 38 per cent. The expectation was that case A would have a positive effect on B, which might be seen in terms of learning. But the effect of the HRD function in both cases is negative; the learning process itself was not stimulated, maybe as a consequence of organisational climate and leadership. If it is true that innovative organisations need relationships of trust to share knowledge, commitment and organisational climate need to be attuned. Innovations often appear as a side effect of systematic strategies – serendipity – but the climate to stimulate this has to be open-minded, committed and involved. Knowledge creation and innovation are not easy to study, but an explorative study like this might help to identify essential factors to explain successful innovations. Strategic alignment seems to be one of them. More in-depth and cross-sectional studies are needed.

Building an innovation, learning and knowledge creation spiral model, and trying to test it, was new not only for the company, but even within studies on human resource development connected to innovation. It combines three concepts that have not been examined much in conjunction before. The model can help organisations to become aware of the relationship between these concepts and the factors that can influence them. This is increasingly important because of the shift from a predictable world paradigm to one governed by discontinuous change. The factors that influence the innovation, learning and knowledge creation spiral model can have an effect on the organisation's ability as regards learning to learn and its ability to gain and apply knowledge.

By studying the model and the factors that can influence them, organisations understand that it is necessary to integrate their initiatives in organisational learning, knowledge creation and innovation for the benefit of the organisation, to find a better way to adjust to discontinuous change and finally gain innovative power. Managers have to know and to learn which factors influence these processes to create an innovative environment and how to optimise learning and share tacit knowledge (Nijman, 2004).

It seems to be crucial for organisations that want to increase their “innovation power” to pay attention to the process of the “innovation spiral” in an organisation, and especially during the development of their managers.

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