

SNF-REPORT NO. 09/01

Acquisition of competences in the workplace

Human resource development in Statoil

by

Erik Døving

SNF-project No. 6050: "Doctoral scholarship – Erik Døving"
The project is funded by Statoil AS

FOUNDATION FOR RESEARCH IN ECONOMICS AND BUSINESS ADMINISTRATION
BERGEN, APRIL 2001

© Dette eksemplar er fremstilt etter avtale
med KOPINOR, Stenergate 1, 0050 Oslo.
Ytterligere eksemplarfremstilling uten avtale
og i strid med åndsverkloven er straffbart
og kan medføre erstatningsansvar.

ISBN 82-491-0129-4
ISSN 0803-4036

PREFACE TO SNF-REPORT

This is a reprint of my doctoral dissertation submitted to Norges Handelshøyskole (Norwegian School of Economics and Business Administration) June 2000 (ISBN 82-405-0046-3). A public defence of the thesis was held on October 26th, 2000. With the exception of minor misprints in the original manuscript, this report is identical to the one published prior to the defence.

Bergen, April 2001

Erik Døving

SUMMARY

This research is designed to investigate three related propositions about the acquisition of competences in work organizations. The first proposition is that learning results from exposure to information (accumulation effects). The second proposition claims that the effect of information wears off and that accumulation of information eventually ceases to have an effect on competences (diminishing effects). The final proposition claims that exposure to a specific source or type of information has different effects on different competence outcomes (differential effects).

Three firm-specific competences were identified as relevant outcomes of learning in organizations. Intraorganizational competence is the non-technical competence which regards the organization as a whole. Intraunit competence is the non-technical competence specific to one organizational unit. Firm-specific technical competence is both firm and task specific and applies to a small set of tasks within the organization. For each of the three propositions, a set of hypotheses were developed relating job history, organizational structures and communication to each of the competence outcomes.

The research reported here addresses three notable shortcomings in previous research on learning in organizations. First, the research investigates the actual competence outcomes of learning (as opposed to performance outcomes). Second, the research distinguishes among different work-related competences as well as their antecedents. Third, the research specifies the notion of experience at a conceptual rather than operational level.

Hypotheses were tested on data obtained from 981 employees in Statoil, the major Norwegian oil company. Twelve of 22 hypotheses relating to the first proposition were supported. Inadequate measurement of explanatory variables may explain why four of the hypotheses were not supported by the results. Four of five hypotheses relating to the second proposition were supported, whereas only two of ten hypotheses regarding the third proposition were supported. Intraorganizational job history and communication appear to have large, positive and diminishing effects on firm-specific competences. Further research is needed to clarify the impact of organizational structures. The research reported here further supports the claim that exposure to information should replace the notion of experience as an explanation of learning. Although the idea of differential effects obtained limited support, this research demonstrates that different competences can be distinguished empirically.

PREFACE

This is the end of a journey that started several years ago. Originally trained as a mechanical engineer, it may indeed seem strange that I ended up studying the software and not the hardware of business organizations.

The path from a broad and general idea to rigorous empirical research is long and frustrating. First of all I have to thank Torger Reve for getting me on the track and pulling me down to the ground. I have to thank Statoil, the Norwegian state oil company, for providing financial support and access to a large and rich empirical setting. Numerous persons inside Statoil were most helpful during pilot study and main study. Most important were of course my liaison officers Nickey Berg and Einar Brandsdal. Thanks to Gunnar Rune Løland, Alf Orheim and Lillemor Sjøtun at Statoil for taking care of some crucial practical details. Jan Roar Nordli and Eirik Oppen at Statoil Bergen and Johnny Mostrum at Opinion AS did the computer wizardry needed get the data collection done in a surprisingly short time. The Foundation for Research in Economics and Business Administration supported the completion of this thesis.

Thanks to Leif Magnus Jensen, Anita Tobiassen, Bente Flygansvær and Svein T. Johansen for proofreading and helpful comments, and to Marius Gran and Børge Gausdal for assistance during data collection. Thanks to Beate Elstad and Anita for support and fruitful co-operation. Thanks to Einar Breivik, Olav Kvitastein, Kristen Ringdal and Rune Lines for advice and suggestions. John Arnold at Loughborough Business School most helpfully provided a copy of his own questionnaire.

Finally, I would like to thank the dissertation committee. Arne Kalleberg for taking time to discuss details of my data collection and data analysis, Tom Colbjørnsen for suggestions and helpful advice, and my advisor, Odd Nordhaug, for guiding me through to the completion of this dissertation.

Responsibility for shortcomings, omissions and errors rests with the author.

Erik Døving
Bergen, June 2000

CONTENTS

PREFACE TO SNF-REPORT

SUMMARY

PREFACE

1. INTRODUCTION

- 1.1 PURPOSE
- 1.2 BACKGROUND
- 1.3 CONTRIBUTION
- 1.4 OVERVIEW OF THESIS

2. THEORY AND PREVIOUS RESEARCH

- 2.1 INDIVIDUAL WORK-RELATED COMPETENCES
- 2.2 LEARNING IN ORGANIZATIONS: THEORY AND RESEARCH
 - 2.2.1 *Individual learning*
 - 2.2.2 *Learning in organizations and the notion of experience*
- 2.3 PROPOSITIONS AND HYPOTHESES
 - 2.3.1 *Career-related factors*
 - 2.3.2 *Organizational structures*
 - 2.3.3 *Communication*
- 2.4 SUMMARY OF HYPOTHESES

3. RESEARCH DESIGN

- 3.1 STATOIL
- 3.2 RESEARCH DESIGN
- 3.3 DATA COLLECTION
- 3.4 SAMPLE AND SAMPLING PROCEDURE

4. MEASUREMENT

- 4.1 OPERATIONALIZATIONS: SELF-REPORT DATA
 - 4.1.1 *Outcome variables*
 - 4.1.2 *Explanatory variables*
- 4.2 QUESTIONNAIRE PRETESTING

- 4.3 QUESTIONNAIRE ORGANIZATION AND LAYOUT
- 4.4 QUESTIONNAIRE RESPONSE
- 4.5 ITEM RESPONSE
- 4.6 MEASUREMENT ASSESSMENT
- 4.7 ARCHIVAL DATA: OPERATIONALIZATION AND ASSESSMENT
- 4.8 VARIABLE CONSTRUCTION AND SUMMARY STATISTICS

5. TESTS OF HYPOTHESES

- 5.1 TESTS OF FUNCTIONAL FORM
- 5.2 TESTS OF HYPOTHESES ABOUT THE EFFECTS ON OUTCOME VARIABLES
 - 5.2.1 *Intraorganizational competence*
 - 5.2.2 *Intraunit competence*
 - 5.2.3 *Firm specific technical competence*
 - 5.2.4 *Summary and comparison*
- 5.3 TESTS OF DIFFERENTIAL EFFECTS
- 5.4 SUMMARY OF HYPOTHESIS TESTING

6. DISCUSSION AND IMPLICATIONS

- 6.1 CONCLUSIONS AND IMPLICATIONS FOR THEORY
- 6.2 LIMITATIONS
 - 6.2.1 *Explanatory mechanism*
 - 6.2.2 *Causal model*
 - 6.2.3 *Measurement*
- 6.3 IMPLICATIONS FOR PRACTICE
- 6.4 FURTHER RESEARCH

REFERENCES

APPENDICES

1. INTRODUCTION

1.1 Purpose

The purpose of this thesis is to test the proposition that exposure to work-related domains generates domain-specific competences. Empirical research on informal learning in the workplace has generally been concerned with the effect of experience (in terms of tenure or cumulative output volume). This study generalizes the notion of experience into a concept of exposure to work-related information, and differentiates this information according to the work-related domain to which the employee is exposed. In this context, information is defined as sense data. Three types of firm-related domain-specific competences are included in the study:

1. *Intraorganizational* competence is the non-technical competence in an organization and includes knowledge about organizational culture, structure, informal networks, and other parts of the organization.
2. *Intraunit competence* concerns specific structural and cultural features of a particular organizational unit, and routines and workflow interdependencies within the unit.
3. *Firm-specific technical competence* is both firm and task specific, and applies to a small set of tasks within the company.

Employees' possession of each of these competences is expected to be associated with their accumulated exposure to the corresponding domains. This study investigates three kinds of exposure. Exposure may accumulate along the employees' intraorganizational career track, exposure may be governed by organizational structures, and exposure may occur through communication.

Previous research has primarily measured learning as performance improvements, has not been concerned with what is actually learned, and has measured exposure to information by proxies such as time or output volume only. In this study, I intend to contribute to the knowledge creation in this fragmented field by measuring different competence outcomes and by relating these competence outcomes to specified domains of information.

1.2 Background

Present research on the competitive advantage of firms, regions and nations is preoccupied with the significance of competence resources. Unlike visible (or tangible) assets such as money, technology and capital goods that can be purchased in the marketplace, basic invisible assets will to some extent be developed and maintained within the company. The more specific competences are, the more they will or must be produced by the organization itself.

Individuals may similarly be pursuing experiences and competences that are competitive in both the internal and the external labor market. This is, in other words, a question of how to manage ones career. From the perspective of the company the individual employee is the basic producer, storage facility and mediator of competence assets.

Recent theoretical developments it is argued that employee competences, rather than jobs, should be viewed as the basic building blocks of organizations (Lawler, 1994; Nordhaug, 1993). Rather than selecting people who fit particular job openings with specified competence requirements, the company should recruit those possessing more broadly defined competences including the ability to learn inside the company. The company should in particular, it is argued (Pfeffer, 1998), select on the basis of competences that are difficult or costly to change. Specific knowledge and technical skills are probably more easily acquired than general competences, such as communication, problem solving and ability to learn. This implies that organizations should select employees on the basis of general competences and let employees acquire more specific competences by designing an appropriate learning environment.

Despite the accelerating interest in these issues, there is a lack of concepts and empirical knowledge linking employee learning and competences to long-term company performance. There is a voluminous body of research on organizational learning curves, but virtually no systematic knowledge about the corresponding competence generation among individual employees. Traditional answers to questions about learning in the workplace have failed to specify what is actually learned by individual employees, there is little systematic knowledge linking learning conditions within the organization to specified competence outcomes.

This study is further motivated by organizational design issues in large divisionalized organizations. In multidivisional organizations, similar activities are performed in separate and often distant units. Learning may thus occur independently at different locations and mechanisms for sharing or transferring accumulated experience-based knowledge (“best practice”) must be established before the company as a whole can profit from the learning (Chew, Bresnahan & Clark, 1990). When effective, such knowledge sharing is assumed to be one of the advantages of a large corporation. Some large (multinational) corporations acknowledge this problem and have implemented matrix-type (lateral) relations across divisional borders (cf. Jarmai, 1995).

Empirical evidence indicates that productive knowledge may reside for several years within a unit before being recognized and utilized by other organizational units (Aase, 1997; Szulanski, 1996). Similarly, research on diversification and multiunit companies have studied the *potential* for resource sharing rather than the *realized* synergies (Hansen, 1996). Limited empirical research exists to guide management and organizational design in this regard. This research consequently compares the effectiveness of such structural remedies to other vehicles of knowledge transfer, notably communication and personnel transfer across divisional borders.

1.3 Contribution

This study intends to contribute to knowledge about learning and competences among individuals in the workplace by:

1. Investigating empirically the competence outcomes of learning (as opposed to performance improvement outcomes)
2. Investigating learning effects on different types of domain-specific competences
3. Generalizing the notion of experience into a concept of learning through exposure to information
4. Developing empirical measures of different types of domain-specific competences

1. Learning outcomes and level of analysis

Previous research on learning in organizations has focused on the increase in productivity with time or cumulative output (“learning curves”; Yelle, 1979) and effects of experience on work performance (McDaniel et al., 1988). Learning curve studies in industrial settings have to a large extent measured performance improvements for larger units, such as plants, organizations (Argote, 1996), or industries (Sheshinski, 1967). Learning is defined as a change of *capacity* to perform and the distinction between learning and performance is considered to be crucial. Research on learning in organizations has largely ignored what competences are actually acquired by individuals.

This study addresses three conceptual and one methodological shortcoming of previous research on learning. First, learning may produce competences that can be applied to other than the current tasks, such that the employee’s capacity to perform may not be fully revealed through the employee’s current tasks. Second, job performance is the combined result of various aspects of performance, such as technical performance, planning and coordination between jobs. If different competence components are related to each aspect of performance, learning as measured by performance improvements does not identify within which competence component learning has taken place. Third, although performance improvement curves are robust indicators of learning, performance in a particular job is also affected by other factors than competence,

notably motivation, role constraints and routines, implying that the employee’s actual capacity to perform may not be revealed. Finally, because objective performance measures such as output per time unit or percentage of errors may not be available at the individual level or such measures may not be comparable across observations, performance improvements may not be used as an indicator of learning.

This study intends to contribute to research on learning in organizational settings by investigating the *actual* competence acquired by individuals in the workplace, rather than by investigating work performance outcomes as indicators of competence changes. Table 1.1 summarizes previous research by level of analysis and outcome variable studied (Table 1.1 is discussed in greater detail in Chapter 2). Due to the large number of studies and reviews on performance outcomes of learning, only sample references are reproduced in the left column.

Table 1.1: Learning outcome and level of analysis

	<i>Learning outcome studied</i>	
<i>Level of analysis</i>	Performance (productivity)	Competence
Individual employee	Individual learning curves (Thurstone, 1919; Yelle, 1979); job experience effect on job performance (McDaniel et al., 1988); effects of experience and training on different types of performance (Motowidlo & Scotter, 1994); experience, performance and earnings (Medoff & Abraham, 1980)	Tenure and job rotation effect on different types of competence (Campion et al., 1994); technical and non-technical competences (Arnold & Davey, 1992); job experience effect on job knowledge (Schmidt, Hunter & Outerbridge, 1986; Morrison & Brantner, 1992); experience effect on knowledge in specific professional field (Tubbs, 1992)
Organization	Organizational learning curves (Yelle, 1979); progress functions (Dutton, Thomas & Butler, 1984)	Resource based theory of the firm (Kogut & Zander, 1993; Prahalad & Hamel, 1990; Markides & Williamson, 1996); organizational aggregates of individual training (Nordhaug, 1991)

2. Different types of competence outcomes

Although learning has been defined as a change of capacity to perform, previous research has been concerned with learning measured in terms of actual, *overall*

performance. Job performance is the combined result of various aspects or domains of performance, for example technical performance, planning and coordination. Learning may occur independently in different domains. Previous research on performance improvements has generally failed to investigate what is actually learned in different domains. The small amount of previous research on different competence outcomes is fragmented, has relied on ad hoc conceptualizations and has not been guided by a general theoretical framework.

In this study, I accordingly decompose learning outcomes into domain-specific competences (Nordhaug, 1993) and investigate the degree to which different competences are differently affected by different learning conditions. In particular, I draw a distinction between technical and non-technical firm-specific competences.

3. Learning and the notion of experience

Despite indisputable empirical success, learning curve studies have proceeded without a clear theoretical understanding of the concept of experience (as measured by time or volume). At the organizational level, little empirical knowledge about the intervening mechanisms exists. At the individual level, little is known about the *content of experience* measured in terms of time or volume. I consider time and volume merely as proxies of the amount of work-related information the individual has been exposed to. Experience is frequently used in a common-sense fashion incorporating the *conditions or events* giving rise to learning as well as *that which is learned*. This notion of experience does not distinguish properly between the causes and the consequences of learning. Due to the conceptual imprecision and connotations of “experience”, I will avoid this term.

Accordingly, I generalize the notion of experience into a concept of learning through exposure to information. This study is based on the notion that learning is a function of exposure to work-related information. Information is in turn defined as concrete sense data or perceptions.

4. Measurement

The distinction between multiple dimensions of work performance has recently generated a number of empirical studies (e.g., Motowidlo & Scotter, 1994). However, only a small number of attempts to operationalize and measure multiple types or dimensions of work-related learning outcomes have been published (Campion et al., 1994; Arnold & Davey, 1992). These efforts have however not been guided by a conceptual framework. In this study, I develop and apply self-report measures of multiple competences as defined by Nordhaug (1993), notably technical and non-technical firm-specific competences.

1.4 Overview of thesis

This thesis is organized as follows. Chapter 2 contains a review of relevant literature and discusses and defines the outcome variables studied. The second part of the chapter specifies exposure in terms of three sets of variables and discusses their expected impact on competence outcomes. The final part of the chapter then summarizes these discussions in a set of specific hypotheses.

In chapter 3, the research designed to test these hypotheses is described. This includes the empirical setting, data collection method and sampling of respondents.

Measurement of variables and descriptive results are presented in chapter 4.

Chapter 5 reports results of hypothesis testing. This includes tests of linearity, tests of effects and tests of differential effects. Results are discussed in chapter 6, and conclusions and implications are outlined.

5. TESTS OF HYPOTHESES

5.2.4 SUMMARY AND COMPARISON

In the preceding paragraphs, I presented and discussed separate regression analysis results for three outcome variables. Each analysis included the same set of independent variables. Table 5.8 presents a comparison of results for all outcome variables (only unstandardized coefficients and significance probabilities are shown). We note that the multiple correlation coefficient is much larger for intraorganizational and intraunit competence than for firm specific technical competence.

TABLE 5.8: Multiple regression results, comparison of all outcomes

	Intraorg. competence	Intra-unit competence	Firm specific tech. comp.
	b	b	b
Cross-unit transfer ^a	0.28 ***	0.18 *	0.09
Job transitions (linear)	0.04 **	0.05 **	0.03 *
Job transitions ^a	-0.23 *	-0.15	-0.20 *
Org. tenure (linear)	0.00	-0.02 *	-0.01
Org. tenure ^a	1.13 ***	0.76 *	0.93 **
Unit tenure ^a	-0.08	0.52 ***	0.08
Teamwork ^c	0.06	0.01	0.03
Cross-unit task forces ^b	0.02	-0.01	0.05 *
Lateral relations ^c	-0.01	0.07 *	0.02
Intra-functional cooperation	0.00	0.02	0.01
Cross-functional cooperation	-0.01	0.04 *	0.01
Cross-unit communication	0.12 ***	0.04 *	0.08 ***
Intra-unit communication	0.12 ***	0.22 ***	0.05
Business degree ^c	0.14 *	0.06	-0.02
Manager ^c	0.14 **	0.15 **	-0.02
Work content ^c	-0.09 *	-0.09 *	0.02
(Constant)	2.76 ***	3.00 ***	3.07 ***
R ²	0.26	0.24	0.06
F	16.0***	14.2***	3.95***

^aHyperbolic transformation *** $p < 0.001$

^bSquare root transformation ** $p < 0.01$

^cIndicator variable * $p < 0.05$

N = 680

Campion et al. (1994) found that job rotation affected administrative competence but not technical competence, whereas promotions did not have any effect on either. Effects

of job history obtained in this study appears to be consistent with Campion and associates' findings and with Morrison and Brantner's (1992) findings that the number of previous jobs did not have any effect on learning in the current job. Campion and associates did not, however, find any effects of tenure, which is inconsistent with previous research (Morrison & Brantner, 1992; Schmidt et al., 1986) as well as with the present results.

These results largely support hypotheses about the effects of communication. Although findings are not perfectly comparable, the present findings are essentially consistent with previous research on organizational learning (Darr et al., 1995) and diffusion of innovations (Rogers, 1983).

In Chapter 4 I noted that it is not possible to calculate the exact number of job transitions within the *current* unit. Although a most unfortunate error, it does not appear to affect the results presented above: About 330 respondents never transferred. Separate regression analyses within this subsample produced virtually the same results as the analyses based on the full sample, with a few interesting exceptions: For those that never changed unit, intraunit communication does not seem to affect intraorganizational competence; the number of jobs is *negatively* related to firm specific technical competence; and job type/content is not related to intraunit competence. These differences may be due both to possible biases introduced in the measurement procedure as well as true differences in learning environments between these categories of employees. Future research should address both issues.

Contrary to conventional wisdom, I found minimal support for hypotheses about structural factors when controlling for actual communication. Results do, however, suggest that structures, by facilitating interpersonal relations and triggering communication, have important indirect effects on competences.