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Learning firm specific knowledge and skills: Conceptual issues and empirical results

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ABSTRACT

The paper discusses the significance of firm specific knowledge and skills resources among employees, discusses strategies for measurement, and reports the results of an empirical study of learning and competence acquisition.

First, the concept of firm specific competences as originally developed within neo-classical human capital theory is discussed. It is argued that the conceptualisation within this theoretical direction has crucial limitations, because of its emphasis on technically related firm specificity. In order to more comprehensively grasp the relationship between employees and companies it is necessary to supplement the technically linked specificity with organizationally related specificity. This paper accordingly distinguishes between intraorganisational competence and firm-specific technical competence. Intraorganisational competences are the non-task-specific competences related to one particular organization and include knowledge about colleagues, culture, structure, procedures, networks and activities in different parts of the organizations. Firm specific technical competences are task-specific competences related to one particular organization and include skills needed to complete specific tasks in the firm, competences needed to operate or maintain tailor-made equipment, knowledge about firm-specific work-practices and competences related to manufacturing unique products.

Second, the paper discusses the challenges of operationalizing and measuring firm specific competences among employees. Until recently the two types of firm-specific competences have not been operationalized for the purpose of self-report survey data collection. A new multi-item, self-report measure was constructed for the purpose of the empirical study reported her. For each item, the employee is asked to assess his or her degree of knowledge or skill with regard to specific subject matters within the task-specific and the non-task-specific domain respectively.

Third, these measures were applied in a study of learning and competence acquisition among 980 managers and professionals in an oil company. The study was designed to investigate the effects of internal job mobility, organizational structure and communication pattern on the acquisition of each of the two firm specific competences. Regression analysis results indicate that cross-unit transfers and extent of communication have large, positive and diminishing effects on intraorganisational competence. The results further indicate that participation in cross-unit task forces and extent of cross-unit communication have positive and diminishing effects on firm specific technical competence. This research demonstrates that different components of firm specific competence can be distinguished empirically and that the two competence types have different antecedents (differential effects). The conceptualisation and operationalization should thus be fruitful for future research.

CONTENTS

1. INTRODUCTION

The purpose of this paper is to discuss vital aspects of competences among employees in firms, with emphasis on knowledge and skills resources that are specific to the single firm. First, we shall present a conceptual discussion that reaches back to the classical formulations of the notion of firm specificity within human capital theory. Limitations of the original approach are uncovered. It is argued that combining the concept of firm specificity with the notion of task specificity provides a fruitful analytical approach to the analysis of competences in organizations. Next, alternative ways to operationalize firm specific competences are treated and problems related to the measurement of such competences are discussed. Finally, the paper reports the results of an empirical study of learning and competence acquisition. The study was designed to investigate the effects of internal job mobility, organizational structure and communication pattern on the acquisition of each of the two firm specific competences.

2. THEORY

2.1 Firm specificity

The concept of human resource idiosyncrasy or specificity was developed by economists focusing on the relationship between employees and employers. The distinction between general and firm specific knowledge and skills is a cornerstone in human capital theory as originally formulated in the 1950s and 1960s (Becker, 1983; Schultz, 1981). Later this distinction has been extensively applied in theories on internal labour markets and transaction cost theory (e.g., Milgrom & Roberts, 1992; Williamson, 1975, 1985).

The notion of firm specificity is useful concerning the question of financing human- resource development in companies. It also constitutes an important element in the description of external and internal labour markets. However, the classical distinction between firm specific and general or firm-non-specific knowledge and skills is generally too crude to grasp the complexity of competences in firms (Nordhaug, 1994; Nordhaug & Grønhaug, 1994). An important point in this context is the fact that firm specificity has primarily been linked to the operation of physical production equipment that is unique to the single firm in question. The focus has accordingly been on technology-related firm specificity, the logic being that the presence of unique technology in firms requires tailored, firm specific skills to be developed among employees (cf. Flynn, 1988, 1991).

Consequently, what has largely been overlooked in the literature employing the concept of firm specific knowledge, skills, or competences, is that such human resources do not necessarily have to be linked to the execution of concrete work tasks associated with the technology unique to the firm. There also exists an important class of firm specific competences that are not connected to single tasks, but that are broadly applicable across a number of different tasks. Stated differently, all firm specific competences are not related to the production technology or equipment of the firm. There is an even more important class of such competences that are related to organizational aspects, such as political processes, organizational culture, and interpersonal networks that are by nature firm specific. There is accordingly a need to supplement the notion of technology-related firm specific competences with the concept of organization-related firm specific competences.

2.2 Task specificity

There has traditionally been a strong focus on generating task-specific competences in order to create maximum fit between competences and work tasks. Demands for flexibility and readiness for change implies that more attention needs to be devoted to task-non-specific competences and their significance for commitment, efficiency, competitiveness, and career mobility. Task-non-specific competences shift the focus from static fit to tasks to dynamic adjustment to changing conditions. Consequently, attention should be paid to the broad and important class of firm specific competences that are not connected to the execution of single, idiosyncratic tasks, but which can be activated in solving a large number of different tasks. Many types of competences are *not* tied to the technology of the firm but to such organizational aspects as political processes, organizational culture, and interpersonal networks that are, by nature, firm specific. Consequently, one needs to complement the notion of technology-related firm specific competences with the concept of organization-related firm specific competences, that is, firm specific competences that are task-non-specific.

This aspect of firm-specific competence has, to some degree, been incorporated into parts of the resource-based theory of the firm (e.g., Barney, 1991; Mahoney & Pandian, 1992; Grønhaug & Nordhaug, 1994; Hamel & Heene, 1994; Colf, 1997), with some authors providing examples of competence classifications spanning several analytical levels (Hamel & Heene, 1994; Sparrow, 1994). However, within most of these formulations competence resources have not been specified at the employee level. The significance of individual competences and the contribution of employee competences to core and organizational competences is a missing link in the macro-oriented approaches. This calls for an elaborate conceptual framework of individual competences. Human-capital theory is a fruitful point of departure for the elaboration of more comprehensive taxonomies and classifications of knowledge and skills resources.

Task specificity has been defined as the degree to which competences are linked to the execution of a narrow range of work tasks (Nordhaug, 1994). Low task specificity is characteristic of competences which are not tied to one particular task, but which are simultaneously relevant to a wide range of different tasks. Analytical skills, competence in cooperating with others, problem-solving capacity, communication skills, and the ability to delegate work are examples of task-non-specific competences. However, when task-specificity is high, competences are tied to one single work task or very few tasks, and they are irrelevant for the execution of other tasks. For example, typing on the basis of the "touch-

method" can only be applied to the task of operating a standard keyboard. In contrast, cooperative competence may be utilized to accomplish or facilitate the execution of a wide spectrum of tasks. In the first case, the competence is highly task-specific, while in the latter task specificity is low.

Recently, typologies of work-related *behaviour* and *performance* have emerged, notably the distinction between task performance and contextual performance (Motowidlo & Scotter, 1994; Murphy & Shiarella, 1997), technical and extra-technical proficiency (Borman et al., 1997), and in-role versus extra-role behaviour (Dyne & LePine, 1998). Campbell et al. (1990) distinguished between job-specific and organization-wide performance measures. Arvey and Murphy (1998) concluded that the most exciting area of research in this field is the development and elaboration of the notion of contextual performance. Motowidlo et al. (1997) acknowledge that task and contextual performance are affected by different competences but do not suggest a framework for analysis beyond the task related – contextual distinction. Accordingly, an appropriate conceptualisation of the competence determinants of such performance is also needed.

If a competence can be used in one firm only, it is firm specific and, by definition, has no potential value for other employers. All competences that are not firm specific are general or non-specific and can be sold in external labour markets. Moreover, it is generally assumed that high proportions of firm specific competences in a company's labour force lead to long-term contractual arrangements between employees and employers, since an enduring relationship is then normally in the interest of both parties (Mitchell & Zaidi, 1990).

2.3 Competence classifications

In order to give an overview of the classifications that result from our preceding discussion, in Figure 1 the dimensions of firm specificity and task specificity have been combined. The four cells represent different variants of competence idiosyncrasy and thus dissimilar types of competences (cf. Nordhaug, 1994).

		Firm specificity	
		Low	High
Task specificity	Low	Meta-competence	Intraorganisational competence
	High	Standard technical competence	Firm specific technical competence

Figure 1. Competence classification

The first competence type is firm non-specific and can be utilized in the accomplishment of a variety of different tasks. It has been labelled meta-competence and encompasses a broad spectrum of knowledge, skills and aptitudes. Examples are literacy, learning capacity, analytical capabilities, creativity, knowledge of foreign languages and cultures, ability to perceive and process environmental signals and events, capacity to tolerate and master uncertainty, ability to communicate and to cooperate with others, general negotiation skills, and ability to adjust to change (see also Campbell, 1994).

Competences that exhibit low task specificity and high firm specificity constitute a kind of ”internal meta-competence” within an organization, and are called intraorganisational competence. Illustrations include knowledge about colleagues, elements in the organizational culture (e.g., symbols, subcultures, history, norms, mastery of organizational dialect or code, and local ethical standards), communication channels and informal networks within the firm, political dynamics within the organization, and the firm's strategy and goals. Yet another illustration is familiarity with different subunits and their working conditions, which is clearly reflected in the aims of trainee programs and job rotation across subunits: ”The HRM program in Philips is thus designed to develop managers with a broad overview of the company so that they can adapt their generalized knowledge to fluid situations. Cumulative knowledge of all aspects of a product division, from development to marketing, can be acquired through assignments to different areas of activity and levels of responsibility” (van Houten, 1990: 108). The development of managerial generalists possessing a substantial amount of intraorganisational competences is particularly well known from many Japanese companies that have extensive job rotation arrangements.

High task-specificity and low firm specificity are characteristic of the standard technical competences that embrace a wide range of operatively oriented knowledge and skills. Examples are typing and stenography skills, knowledge of generic budgeting and accounting principles and

methods, skills in computer programming, knowledge of standard computer software, and craft skills and professional task-oriented skills that can be applied across industries.

The last category, firm specific or idiosyncratic technical competences, are highly firm specific and task specific. They can be applied to solve one or very few tasks within one firm only, and they include knowledge and skills related to operation of unique technology and routines. Examples are skills related to the use of specialized tools crafted in the firm, knowledge about rationalization devices developed exclusively within the company, skills in repairing tailored technology and in operating specialized local filing or data systems as well as skills related to the administration and maintenance of organizationally idiosyncratic routines or procedures in general.

2.4 Firm specific competences

Above, we discussed two important and dissimilar classes of firm specific competence that need to be separated if more subtle and refined analyses of firm idiosyncratic knowledge and skills resources are to be conducted. In the following, we shall look more thoroughly at these two categories.

Technical firm specific competence may generate the strongest possible lock-in of employees in regard to both employers and jobs, because the value of this type of knowledge and skills is confined not just to one and only one employer but also to a narrow range of work tasks. The main significance of these competences lies more in their contributions to generating congruence between personnel and tasks than in their contribution to facilitating change within the organization. Idiosyncratic technical competences can only be generated within the one firm and are developed through informal learning, job rotation, in-house training, apprenticeship arrangements and trainee programs.

As with meta-competences, the importance of intraorganisational competences has been discussed in the management and leadership literature but also within politically oriented organization theory concerned with power relations (e.g., Kotter, 1978; Pfeffer, 1992; Cobb, 1986). The focus has been on internal networking capabilities, knowledge of and capacity to manage firm specific symbols, and familiarity with the culture of different parts of the organization, as epitomized by such metaphors as “the manager as a political detective” (Yates, 1985: ch.3). In addition, the significance of knowing persons and coalitions and, not least, their respective idiosyncrasies and behaviours, is emphasized.

Intraorganisational competences are inextricably linked to the organizational culture of the firm, and vice-versa. Although it is common to think of corporate culture as a structural phenomenon, it is partly made up of the organizational interpretations shared by the employees. However, it clearly transcends the level of individuals, as is demonstrated by the fact that knowledge and interpretation systems continue to exist even after key employees have been replaced (Weick & Gilfillan, 1971; Walsh & Ungson, 1991: 61).

Carnevale (1991:159) made the point that certain meta-competences may be useless if they are not combined with relevant intraorganisational competences. He particularly referred to the need to blend general leadership skills with knowledge about specific organizational conditions, especially understanding of implicit and explicit power structures: to be effective inside the organization, the employee needs to understand both. Without this understanding, leadership skills are misplaced, and they can even be counterproductive if they become barriers to strategic organizational goals or positive change processes.

Intraorganisational competences are acquired chiefly by everyday learning in the workplace through interaction with and observation of colleagues and teams. However, when firms take steps to shape the formation of intraorganisational knowledge and skills by implementing job rotation, trainee and mentoring programs, on-the-job coaching, internal executive-development programs, and campaigns aimed at disseminating core values and information about the organization's goals, this is often explicitly intended to expand the amount of intraorganisational competence in their labour force. Probably the most characteristic example of formal training geared towards generating intraorganisational competence can be found in introductory courses and programs for recently recruited employees who are expected to become familiar with and start internalising organizational norms and values as well as to obtain knowledge about symbols and artefacts of the firm.

2.5 Explanatory variables

An individual’s competence in a specific domain is assumed to be a function of accumulated experience in that domain. Firm specific competences should thus be a result of intraorganisational experience. We included three types of measures of individual intraorganisational experience.

First we included the number and characteristics of job changes as career-related measure of experience. In order to capture extent of experience corporate and unit environments, we

distinguish between two types of job changes: Change of job within the unit (*job transitions*), and change of job that involves a transfer between units (*cross-unit transfer*). The two types of job changes are expected to contribute differently to different competences.

Second the type and extent of experiences the individual is exposed can partly be governed by organizational structure and we included aspects of formal design that differs from hierarchy. Vertical relations connect superiors and subordinates in a chain-of-command structure. Horizontal (or lateral) structures connect employees and units in other ways than through a common manager. Whereas vertical relations are multi-purpose channels, horizontal relations are often shortcuts designed for specific purposes. The kind and extent of horizontal relations varies across employees, these are the overlaid structures not generally shown on the organizational chart. This study includes two types of formal cross-unit horizontal relations: Formal lateral professional networks (connecting employees within the same profession) and temporary cross-unit task forces (set up to solve a specific problem). In addition it includes regular cooperation within the department: One measure of cross-functional cooperation and one measure of intra-functional cooperation.

Finally, we incorporated indicators of information flows, that is measures of actual (formal or informal) communication within and across unit boundaries. All variables are expected to contribute positively to learning.

3. METHOD

3.1 Operationalization of firm specific competences

Empirical research on the firm-specificity of competences in organizations has typically been concerned with the degree or amount of investments in firm-specific competences among employees and related this to organizational and contractual properties. Typical measures of firm-specific training at the job-level are the number of hours received by a typical job incumbent after having been hired (Davis-Blake & Uzzi, 1993), the degree to which the employer has provided on-the-job training (Cohen & Pfeffer, 1986), average in-house training and experience required for various jobs (Baron, et al., 1986), and the number weeks and months of training (excluding education) which is deemed to be required for being able to perform a particular job (Kalleberg & Reve, 1993).

Although adequate measures of the learning required or training provided by the employer, these measures suffer from several shortcomings. First, they do not distinguish between the two different types of firm-specific competence emphasized in this paper, that is, intra-organizational and firm-specific technical competence. Second, these measures all reside on the job-level or the organizational level, not at the level of the individual employee. The measures referred to are better equipped to capture a firm's general or job-related training policy, and the assumed competence requirements of particular jobs than to map the development of firm-specific knowledge and skills.

Moreover, it must be noted that until very recently the two types of firm-specific competences included in Nordhaug's typology (1994) have not been operationalized for the purpose of self-report survey data collection. Motowidlo and associates (1997) distinguished between task and contextual competences that govern task and contextual performance, but did not suggest a framework for measurement. A small number of measures of, for example, job learning (e.g., Morrison & Brantner, 1992), task proficiency/mastery (e.g., Lance et al., 1989; Morrison, 1993), job knowledge and performance (McDaniel et al., 1988; Rowe, 1988), technical competence (Kirchner, 1965), and knowledge about specific features of the organization (e.g., Williams & Levy, 1992) have been elaborated. Objective measures of competence have, for example, been used within highly specific professional fields (Tubbs, 1992), and in experimental research on consumer decision-making (Coupey & Narayanan, 1996). Yet, these cover only quite specialized competence aspects.

Only a small number of empirical investigations have been reported in which variables similar to those in the previously discussed typology are measured. Campion, Cheraskin and Stevens (1994) developed a broad list of competence needs within the finance function of a company and, based on factor analysis, grouped these into three competence types: administrative, technical and business. Administrative competences cover a range of general competences, technical competences are related to accounting and finance (i.e., standard technical competences) whereas business competences roughly correspond to intra-organizational and general knowledge about the industry or sector that the company operates within.

Sonntag and Schäfer-Rauser (1993) distinguished between methodical competence (creativity, ability to learn, problem solving), social competence (communication, cooperation), and technical competence (task-related skills and knowledge). The former two are examples of meta-competences, whereas the latter corresponds to various types of task specific competences. Knowledge items included for example; “I know very well how technical equipment needed in my field of practice works” and “I know the best way of doing most of the work that I am assigned to.”

Arnold and Davey (1992) operationalized company know-how, interpersonal skills, product knowledge, specialist competence and skills in achieving results; these constructs clearly resemble those in the present typology. Some of Arnold and Davey’s constructs (as operationalized) do overlap those of Nordhaug’s (1994) typology. Product knowledge, for example, includes both knowledge about the company's products (intra-organizational competence) and knowledge about products of competitor companies.

Kozlowski and Farr (1988) collected data on competence and competence maintenance (updating) among engineers. Based on factor analysis results they distinguished among competence maintenance activities, general technical competence and general administrative skills. General technical competence included possession of fundamental engineering knowledge, ability to understand causes of a problem, ability to create several feasible solutions to a problem, and ability to evaluate alternative solutions. General administrative skills included ability to communicate, ability to seek others for help and advice, ability to plan and organize, ability to implement solution in a specific situation, and response to change. Kozlowski and Farr did not however separate firm specific from firm non-specific components.

3.2 Suggested measures

In the following, we suggest two strategies for operationalising the employee's actual level of firm specific competences.

First, global measures of employee intra-organizational and firm-specific technical competences could be elaborated. This strategy produces mainly two types of measures: (a) A measure of the amount of experience required to reach this particular employee's level of competence or (b) a measure of the employee's self-assessed level of competence.

> (a) Intra-organizational competence, for instance, could be measured with questions like "Imagine a person having about the same education as you and your experience, but from a different company in the same industry. How much time would this person need to gain your level of knowledge about your organization?" Such a measure will easily be contaminated both by the requirements of the job and by the person's speed of learning. Such an operationalization could possibly produce data at a high level of reliability, whereas the concept validity could be seriously questioned.
>
> (b) In a self-report questionnaire, the employee's self-assessed level of firm-specific competences could also be measured. Careful wording would, however, be required to distinguish between intra-organizational and firm-specific technical competences. This strategy would in particular require that the conceptual framework presented in this paper is communicated to the respondents. A large proportion of respondents could be confused or exhausted by cumbersome delimitations of competence domains. In addition to a loss of reliability, concept validity would be at risk.

Second, a multi-item measure could be constructed by sampling objects specific to competence domains. The employee would then be asked to assess his or her degree of competence related to these objects. Intra-organizational knowledge, for example, could be measured with items such as "I am well informed about the activities of other units in this organization" and "Compared to my fellow workers, I have extensive knowledge about organizational structure."

By asking clear and short questions about relatively specific issues the likelihood of misinterpretation is reduced. The relation between individual items and theoretical variables can be evaluated fairly easily in order to establish concept validity. Each respondent's self-rated competence with regard to a sample of objects within the intra-organizational and firm-

specific competence domain respectively, should then be summarized into an index of competence with regard to each of these domains as a whole. It is virtually impossible to construct an exhaustive list of objects within a domain, nor is it possible to obtain a representative sample of objects. We do however believe that it is possible - guided by theory, pilot studies and sound judgement - to suggest a representative sample of important issues within each of these competence domains. In addition, random measurement errors in individual item ratings will to some extent even out across multiple items. This strategy should accordingly provide acceptable reliability and validity.

In the present study of acquisition of work-related competences in the Norwegian oil company, we chose the latter strategy. We used a small number of relevant questionnaire items from the above studies (Arnold & Davey, 1992; Campion et al., 1994; Kozlowski & Farr, 1988; Sonntag & Schäfer-Rauser, 1993) as a pattern and constructed items from a list of domain-specific objects (see Figures 2 and 3). Competence items with regard to domain-specific objects together constitute the respondent's total competence in that domain.

Wording of Items
• I'm well informed about the activities of other units in the company
• Compared to most of my colleagues, I have a good grasp of the company's organizational structure.
• I have a good command of the routines in the company.
• Compared to most of my colleagues, I know how to influence important decisions in the company.
• I have extensive knowledge of the company's strategy, objectives
• and history.
• I know who to ask for help within the company to solve problems that might occur.

Ratings: 1 (strongly disagree) to 5 (strongly agree)

Figure 2. Intraorganisational Competence

Wording of Items
• Compared to my colleagues, I know very well how similar tasks are performed in other units in the company
• I have somewhat inadequate knowledge of circumstances specific to the company
• I have somewhat inadequate knowledge of how to use company-specific equipment.
• I have good command of working methods within my field in the company.
• I am well aware of current developments within my field of work within the company.
• Compared to most of my colleagues, I have extensive knowledge of the company's main challenges within my field of work.
• Compared to my colleagues, my knowledge of the company's experiences within my field is good.
• I have extensive knowledge of the company's standards within my professional field.

Ratings: 1 (strongly disagree) to 5 (strongly agree)

Figure 3. Firm Specific Technical Competence

3.3 Independent variables

Two types of career-related factors were measured: duration of employment in the company and the current unit, and the total number of job changes within the company (see also Louis, 1980; Pinder & Walter, 1984). Employees reported the number of different within-company jobs held, and the number of transfers between organisational units. These variables are factual and are measured with one question each.

The second set of factors concerns the employee's formal relations within the unit and across units. We measured *intra-unit* relations in terms of the individual's extent of intra-unit cooperation. Each respondent reported the number of hours a day that she or he worked together with others (Roberts & O'Reilly, 1974). Number of hours a day was separated into two questionnaire items, one regarding the number of hours spent working together with co-workers with tasks different from the employee's own and the other regarding time spent with co-workers having similar tasks. We measured two types of *cross-unit* relations. Respondents reported their affiliation with a formal lateral network of professionals. Each network is dedicated to one functional specialty or professional field. In addition, respondents reported the number of cross-unit task forces they had been involved in during the past two years. This was intended to measure cross-functional and cross-unit experience through formal structures (Ghoshal et al., 1994).

This set of factors concerns the extent of employee's communication activities *within the unit* (intra-unit) and *across unit borders* (cross-unit). Extent of communication is most easily

measured as the *frequency* of a particular communication behaviour. We selected and adapted six different communication issues from Van de Ven and Ferry (1980; see also Ghoshal et al., 1994, Roberts & O'Reilly, 1974): professional exchanges, discussions related to specific tasks, requests for help or advice, receipt of reports and memos, getting help or advice from co-workers, and participation in meetings with more than two people. Intra-unit and cross-unit communication were measured using items identical except for the words "same unit"/"other unit" and the time range.

3.4 Data collection

In order to test the operationalisations and hypotheses outlined above, we designed a cross-sectional study. We collected data by means of a self-report questionnaire distributed to a sample of managers and professionals in a large Norwegian oil company. This oil company is a vertically integrated petroleum company, incorporating exploration, production, transportation, processing and retailing as well as research and technology development related to these activities. It is a dominant retailer of petrol and other oil products in Scandinavia and a substantial supplier of natural gas to continental Europe. It has about 18,000 employees and revenues of more than 10 billion dollar. The outcome variables in this study, competences, were collected through self-reports only. Respondents were asked to provide information about communication, organizational affiliation, tenure, type of job, content of job, age, gender and education on a separate sheet in the questionnaire. The questionnaire was distributed to a stratified random sample of 2900 managers and professionals; 980 (34%) of these returned complete questionnaires.

4. RESULTS

Factor analyses of competence measures revealed that item #2 and item #3 for firm specific technical competence do not correspond well with remaining items. These items were accordingly not included in the overall measure of firm specific technical competence. We used regression analysis to investigate the impact of communication, organizational structure and intraorganisational career on each of the types of firm specific competences. Organizational tenure, type of education (business degree), type of job (manager) and content of job (engineering) were included as control variables. Participation in cross-unit task forces, organizational tenure and job history were transformed in order to account for non-linear effects. Hyperbolic transformations yield a negative coefficient when the relationship is positive. Regression results are displayed in table 1.

Table 1. Regression analyses with regard to firm specific competences

	Intraorg. competence		Firm specific tech. comp.	
	b	t	b	t
Intercept	2,85	19,44	3,06	17,48
Cross-unit transfer[a]	-0,33	-5,06***	-0,13	-1,59
Job transitions (linear)	0,03	1,80*	0,01	0,74
Job transitions[a]	0,23	2,20*	0,19	1,54
Cross-unit task forces[b]	0,03	1,44	0,06	2,48**
Lateral relations[c]	0,05	1,10	0,08	1,58
Intra-functional cooperation	0,00	0,23	0,00	0,11
Cross-functional cooperation	-0,01	-0,77	0,01	0,35
Cross-unit communication	0,11	5,43***	0,11	4,30***
Intra-unit communication	0,11	3,87***	0,05	1,37
Org. tenure[a]	-0,99	-4,66***	-0,60	-2,34**
Business degree[c]	0,12	1,83*	0,00	-0,04
Manager[c]	0,15	3,17***	0,01	0,11
Job content[c]	-0,10	-2,48**	-0,03	-0,64
R^2	0,27		0,09	
F		21,02***		6,10***

[a]Hyperbolic transformation
[b]Square root transformation
[c]Indicator variable

*** p < 0.001
** p < 0.01
* p < 0.05

N = 774

These results indicate that cross-unit transfers, job transitions and communication frequency contribute to the learning of intraorganisational competence. Among the control variables we observe that managers and employees with a business degree on average have a higher level of intraorganisational competence, whereas employees working in an engineering domain on average have acquired less intraorganisational competence. A somewhat different pattern

emerges with regard to firm specific technical competence. Among the explanatory variables task-force participation and cross-unit communication dominate, whereas organisational tenure is the only significant control variable. If organisational tenure is excluded the number of cross-unit transfers is also significant.

We note that the multiple correlation coefficient is much larger for intraorganisational competence than for firm specific technical competence. This suggests that task-specific competences are mainly affected by variables not included in the present study, which in turn means that task specific competences are affected by a different set of variables than non-task-specific competences (that is, differential effects). This is consistent with Campion and associates' (1994) results where career-related variables achieved a very small R^2 with regard to technical competence but a substantially larger R^2 with regard to administrative and business competence. At the present stage of research, we can only speculate about these not-included variables.

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). 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.

Finally, the presence of non-linear relations (diminishing effects) is consistent with traditional learning curve research. Thus the well-known notion of diminishing returns to experience has been successfully extended to other indicators of experience than time and accumulated

output. Moreover, the presence of diminishing effects support the basic proposition that learning occurs through accumulation (cf. Mazur & Hastie, 1978).

5. DISCUSSION AND CONCLUSIONS

5.1 Measurement assessment

This paper outlined strategies for operationalization and suggested measures for intra-organizational and firm-specific technical competences respectively. In our regression analyses we obtained a consistently and substantially lower multiple correlation coefficient (R^2) for equations involving firm-specific technical competences as the dependent variable than for equations involving intra-organizational competence. This suggests that there may be a greater proportion of random measurement error related to firm-specific technical competences than to intra-organizational competence. Whereas intra-organizational competence is related to the same or very similar domains for all employees in the survey, firm specific technical competences are related to technical domains with highly different characteristics. Questions may have different meanings or be interpreted differently by employees within different occupations or different jobs. Questionnaire responses related to task specific domains (defined as “field of practice”) might thus involve a larger random error than responses related to competence domains common to all employees.

Previous research on abilities, competences and performance has been concerned with the validity of self-report measures for such variables. It has been suggested that specific measurement formats may be applied in order to increase the accuracy of self-report (Mabe & West, 1982): The use of social comparison terminology (such as "as compared to your fellow workers"), expectation of validation of self-reports, and promises of anonymity. Respondents in the present study did not welcome social comparison; this could be attributed to the stronger egalitarian norms in Norway as compared to the USA where Mabe and West’s data was collected.

Previous research has invested much effort into assessing and improving self-rating of performance as well as developing alternatives (notably supervisor and peer rating). Although we did not detect any critical deficiencies connected to self-ratings, future research may benefit from a more elaborate measurement strategy. Third party rating is a feasible although complex measurement procedure. Future research may alternatively explore other external criteria of validity that do not require third party rating.

Although the measures suggested here seem adequate to the task, there are areas where future research can potentially achieve methodological improvements. It does seem as if the

comparison format is not equally appropriate in all cultural contexts. Future research should in particular make an effort to improve the reliability of the proposed strategy for operationalising firm specific technical competences. This may include adding self-report items developed through qualitative studies as well as refinements of the current measures. A triangulation of measures, for example peer- or supervisor-rating in addition to self-rating, may further increase the validity and reliability of the suggested measures. Measures may be slightly biased by employee-self-confidence, but relationships with other variables of interest do not seem to be affected. Measures suggested in this paper emphasize knowledge-components at the expense of skills. Future research should further explore the trade-off between skill- and knowledge-components in the measurement of firm specific competences.

5.2 Implications for theory

The classical distinction in human-capital theory between general and firm specific skills is not adequate for analysing the evolution, change and demise of different types of competences. Adding the dimension of task specificity, allows for analytical distinctions between different competences and their development over time. This is illustrated by the transformation of employee competences into technology either in the form of physical equipment, routines, or written procedures (e.g., computer programs). It is reasonable to assume that highly task-specific competences (standard technical competences and firm specific technical competences) have a higher probability of being "materialized" over time as the relevant technology matures than competences exhibiting low task specificity. For instance, it is hard to imagine meta-competences becoming "transferred" into technology. Although efforts to create "artificial intelligence", "expert knowledge systems" and successful chess computers may be interpreted as steps in such a direction, these clearly are exceptions.

Our impression is that firms have been far more willing to spend resources on development of task non-specific competences in managers than in other groups of employees (e.g., Doeringer et al., 1991). The implicit rationale for this situation is probably a belief that change- and innovation-related skills are needed mainly by managers. However, it seems clear that it will be increasingly important to generate readiness and capacity for mastering such changes at virtually all levels in firms that operate in competitive environments.

There is a risk that firms that concentrate all their effort on highly task-specific competences may thereby develop organizational inertia, due to an emphasis on static fit between jobs and

job incumbents at the expense of the widespread need for organizational adaptability to changing external and internal conditions. The degree to which companies will actually exhibit such behaviour is a relevant topic for future empirical research.

In regard to the financing of competence development in firms, a potential for conflict of interest which was fundamental for the founders of neoclassical human capital theory, is present between employees and employers. According to these researchers, the employer will pay solely for the development of firm specific knowledge and skills, whereas the development of general competence will have to be funded by the individuals themselves. As a result, it will not be rational for the current employer to finance human resource development that may stimulate brain-drain from the organization unless costly and rigid exit barriers are established.

The research reported here is based on developments in two areas. First, recent conceptual developments are concerned with the multidimensionality of knowledge and skills (Nordhaug, 1994; Sonntag & Schäfer-Rauser, 1993) as well as work performance (Motowidlo & Scotter, 1994; see also Dyne & LePine, 1998). Second, concern with the specificity or multidimensionality of experience has also emerged (Quiñones et al., 1995; see also Tesluk & Jacobs, 1998). Although several researchers have proposed that different dimensions of performance outcomes have different antecedents (Murphy & Shiarella, 1997; McCloy et al. 1994), virtually no research has investigated relations among multiple experiences and multiple competence outcomes.

The presence of non-linear relations (diminishing effects) is consistent with traditional learning curve research. Thus the well-known notion of diminishing returns to experience has been successfully extended to other indicators of experience than time and accumulated output. Moreover, the presence of diminishing effects support the basic proposition that learning occurs through accumulation (cf. Mazur & Hastie, 1978). A theory of competence acquisition in the workplace should hence incorporate the notion of learning through accumulation and the associated phenomena of diminishing returns and plateauing. The findings in particular indicate that the actual amount of experience makes a difference, a mere affiliation or relation to a source or domain of experience provides little data about the learning taking place. A theory of competence acquisition in the workplace must take into account the quantitative aspects of learning.

There is virtually no previous research on competences as outcomes of learning in the work-place, and existing research is fragmented and has not been guided by a coherent or shared conceptual framework. The current fine-grained definition of competence outcomes has not been applied in previous empirical research. The question remains whether such a fine-grained typology adds value. One possible criterion of the appropriateness or value-added of a conceptual typology, would be that variables distinguished by the framework have differential relations with determinants and consequences (Conway, 1996; Motowidlo et al., 1997). Different competences may have different performance implications and may be acquired in different ways. Our statistical analyses revealed unique sets of antecedent variables for each outcome variable. In other words, if a variable derived from a specific typology is involved in a pattern of causal relations distinct from other variables derived from that typology, we can claim that the typology adds value compared to conceptual frameworks where those variables are not distinguished.

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