Training, Technology and Human Resource Management in Call Centers

Inge Sieben & Andries de Grip

Research Centre for Education and the Labour Market (ROA)

Maastricht University, the Netherlands

Jessica Scholten

Institute of Sociology

Duisburg/Essen University, Germany

Ole Sørensen

National Institute of Occupational Health

Copenhagen, Denmark

First draft

Version August, 8, 2006

Training, Technology and Human Resource Management in Call Centers

Abstract

In this paper, we explore whether training participation in call centers is related to information and communication technology and human resource management. We distinguish between two coordinated market economies (Denmark and Germany) and two liberal market economies (UK and US). Employing an international dataset based on surveys among call center managers, we find several positive relations between the use of advanced technologies and training. Ccustomer interaction automation technologies positively affect initial training, especially in the US, whereas work-flow management systems positively affect initial training in the UK.. Advanced production technologies, such as media-blending, customer relationship management, and web-enablement, seem to induce more ongoing training. However, in call center high quality workplaces and internal labor markets do not influence initial training, with the exception of Denmark. No relationship was found with ongoing training either, although German call centers with a high quality workplace provide more ongoing training than call centers without this HR strategy. Finally, quality selection at recruitment is positively related to initial training, showing that call center training is mostly seen as a complement to recruiting skills.

Introduction

Call center work is associated with negative images, both externally and internally. Public perception is that call center work is monotonous in its nature and requires practically no skills. In academia, call centers have been called 'assembly lines in the head' (Taylor and Bain, 1999) or 'electronic sweatshops' offering 'dead-end jobs' (Fernie & Metcalf, 1998; Taylor, Mulvey, Hyman & Bain, 2002; Deery & Kinnie, 2004). Although call center jobs are mythologized as simple and routine, many complex roles and skill demands do exists (Houlihan, 2000). In the past years, intensified competition on customer contact quality, more demanding customers, and an increase in the number of business-to-business and sales contacts have lead to an increase in skill requirements. Employers and industry representatives therefore present the call center industry as knowledge intensive and requiring skilled employees (Frenkel, Tam, Shire & Korczynski, 1999), which makes that training and competence development are key issues in call centre management.

Given this imminent importance of training in call centers, it is remarkable that in the growing body of literature on call centers, little attention is given to call center training (Wilson, 2006). In this paper, we will try to fill this gap by looking at the incidence of training in call centers. As these organizations vary considerably in the amount of training provided, we will explore how a number of interrelated call center characteristics influence training participation. In particular, we will focus on the relations between training, information and communication technology (ICT), and human resource management (HRM) in call centers. Technology is crucial in the production process of call centers, although there are large differences in the technologies used and the skills demanded (Taylor et al., 2002; Deery & Kinnie, 2004). Call centers are more interfused by the use of a broad scope of technologies than most other service organizations. The differentiation of work tasks in call centers is in the first place facilitated by the linking of information and communication technology, such as databases and computerized telephony, with automatic call distribution, monitoring etc. (Batt & Moynihan, 2002). Several studies found that technology increased the complexity of jobs (e.g. Autor, Levy & Murnane, 2003). As Groot and De Grip (1991) and Bresnahan, Brynjolfsson, and Hitt (2002) show, new technologies may increase the level of workers' training participation. Other studies, however, argue that new technologies can also 'downgrade' the level of jobs (Spenner, 1985; Goos & Manning, 2003). In that case, training participation might be negatively related to the introduction of new technologies. Moreover, call centers vary to a large extent in their human resource practices as they are often rather new firms that are less bound by historically developed structures. Therefore, they have more opportunities to organize their workplace in accordance with the opportunities of advanced technologies (cf. Ichniowski, Shaw & Prennushi, 1997). In addition, human resource management in call centers has a large impact on workers' training participation. Studies in the field of human resource management consider extensive skill training as one of the ingredients of a more advanced human resource system (e.g. Appelbaum & Batt, 1994). Firms might therefore benefit from

incorporating investments in the training of their workforce in a consistent human resource strategy, because this could reduce quit rates and therefore increase the returns on training (e.g. Ichniowski & Shaw, 2003).

The main research question in this paper thus is how and to what extent training participation in call centers is related to the use of information and communication technology and human resource management. We will look at four different countries (Denmark, Germany, the UK, and the US), as institutional settings may shape the environment in which call center training takes place. In so-called coordinated market economies, like Denmark and Germany, firms coordinate their activities through processes of strategic interaction with others (Hall & Soskice, 2001). In these economies, there is a strong influence of the government, trade unions, and trade associations in setting standards on employment conditions. In addition, there is more employment protection and a higher investment in firm-specific training. In liberal market economies like the UK and the US, firms are regulated by competitive markets. Trade unions and trade associations in general are weaker and there is less employment protection and investment in training.

When studying the relationship between training, ICT, and HRM in call centers, we will focus on the 'core' employees[1] working in call centers (cf. Osterman, 1994, 2000), i.e. customer service representatives (CSRs). These employees, who are sometimes also called call center agents, interact with the customers, mainly by telephone. CSRs do not only have to manage customer contacts, they are expected to react on customers' demands instantly, to give information which is relevant and to set service delivery in motion predominantly while the customer is on the phone. In general, CSRs are extensively trained when they start working in a call center. These initial training periods even seem longer than introductory training for other types of clerical work (Belt, Richardson & Webster, 2002). The main reason for this is that call center work is highly specialized and hardly any vocational initiatives exist in formal education. Therefore, call centers often move out of institutionalized training paths, even in countries with highly developed institutions of vocational training like the German dual system (Holtgrewe & Scholten, 2005). They feel that for recruitment purposes, employees' educational and training certificates are not particularly relevant, and subsequently offer extensive training to CSRs internally (cf. Thompson, Warhurst & Callaghan, 2000). In addition to initial training programs, call centers usually offer training to their more experienced CSRs, for example to inform them about new products or product updates, or to improve their sales techniques.

In general, both initial and ongoing call center training comprise so-called hard skills and soft skills. The former relates to knowledge on products, services, or procedures, technical and computer skills etc, whereas the latter refers to communication and interpersonal skills like conversation techniques, customer orientation, and dealing with anger and aggression. Most call center training focuses on products and procedures (Crome, 1998), although many authors emphasize the greater importance of soft skills compared to hard skills in call center work (Belt, Richardson & Webster, 2002; Callaghan & Thompson, 2002). To provide a comprehensive picture of training participation in

call centers, and its relations with ICT and HRM, we will pay attention to both initial and ongoing training of CSRs. In addition, we will look at the incidence of different types of call centers training, i.e. training on updates on product or service information, customer interaction skills, and interpersonal or team-building skills.

Of course, training participation in call centers is influenced by many other job, firm, and worker characteristics (cf. Bishop, 1997). We will therefore control for a number of call center characteristics in the analyses, such as firm size, type of call center, and job complexity. These controls will be explained later on. First, we elaborate on the relationship between training, ICT, and HRM in call centers in order to provide a theoretical framework for the empirical analyses.

Information and Communication Technology

We have not identified much literature on information and communication technology in relation to training participation in call centers. Most of the literature on call center technology is related to discussions about possibilities for control and monitoring (Fernie & Metcalf, 1998; Taylor & Bain, 1999; Holman, Chissick & Totterdell, 2002; Callaghan & Thompson, 2001). Other strands of literature are much more normative, e.g. on how to implement a specific technology (Gherardi, 1999; Cena & Torre, 2006). The effects of information and communication technologies on skill demands have been discussed on a more general basis, though (e.g. Zuboff, 1988). Two different views about ICT's impact have been identified. On the one hand, it is argued that ICT substitutes workers performing limited and well-defined tasks (Cooley, 1986; Shaiken, 1985). On the other hand, it is argued that ICT complements work processes that involve more difficult tasks such as problem solving and complex communication activities (Kern & Schuhmann, 1984).

Work in call centers usually encompasses simple tasks as well as more complex activities. According to previous findings on the general impact of ICT, it can be inferred that the use of ICT in call centers increases skill demands. Call centers would be more dependent on educated CSRs and have a decreased need for less skilled workers (cf. Autor, Levy & Murnane, 2003; Doms, Dunn & Troske, 1997; Athey & Stern, 2002). These effects are stronger when changes in the technical infrastructure are combined with workplace reorganization and with product as well as service updates (Bresnahan, Brynjolfsson & Hitt, 2002). It should be noted that other authors have contested the impact of ICT on skill levels. They assert that there is no direct relationship between skill demands and computer technology use at work (Borghans & Ter Weel, 2006). We will, however, work from the proposition that use of ICT raises skill demands and thereby training participation in call centers. In addition, research shows that the establishment of call centers based on advances in and decreasing prices on ICT has lead to a new division of labor that decreases the skill demands for employees working with customer service compared to traditional organizations of work (Batt, Hunter & Wilk, 2003). However, this discussion is outside the scope of this paper.

Technology is here understood as materialized and systematic, goal directed use of knowledge as well as skills. When we refer to specific technologies through material and observable manifestations such as a product, a computer, a software program or a display, technologies are construed as tangible artifacts. However, technologies should not only be considered as such tangible artifacts. They also have a soft part which is represented in local routines as well as in work practices. Technology's impact on organization and work relations is contingent on its use by different actors (Orlikowski, 2000), whereas its effectiveness is related to the knowledge and the skills of the users interacting with the technology (Layton, 1974). As call centers are organizations interfused by technologies more than most of other forms of organizations, the effectiveness and quality of service work is closely related to the development of appropriate skills concerning the use of technology by employees. Therefore, skill demands, training needs, but also recruitment practices reflect this organizational dependence on technology and it affects the efficiency of the technology use.

In the discussion below, we distinguish between *domain specific product technology* and *production technology*. By domain specific product technology, we refer to the complexity of product characteristics that the call center is providing service for. In contrast, production technologies, such as information and communication technology, enable CSRs to provide service to the customers, and they are central to the call center organization model, because they are used while the customer is calling.

Domain specific product technologies

CSRs' training might be highly influenced by the complexity of the product technology domain. In part, complexity is a function of the product market. For example, electronic devices might be more complicated to explain than furniture. However, within each product market, call centers might position themselves differently and skill demands can vary substantially in call centers belonging to the same industrial sector. Such differences can also be related to functional differentiation within the same organization (Batt, Hunter & Wilk, 2003). In addition, the national context may play a role due to the different industrial composition of product markets (Porter, 1990; Nelson, 1993) and different institutional setups (Whitley, 1999; Casper & Whitley, 2004).

Especially for subcontractors, the need for domain specific product knowledge can be extensive. In many cases, CSRs are assigned to several customer contracts that can span from simple reception calls to tasks requiring knowledge about products. This points to the fact that complexity of product technology is affected by two different dimensions. First, it is a function of the inherent characteristics of the products (complexity by product scope). Second, it depends on the number and variety of products supported by CSRs (complexity by product scale). Hence, a high complexity of product scale could be found particularly at subcontractors who provide services for clients that belong to different industrial sectors, and therefore for a wide range of different products. Often the inclusion of new product domains in CSRs' work functions is part of an attempt to provide more variation in

work tasks. At the same time, it increases the functional flexibility in the call center (Lautsch, 2002). Although these attempts of increasing work complexity by raising the complexity of companies' product scale are also common in in-house call centers, it is a more prevailing practice in the independent subcontractors. This means that even though CSRs working in subcontracting call centers often have less complex work tasks than the CSRs of the subcontracting companies' in-house call center, training requirements might be just as high because of the broader product portfolio.

Unfortunately, there are no direct measures of product technology complexity in the dataset we employ in this paper. There are, however, some indirect measures of complexity such as business segment, time for fulltime CSRs to become fully competent, and call duration. As these measures also entail skill demands related to production technologies, we will not use them as indicators for product technology complexity. Some of these measures, however, will be included in the analyses as controls, because they are most likely related to training.

Production technologies

One of the most important production technology areas are automation technologies. In call centers automation of customer interaction is realized by the implementation of Voice Response Units (VRU) and Interactive Voice Response (IVR) systems, speech recognition, and web automation. VRU is a system for conveying taped messages; IVR adds the possibility to interact, e.g. with touch tones telephone keys. Speech recognition makes interactions between synthetic speech messages and recognition of customer answers possible. There is a national component to these automation systems. First of all, speech recognition support is not equally well developed in all languages. Second, practitioners assert that customers' acceptance of automated interactions differ between countries, which is generally the case for new technologies (Porter, 1990). Web automation is based on information systems made available to customers on the Internet, such as a web shop or a FAQ. However, as we do not have any information on these systems in the dataset we employ in this paper, we will leave web automation out of the analysis here.

The use of automation technologies for customer interaction might affect employees' skill level through different scenarios. Automation might remove simple, repetitive tasks leaving the more complex tasks to the employees and therefore increase skill demands (Richardson & Gillespie, 2003). On the other hand, automation might be used to segregate the workforce and create jobs with either high and low skill demands, which would blur the correlations (Batt, Hunter & Wilk, 2003). Finally, high levels of automation might simply be correlated to low product complexity and therefore to low skill demands. We therefore propose the following dual hypothesis:

H1a: Customer interaction automation will be positively related to CSRs' participation in both initial and ongoing training.

H1b: Customer interaction automation will be negatively related to CSRs' participation in both initial and ongoing training.

In addition, work-flow automation technologies can be used to automate (and standardize) work processes. Call center work-flow systems automate the distribution of calls, the flow of tasks, and facilitate resource planning and staffing. Again, it is highly contested whether automation generally leads to deskilling or reskilling (Braverman, 1974). On the one hand, the implementation of work-flow management might lower skill demands related to organizational processes. However, skill demands related to ICT use might increase. Therefore, work-flow management systems are expected to be correlated to longer duration of initial call center training, but probably not to ongoing training for more experienced CSRs. This leads to the following hypothesis:

H2: Work-flow automation is positively related to CSRs' participation in initial training but not to participation in ongoing training.

The production technologies e-mail, fax, and voice-over-IP (VoIP) are communication technologies. E-mail and fax can be used by CSRs who mainly deal with telephone calls, but often they are handled by employees in special teams or in back office functions. If call centers use e-mail and fax, it may require increased writing skills, but it might just as well indicate that these call centers use functional segmentation that leads to lower skill demands. VoIP essentially is a phone technology that provides cheaper telephony and some more flexibility for routing telephone calls. VoIP also has integration possibilities with other IT functions. There is no reason to expect that VoIP should raise skill demands for CSRs, although the use of VoIP may be an indication of a larger and more professional call center (Holtgrewe, Mottweiler & Scholten, 2005). Therefore, we will not pay attention to the relationship between these communication technologies and call center training in this paper.

Advanced production technologies in call centers include media blending, Customer Relationship Management (CRM) systems, and web-enablement. 'Media blending' indicates that CSRs use a mixture of media such as e-mail, fax, phone etc. We expect this to be positively related to increased skill demands, as CSRs must master several techniques and skills, e.g. writing skills as well as conversation skills. Electronic CRM systems are essential to call centers with repeated interactions with the same customers. CRSs retrieve and store information about each interaction with the customer in these systems. Thereby, customer interactions can be personalized even when the customer interacts with different CRSs, possibly located in different locations. The complexity of CRM systems often requires good ICT and multi-tasking skills. Finally, web-enablement is a technology that enables employees to use intra- and internet sources, e.g. knowledge databases, e-learning, joint browsing, chat, etc. It increases the variety as well as the complexity of customer interactions and therefore is also expected to increase skill demands in call centers. Altogether, this leads to the following hypothesis on the relationship between advanced production technologies and call center training.

H3: Advanced production technologies are positively related to CSRs' participation in initial and ongoing training.

Finally, as mentioned above, the issue of monitoring and control technologies which are omnipresent in virtually all call centers is much discussed in call center literature (e.g. Fernie & Metcalf, 1998; Taylor & Bain, 1999). Monitoring functions are usually part of a phone system that registers how long conversations last, how much time CSRs use on "wrapping up" conversations, and the length of the breaks they take. Phone systems are most often supplemented by call waiting systems that place customers in queues. Control and monitoring systems are in general managed by managers, supervisors or staff consultants, except in rare cases where autonomous work groups get access to these systems. Therefore, there are no direct implications of monitoring and control technologies for CSRs' skill demands. If these technologies have an impact, it is more likely to be because they are used to support a given HRM strategy. In addition, as these technologies are central to the core function of call centers and most often directly integrated in communication technologies, we will not derive separate hypotheses for the relationship between these technologies and training participation in call centers here.

Human Resource Management

The literature on the effects of human resource management particularly focuses on various aspects of the performance of the firm, such as sales, productivity, and quit rates. Most studies emphasize the importance of a good internal fit of various HR practices (Wood, 1999). As there often are large complementarities between different HR practices, it is thought to be less useful to analyze the effects of separate HR practices. Therefore, the majority of studies analyzes the performance effects of 'bundles' of HR practices (e.g. MacDuffie, 1995), or HR systems (e.g. Arthur, 1994). We will use the same approach to study the effects of HRM on CSRs' training participation, because the training of the core workers of a firm will usually be related to a firm's general HRM strategy (Lynch & Black, 1998).

When looking at HRM strategies and training participation, three strands of literature can be distinguished. First, most studies on the effects of HRM focus on the distinction between a more traditional "low quality" approach and a so-called High Performance Workplace (HPW) (for an overview see e.g. Wood, 1999). Second, the labor market segmentation literature also deals with the relation between a firm's HRM strategy and the training participation of its workforce (e.g. Doeringer & Piore, 1971; Osterman, 1982). This literature distinguishes between internal labor markets where firms and their workers have a mutual long-term commitment, and secondary labor markets where firms are indifferent to workers' skills and tenure. Finally, other studies focus on the quality of selection and recruitment (e.g. Terpstra & Rozell, 1993). This quality selection is to some extent related to the HPW. However, there may also be a trade-off between quality selection at recruitment

and the need to further invest in a firm's workforce. In this section, we will discuss the determinants of employees' training brought about by high quality workplaces, internal labor markets, and the quality of selection, respectively.

High Quality Workplace

The shift of service delivery to call centers in the last decades of the 20th century has often caused low-quality working conditions with increased routinization of work processes. Batt & Moynihan (2002), however, showed that in call centers alternative high quality HR strategies also exist. Although the literature on these high quality strategies sometimes distinguishes between a high involvement strategy (e.g. Walton, 1985; Arthur, 1994), and a high worker quality strategy, the overarching concept is known as the High Performance Workplace. This HPW also relates the high quality HR strategy to the strategic management of the firm, i.e. as an element of Total Quality Management (e.g. Black & Lynch, 2001; Wood, Holman & Stride, 2006). In this way, a firm's HRM can contribute to a specific competitive advantage in the markets where the firm operates (Huselid, 1995).

However, the HPW is not uniformly defined. Whereas Osterman (2000) focuses on quality circles, job rotation, teams and Total Quality Management, other authors include incentive pay, recruitment and selection, employment security, flexible job assignments, skills training, and communication (e.g. Ichniowski, Shaw & Prennushi, 1997). Obviously, a crucial characteristic of the HPW is the shift of responsibility to the 'core workers' in the workplace who co-operate in self-responsible teams (e.g. Youndt et al., 1996). Moreover, in order to have a highly committed workforce that is loyal to the firm, the HPW should offer attractive financial incentives (e.g. Becker & Huselid, 1998). In her study on customer services, Batt (2002) distinguishes three dimensions that define high quality workplaces (cf. Appelbaum et al., 2000):

- high relative skill requirements;
- high degree of worker's discretion and teamwork;
- motivating incentive structures.

In this paper, we will restrict our definition of a high quality workplace to the last two dimensions[2], and indicate a HPW by two major characteristics: *work design* – the level of discretion provided to employees, and the use of self-directed teams or quality circles – and *incentives* which enhance workers' motivation and commitment, like high wages and full-time permanent positions.

In the literature on HPW, worker's training participation is often included as a basic dimension of the high quality workplace. Other studies emphasize that firms might gain from incorporating investments in the training of their workforce in a consistent human resource system, because this could reduce quit rates and therefore increase the return on training (e.g. Ichniowski & Shaw, 2003). However, there are hardly any studies that focus on the question to what extent innovative HR practices actually encourage workers' training participation. An exception is the study of Lynch & Black (1998) who found that the proportion of workers trained is positively associated with a high

performance workplace. Lindbeck & Snower (2000) argued that a major driving force behind the emergence of high quality workplaces is the advancement of production and information technologies promoting task complementarities. Because of these task complementarities workers have to work in teams in which occupational barriers are breaking down. In this context, workers need multiple skills, for which they should be involved in continuous skill development. This suggests the following hypothesis:

H4: High quality workplaces will be positively related to CSRs' participation in both initial and ongoing training.

Internal Labor Market

Some studies on the high performance workplace refer to the distinction between an internal and external recruitment system (e.g. Delery & Doty, 1996). This distinction is highly related to labor market segmentation theory (e.g. Doeringer & Piore, 1971) which distinguishes between a 'primary segment' with better, permanent, well-paid jobs with career prospects, and a 'secondary segment' which consists of temporary, badly paid jobs without any career prospects. Within the primary segment of the labor market, a distinction is often made between internal labor markets that operate within large firms, and profession-specific submarkets (Osterman, 1982). Internal labor markets exist in large firms that want to create a well-trained labor force, and protect their internal labor market against the external labor market. Profession-specific submarkets, on the other hand, are external labor market segments for groups of workers trained for a specific profession who can be deployed productively in a number of firms.

In internal labor markets, only insiders compete for the higher-ranked jobs. The training that is required for these jobs is usually acquired by means of formal and informal on-the-job training. Internal labor markets therefore offer attractive career prospects for its workforce, and quit rates are very low. Sanders & De Grip (2004) showed that also low-skilled workers have career prospects in internal labor markets.

Internal labor markets enable firms to invest in the human capital of their workforce with a reduced risk that trained workers leave for other firms (Cf. Fairris, 2004). Therefore, workers' training participation is high in internal labor markets. Dekker, De Grip and Heijke (2002) showed that this holds for both core training, which is necessary to keep up with changing job requirements, and career training, which prepares workers for the next step in their career, and which identifies employees' potential productivity (Bartel, 1995).

As far as we know, there are no studies on the occurrence of internal labor markets in call centers. Call centers often have very high quit rates, which indicate that the jobs offered can be characterized as a secondary labor market (De Grip, Sieben & Van Jaarsveld, 2006). However, various studies refer to the career mobility of CSRs to supervisor jobs in the call center, and promotions to other jobs in the larger organization (e.g. Belt, Richardson & Webster, 2000; Batt et al., 2000).

Obviously, the former is more likely to occur in larger call centers, whereas the latter will only be possible for in-house call centers, which are usually part of a larger firm. In this paper, we will identify the existence of internal labor markets by these two characteristics: (1) upward promotion both within the call center and the larger organization, and (2) a low quit rate. As described above, we can derive the following hypothesis from labor market segmentation theory:

H5: Internal labor market will be positively related to CSRs' participation in both initial and ongoing training.

Quality Selection at Recruitment

Some studies on the HPW include selective hiring among the high quality HR practices (e.g. Batt, 2002). By selecting employees with a relatively high level of education, firms recruit a skilled workforce which will have high returns on further training, because the trainability of more skilled employees is.usually higher (Thurow, 1975; Heckman, 2000) Other studies explicitly focus on the relation between staffing practices and the performance of the firm. Breaugh (1981) found that informal recruitment yields higher quality employees than formal recruiting, whereas others found that cognitive ability tests are superior selection devices (Terpstra & Rozell, 1993). Therefore, we indicate the quality of the CSRs selected by means of the severity of the recruitment and selection process[3]. This signifies that two characteristics are important: the use of selection tests, and the percentage of applicants that are actually hired.

In the labor economics literature on the determinants of training, many authors found that employees with a higher level of education more often participate in further training. Heckman (2000) explains this complementarity between initial education and training by the higher trainability of those who are higher educated: "Skills acquired early on make learning easier." Other researchers, however, found that although a higher level of education in general contributes to a higher probability of training participation, this is not the case when workers are 'overeducated' for their job (Sicherman, 1991; Hersch, 1991; Van Smoorenburg & Van der Velden, 2000). This indicates that in particular kinds of jobs, workers' training participation may be complementary to their skill level as well as substitutable for initial skills: training participation enables those who are lower educated to acquire skills which the higher educated already acquired in initial education. The literature therefore does not lead to straightforward expectations on the relation between the quality of the employees recruited and their participation in training. We will, therefore, formulate the following dual hypothesis:

H6a: Quality selection at recruitment will be positively related to CSRs' participation in both initial and ongoing training.

H6b: Quality selection at recruitment will be negatively related to CSRs' participation in both initial and ongoing training.

Data

To test the hypotheses mentioned above, we employ data from the Global Call Center Project, which is based on surveys administered to call center managers in 18 countries around the world. We use the information available for Denmark, Germany, the UK and the US. Although the questionnaires were standardized, each country had a slightly different survey and sampling design, which we will briefly discuss here. In Denmark, a database of 226 call centers was created using different sources, representing an estimated 50 to 75% of all call centers in Denmark. The managers of these call centers were contacted by letter in May 2004 to inform them about the survey, after which they received an e-mail with a link to an electronic questionnaire. After sending out several reminders and closing the data collection in August 2004, 118 companies provided answers to the survey, yielding a response rate of 52% (Sørensen & El-Salanti, 2005). In Germany, the survey was administered by phone to managers of 300 call centers which were randomly sampled from a database of 2,700 call centers. Again, this database was compiled using different sources, including information from regional call center associations and business development agencies. In Germany, the response rate was 51% (Holtgrewe, 2005). In the UK, a representative sample of 554 call centers, randomly selected from the Call Centre Association (CCA) database, was contacted by phone or e-mail between February and May 2004. This database represents both the CCA membership and the wider industry. 167 managers completed the survey by telephone or self-completion questionnaire – a response rate of 30% (Holman, Wood & Stride, 2005). Finally, in the US, a stratified random sample was drawn from two sources: the subscribers list of 'Call Center Magazine' and the Dun and Bradstreet listing of establishments in the telecommunications industry. 464 managers completed the telephone survey that was administered in mid-2003, yielding a response rate of 62% (Batt, Doellgast & Kwon, 2005). An overview of the number of cases and response rates per country is given in Table 1.

[Please insert Table 1 around here]

In addition, Table 1 tells us what kinds of call centers are surveyed. First, we see that the majority of call centers are in-house divisions of larger organizations, except for Germany, where the percentage of in-house call centers is quite low (33%). However, there might be an oversampling of German subcontractors (i.e. third-party companies that provide services for a number of organizations), as the percentage of in-house call centers in Germany is estimated to be 49% (Deutscher Direktmarketing Verband, 2005). Since both types of call centers vary in many aspects, we will pay attention to differences between in-house and subcontracting call centers in the remainder of this paper. Looking at the size of call centers, we observe large differences between countries. Call centers in Denmark are quite small (on average 61 employees), whereas call centers in the US are much larger (on average 205 employees). In general, subcontractors are larger than in-house call centers; in Germany and the US even twice as large. The type of work handled by in-house and subcontractor call centres is an important source of difference that may influence the divergent working conditions of CSRs. For

example, more than 80% of call centers in Denmark, the UK, and the US handle so-called inbound calls, i.e. calls made at the initiative of the customer (for example to ask for information, to make purchases, submit complaints, etc.). In comparison, only 70% of the German call centers handle mainly inbound calls. The other call centers have their largest volume of calls spent on outbound calls, which involve the call centre as opposed to the customer initiating the contact. Outbound calls may be performed for a variety of functions, including survey research, fund-raising, and telemarketing. As these functions are fairly specialized and highly transactional in nature, companies tend to outsource these to subcontractors. This might also explain the fact that so many call centers in Germany (30%) perform outbound calls; in this country, we have a lot of subcontractors in the dataset. In general, inbound calls are thought to be more complex than outbound calls, as the latter ones usually are scripted and thus more routine work than inbound conversations which are more difficult to predict. The complexity of the job can also be indicated by the number of weeks it takes full-time CSRs to become fully competent. This ranges from about 17 weeks in Denmark, Germany, and the US to 26 weeks in the UK. CSRs in in-house call centers appear to have more complex jobs, as it takes them somewhat longer to become fully competent. The exception here is Germany, where CSRs in subcontracting call centers on average need 4 months more to reach full competency than CSRs in in-house call centers. As we will see later on, the complexity of the job also has a large influence on the amount of training.

Training, ICT and HRM in Call Centers

Before we examine the relationships between training, ICT, and HRM, we take a closer look at the incidence of training, technologies and HR practices in call centers in Denmark, Germany, the UK, and the US. Table 2 first of all shows that call centers in coordinated market economies do not provide more initial or ongoing training to their CSRs than call centers in liberal market economies, as the variety of capitalism theory predicts (Hall & Soskice, 2001). However, CSRs in in-house call centers follow more training during the first year of their job than CSRs in subcontracting call centers. On average, they receive 21 days of initial training, including orientation, induction and job-related training. In the UK, CSRs working in in-house call centers even follow 27 days of initial training. Subcontractors, on the other hand, provide their CSRs with on average of 18 to 19 days of training during their first year, except for subcontractors in the US, who allow for 13 days of initial training only. After the first year, the training pattern is reverse, as CSRs employed at subcontractors receive more ongoing training than CSRs in in-house call centers. This could be explained by the fact that subcontracting call centers often work for several, varying, customers; hence training on new products or services is needed more often than in in-house call centers. However, it should be noted that the differences in ongoing training between subcontractors and in-house call centers are not that pronounced and in the German case hardly exist. Moreover, call centers that provide more initial training in general also provide more ongoing training for their CSRs[4].

[Please insert Table 2 around here]

What kind of training is followed by CSRs? The information available in the dataset suggests that most formal training, both in in-house and subcontracting call centers, is on updates on product or service information. Particularly in Germany, a lot of formal training is offered in this area. Training on customer interaction skills is not as frequently given as one might expect given the apparent importance of these skills for customer contact quality. Research, however, shows that call centers mainly focus on training on products and services and leave human interaction skills mostly to CSRs' individual resources (e.g. Frenkel, et al. 1999; Thompson & Callaghan, 2002). Formal training on interpersonal or team-building skills is even less provided. In-house call centers appear to be slightly more involved in this kind of training than subcontractors.

Information and Communication Technology

Table 4 gives an overview of technology use in in-house call centers and subcontractors for the four countries related to the distinction between automation and advanced production technologies described above. The table shows that there do not seem to be any systematic differences between technology use in in-house call centers and subcontractors except in the area of automation technologies. Customer interaction automation technologies are not regularly used in call centers. Only a small percentage of calls is answered through VRU or IVR, except for the US, where this share is about 10%. In addition, VRU and IVR systems are more common in in-house call centers than in subcontractors, except in the US. Speech recognition is also used regularly by CSRs in less than 10% of the call centers; the least frequently in Denmark, where 5% of the subcontractors and even 0% of the in-house call centers apply speech recognition. It should be noted that the question about speech recognition in the survey might be a bit misleading as CSRs normally do not use speech recognition in their interactions with customers. Speech recognition systems are used on the call center level in line with or integrated into VRU/IVR systems (Anton, 2000).

[Please insert Table 3 around here]

Automation of processes through work-flow automation technologies are used quite frequently in Germany and the UK, where about 30% to 40% of the call centers have work-flow management, and less so in Denmark, where this technology is regularly used in only 11% of the in-house call centers and 15% of the subcontractors. There are no figures on work-flow management available for the US. Work-flow automation technologies seem to be slightly more common in subcontracting than in in-house call centers in the UK and in Denmark.

The advanced production technologies also show noteworthy variation across countries. Regular use of media blending by CSRs is most common in Germany, where 29% of in-house call centers and 24% of subcontractors use this technology, and least in Denmark and the UK (less than 12%). Electronic Customer Relationship Management systems (CRM) are fairly regularly used in all countries, with a higher frequency in subcontractors and in Germany. Web-enablement is least common in Denmark, where 11% of in-house call centers and 20% of subcontractors make regular use of web-enablement. This technology is most common in the US where 56% of all call centers use web-enablement.

Two of the production technologies which we excluded from the analyses, e-mail and fax, are the most frequently used technologies in all four countries. This is not surprising, as they are common in all office settings in the countries analyzed. E-mail is used most frequently in the US, Denmark and Germany, where 80% to 90% of call centers indicates that their CSRs regularly use e-mail. E-mail communication is least often used in the UK, where 61% of in-house call centers and 68% subcontractors regularly deal with e-mails. Fax use is most common in Germany and the US, where about 90% of all call centers handle fax, and least common in Denmark, where this percentage is about 60%. Voice-over-IP technology is implemented by 15% to 20% of all call centers, except for subcontractors in Denmark, where the implementation is considerably larger (35%).

Overall, it is difficult to establish a pattern that distinguishes coordinated from liberal market economies. The figures in the table indicate that call centers in the US and Germany use ICT more intensively than the other two countries. The US call centers more frequently use IVR/VRU systems and web-enablement, which indicates a higher degree of automation of customer interactions. The German call centers, on the other hand, more frequently implement work-flow management and electronic customer relationship management systems, which hints at a higher degree of automation of work-flow processes.

HR Practices

Table 4 gives an overview of the incidence of various human resource practices in both in-house call centers and subcontractors for the four countries, related to the three theoretical explanations of CSRs' training participation: high quality workplace, internal labor market, and quality selection at recruitment. The table shows that all of these HPW related HR practices occur more frequently in in-house call centers than in subcontracting call centers. However, in the UK CSRs' annual earnings in in-house call centers are not higher than in subcontracting call centers.. Moreover, the level of discretion at work provided to CSRs is higher in call centers in the two coordinated market economies. Probably, the larger influence of trade unions and associations on employment conditions in these countries makes that CSRs perform less standardized functions, are less monitored, and have more discretion over the daily work tasks they do, the methods and procedures they use, the speed at which they work, what they say to the customer etcetera. Self-managed or semi-autonomous teams in which

CSRs supervise their own work and make decisions about tasks or work methods, and quality circles, such as task forces, problem solving groups, or quality improvement committees, are most frequent in German call centers. In this country, 36% of the in-house call centers, and more than 30% of the subcontractors work with these kinds of teams, opposed to only 23% of the in-house call centers and 14% of the subcontractors in the UK. In contrast, full-time permanent jobs are relatively scarce in Germany, where there are much more flexible arrangements (cf. Shire, Holtgrewe & Kerst, 2002; Arzbächer, Holtgrewe & Kerst, 2002). In Germany, only 61% of the CSRs in in-house call centers have full-time permanent contracts, whereas 83% of the CSRs working in the in-house call centers in Denmark and the US have such contracts. The subcontracting call centers in Germany employ even less full-time permanent CSRs: 56%. Although this percentage is much lower than in the UK (70%) and Denmark (68%), it is rather similar to the percentage of full-time permanent CSRs in subcontracting call centers in the US (57%).

[Please insert Table 4 around here]

With respect to the internal labor market we see that internal promotions within the call center most frequently occur in subcontracting call centers, except for the US where the rate of internal promotions is high in both subcontracting (7%) and in-house call centers (8%). In in-house call centers in Denmark, internal promotions are very scarce (3%). It should be kept in mind that subcontractors are larger than in-house call centers, which makes internal promotions more likely. Promotions within the larger organization, on the other hand, are most frequent in in-house call centers. However, these promotion rates are much lower than the internal call center promotion rates. CSRs' quit rates are highest in subcontracting call centers. Moreover, these quit rates are much larger in call centers in the two market economies. Both in the US and the UK almost 20% of the CSRs in subcontracting call centers quit annually, as opposed to only 9% in Denmark and 7% in Germany.

Table 4 also shows that quality selection at recruitment differs substantially between call centers in liberal and coordinated market economies. Call centers in the UK and US much more rely on systematic selection tests. Whereas in the UK about 62% of the CSRs recruited in both in-house and subcontracting call centers is selected by means of systematic testing, in Denmark only 28% of the CSRs in in-house call centers and 24% of the CSRs employed in subcontracting firms is tested. Nevertheless, the more frequent use of systematic testing in the UK and US does not mean that quality selection in call centers in these two market economies is more selective; it is remarkable that the percentage of applicants actually hired – as well as the quit rate – is much higher in these two countries than in Denmark or Germany. This particularly holds for subcontracting call centers where in the UK and US more than 41% of the applicants is hired, compared to only 28% of the applicants in subcontracting call centers in Denmark, and 22% of the applicants in Germany.

Results

In order to see how ICT and HRM are related to training participation in call centers, we perform OLS regression analyses. We will estimate the effects of three technology indexes (customer interaction automation technologies, work-flow automation technologies, and advanced production technologies) and three HRM indexes (high quality workplace, internal labor market, and quality selection) on the number of days CSRs receive initial training in their first year, and on the number of days experienced CSRs receive formal training per year. In addition, we include a number of call center characteristics that are thought to be relevant when explaining training participation. First of all, as discussed before, the distinction between in-house call centers and subcontractors is important. In general, in-house call centers offer more training to their CSRs than subcontracting call centers, as the former ones often have better working conditions on the whole (De Grip, Sieben & Van Jaarsveld, 2006). On the other hand, CSRs working in subcontractors might need more training on new products and services, as they often work for several, varying customers. Size of the call center is also included, as ample studies show that large firms provide more training than small firms (see e.g. Bishop, 1997; Shields, 1998, Lynch & Black, 1998). Furthermore, we distinguish between call centers that mainly deal with inbound calls and call centers that handle outbound calls. Inbound calls usually are more complex than outbound calls, because they are more difficult to forecast than outbound calls. In addition, CSRs who make outbound calls often use scripts, which make these conversations more routine work than inbound calls. Job complexity may also be indicated by the number of weeks it takes full-time CSRs to become fully competent in the job[5]. More complex jobs would lead to more initial training in the first year as well as to more ongoing training for experienced workers. More information about the variables included in the analyses and the construction of the technology and HR indexes can be found in the Appendix.

Initial training

The results of the OLS regression analyses for initial training participation are presented in Table 5. The results first of all show that customer interaction automation technologies have a positive effect on the number of initial training days in the first year in the US and for the total sample. This indicates that VRU/IVR and speech recognition systems[6] in call centers take care of simple, repetitive tasks while leaving the more complex tasks to CSRs, thereby increasing skill demands and training needs (cf. Richardson & Gillespie, 2003). Hypothesis 1a, specifying a positive relationship between customer interaction automation technologies and initial training, is thus confirmed. However, in Denmark, Germany, and the UK, no relationship between these technologies and initial training is found. It could be that customer interaction automation technologies are simply not common enough in the call centers in these countries to have a large impact. For example, the figures in Table 3 showed that use of VRU/IVR systems is much higher in the US than in the European countries. Another explanation, however, might be that automation in these countries is used to segregate the workforce,

creating jobs with either low or high skill and training demands (Batt, Hunter & Wilk, 2003), which would blur the correlations. Regarding work-flow automation, a significant effect is found in the UK only[7]. Here, work-flow management appears to be positively related to initial training, thereby confirming hypothesis 2. The advanced production technologies show no relations with initial training. Differently than expected in hypothesis 3, media blending, electronic CRM systems, and web-enablement do not induce more initial training. Maybe these technologies are thought to be too complex to deal with in initial training and are dealt with by more experienced CSRs.

[Please insert Table 5 around here]

The impact of human resource management on initial call center training is somewhat more pronounced. Especially quality selection at recruitment plays an important role, as it positively affects initial training in all countries except Denmark. This indicates that initial training in call centers is complementary to the skill levels of newly hired CSRs, thereby confirming hypothesis 6a which stipulates a positive relationship between quality selection at recruitment and initial training. Call centers that can be characterized as a high quality workplace provide more training in the first year in the UK (hypothesis 4), but not in the other countries. In addition, internal labor markets (ILM) lead to more initial training in Denmark. Here, higher levels of promotions and lower quit rates result in more training days for CSRs in the first year. However, ILM do not affect initial training in Germany, the UK, and the US.

The effects of the control variables show that in-house call centers provide more initial training to their CSRs than subcontractors (cf. De Grip, Sieben & Van Jaarsveld, 2006). The number of training days in the first year does not depend on the size of the call center, though. Job complexity, however, is positively related to initial training. Both call centers which mainly deal with inbound calls as opposed to outbound calls and call centers in which it takes full-time CSRs more weeks to become fully competent, offer more initial training to their CSRs.

Ongoing training

Table 6 shows the results of the OLS regression analyses on the number of formal training days for experienced CSRs. First of all, both customer interaction and work-flow automation technologies do not affect ongoing training. This means we have to reject hypothesis 1a and 1b, which specify a positive and negative relationship between automation technologies and ongoing training respectively. These findings, however, confirm hypothesis 2, as we expected that work-flow automation only influences initial training and not ongoing training. In addition, the advanced production technologies, such as media blending, CRM systems, and web-enablement, have a positive effect on training for experienced CSRs in the US and in the total sample. This partially confirms our hypothesis 3, as the impact of these technologies is limited to ongoing training. It seems that these advanced production

technologies foster a higher training demand in the long term. It might also be argued that call centers offer more training regarding these technologies at a later date, because at this time, they could draw on first experiences of CSRs.

[Please insert Table 6 around here]

With respect to HRM, a high quality workplace positively influences ongoing training in Denmark only. Quite remarkably, internal labor markets show no impact on training for experienced CSRs. ILMs usually provide both more core training, which is necessary to keep up with changing job requirements, and career training, to prepare workers for higher-ranked jobs inside the organization (Dekker, De Grip & Heijke, 2002), but this seems not be the case in call centers. Quality selection at recruitment, however, is important. It positively affects ongoing training in the total sample and in Germany. Again, this indicates that call center training is more a complement than a substitute for CSRs' skill levels as expected in hypothesis 6a.

Experienced CSRs working in in-house call centers do not attend more formal training than CSRs employed by subcontractors. The size of call center positively affects ongoing training, as larger call centers provide more of this training in the US and in the total sample. Surprisingly, there is no relationship between ongoing training and job complexity. It appears that call centers handling inbound calls provide even less training than call centers that deal with outbound calls, at least in Denmark. In addition, the number of weeks for full-time CSRs to become fully competent is not related to ongoing training, except for the total sample.

Different types of training

To get more insight in the relationship between ICT, HRM and training participation in call centers, we explore how automation and advanced production technologies and specific HR strategies are related to different types of training. We here distinguish between training in hard skills (i.e. updates on product and service information) and training in soft skills (i.e. customer interaction and teambuilding skills). Both types of training are vital in call centers, although our data (see table 2) show that most call center training focuses on products and procedures (Crome, 1998). Belt, Richardson & Webster (2002) and Callaghan & Thompson (2002), however, emphasize the greater importance of soft skills compared to hard skills in call center work. To estimate the relationship between ICT, HRM, and training in call centers, we use ordered probit models, which are conceptually close to linear regression techniques, but specifically designed for analyzing dependent variables that take only a finite number of values possessing a natural ordering (McKelvey & Zaviona, 1975). In our ordered probit models, the discrete but ordinal nature of the amount of formal training received on updates on product or service information, customer interaction skills, and interpersonal and teambuilding skills is modeled by denoting three outcomes: 1 – none or a little; 2 – a moderate level;

and 3 – a lot or a great deal[8]. The ordered probit models are estimated for Denmark and the UK only, as information on type of training is not available or feasible for Germany and the US[9].

Table 7 shows that in Denmark, quality selection at recruitment has a significant and positive effect on formal training on updates on product and service information. All other variables are not significant, indicating that technologies or human resource management in call centers do not affect this type of training.. With respect to training on customer interaction skills, there are no effects of ICT either. The high quality workplace, however, positively influences customer interaction training in call centers. Call centers in which CSRs have more discretion at work, are more involved in self-managed teams or quality circles, have higher wages, and more often a full-time permanent contract, follow more training on how to deal with customers than CSR in other call centers. In addition, larger call centers provide more training on customer interaction skills than smaller call centers, and so do call centers that handle outbound calls. Finally, formal training on interpersonal or team-building skills is not affected by ICT or HRM, with the exception of call centers with an internal labor market providing more of this type of training. In this respect, it is striking that CSRs working in call centers with a high quality workplace follow more training on interpersonal or team-building skills than other CSRs, as these skills are highly relevant in a HPW. In-house call centers and larger call centers, however, provide more training in these soft skills than subcontractors and smaller call centers.

[Please insert Table 7 around here]

Table 8 gives the estimates of the same ordered probit models for different types of training in the UK. ICT does not seem to influence any type of training considered here, with the exception of work-flow automation technologies having a negative impact on formal training in customer interaction skills. This finding is in contrast with the more general finding in Table 5 that work-flow management systems induce more initial training in the UK. Apparently, this does not refer to training in customer interaction skills. Effects of HRM turn out to be not significant either, although there is one exception here too. As could be expected, call centers with a high quality workplace provide more training in interpersonal or team-building skills.

[Please insert Table 8 around here]

Discussion and Conclusions

In this paper, we dealt with one of the ignored topics in call center research: the training of CSRs, the core workers in call centers. We found no large differences in the incidence of training between coordinated market economies (Denmark and Germany) and liberal market economies (UK and US). This is contrary to predictions of the "variety of capitalism" theory (Hall & Soskice, 2001), which stipulate that influenced by governments, trade unions, and trade organizations, firms in coordinated

market economies provide more training to their workers than firms in liberal market economies. This might indicate that in coordinated market economies call centers operate at the periphery of the national industrial relations, as shown in De Grip, Sieben & Van Jaarsveld (2006).

We did, however, find large differences between in-house and subcontracting call centers. CSRs working in in-house call centers received more initial training (on average 21 days) than CSRs employed by subcontractors (on average 18 to 19 days). After the first year, the training pattern is reversed, as CSRs in subcontracting call centers follow somewhat more ongoing training than CSRs in in-house call centers. In general, however, one can conclude that call centers that provide more initial training, also offer more ongoing training to their CSRs. We then explored the relationships between training participation and two important factors shaping production processes in call centers: information and communication technology (ICT) and human resource management (HRM).

Information and Communications Technology

ICT could affect call center training in two ways: it could lead to higher or lower skill demands. This duality is reflected in the way customer interaction automation technologies, such as Voice Response Units (VRU) and Interactive Voice Response (IVR) systems and speech recognition might influence training in call centers. On the one hand, these automation technologies might remove simple, repetitive tasks, leaving the more complex tasks to the employees (Richardson & Gillespie, 2003), thereby increasing skills demands and CSRs' initial and ongoing training. The results of our multivariate regression analyses showed that this is the case in the US and in the total sample for initial training. However, customer interaction automation technologies did not have a significant impact on initial training in Denmark, Germany, or the UK. Moreover, there was no relationship between these automation technologies and ongoing training in call centers. This might indicate that automation is used to segregate the workforce and create jobs with either high and low skills demands, which would blur the correlations (Batt, Hunter & Wilk, 2003).

In addition, work-flow automation is used in call centers to automate and standardize work processes. Skill demands related to ICT might increase because of this, which implies that work-flow management systems are related to a longer duration of initial training, but probably not to more ongoing training for more experienced CSRs. This indeed was found for the UK, where work-flow automation positively affected the number of days of initial training in the first year, but showed no relationship with the number of formal training more experienced CSRs get after the first year. However, no significant associations were observed in the other countries.

Advanced production technologies such as media blending, electronic customer relationship management and web-enablement were also thought to be positively related to increased skill demands, as CSRs must learn more techniques and skills to master this. It is therefore remarkable that we observed no relationship between these production technologies and initial training. With respect to ongoing training, a positive influence was found for the US and for the total sample. It thus seems

that these advanced production technologies induce higher training on the long term. As mentioned before, it might be that call centers offer more training regarding these technologies, which are quite complex, in a later stage, when CSRs are more mature in their work and can draw upon their experiences. Another explanation could be that system changes related to advanced technologies require substantial skill changes, which increase the need for ongoing training. Observations from case studies support this view.

Human Resource Management

With respect to HRM, we first of all focused on the so-called High Performance Workplace (HPW). This high quality strategy would be positively related to both initial and ongoing training, as CSRs would need multiple skills to perform task complementarities. The results showed this was not the case. Two exceptions prevailed: In Denmark, the high quality workplace had a positive effect on initial training, and in Germany, there was a positive influence on ongoing training.

Labor segmentation theory indicates that some firms operate as internal labor markets (ILMs): these firms create a well-trained labor force and offer attractive career prospects. Therefore, we expected a positive effect of ILMs on both initial and ongoing training. However, this hypothesis had to be rejected. An exception was Denmark, where ILMs did have a positive effect on initial training.

Finally, selective hiring could be part of a high quality HR strategy. By selecting employees with a relatively high level of education, firms recruit a skilled workforce which will have high returns on further training. Training participation thus might be considered as both complementary to workers' skill levels as well as substitutable for initial skills. We found that there was a positive relationship between quality selection at recruitment and initial training in all countries except Denmark. This shows that CSRs training participation is a complement to recruiting skills. With respect to ongoing training, we only found a positive relation with quality selection in Germany and in the total sample.

All in all, we did find some positive influences of ICT and HRM on initial call center training, but hardly any on ongoing training. A possible explanation for this could be that our research is limited to formal call center training only. Research shows that informal or on-the-job learning is as important as or even more important than formal training (Baron, Berger & Black, 1997). Case studies performed by the authors indicate that informal learning is highly relevant in call centers, especially in the case of ongoing training. After induction training, most CSRs are involved in an intensive period of mentoring, where more experienced workers sit next to the CSRs and listen in to their calls in order to give them feedback and help them with customer interactions. In addition, coaching of more experienced CSRs takes place on a regular basis. Supervisors or specially appointed coaches personally work with CSRs to improve their skills. Informal training also takes place in other settings, such as during team meetings, in e-learning modules worked through by CSRs in down times, and by

e-mails on product or system updates. Formal ongoing training seems to be quite rare in call centers, as managers thinks it interrupts the production process too much.

From this perspective, our finding that ongoing training is not affected by work complexity (measured by number of weeks to become fully competent) in any of the countries we analyzed is not surprising, although a weak positive relation was found for the total sample. Work complexity is positively related to initial training in the first year, though. It would be fascinating to extent the scope of this paper to more informal ways of learning, although it is quite a challenge to measure informal learning in surveys (cf. Bishop, 1997; Veum, 1995).

Future research

It should be noted that the relationship between ICT, HRM, and training is more complex than referred to before. The way human resource management is dealt with in call centers, highly depends on the technologies used, and vice versa. For example, call routing systems can be used to support teams with mixed competencies or to segregate the work force and create jobs with either high and low skill demands. Some call center managers experience technology as an obstacle for HPW strategies, because none of the contemporary planning systems have possibilities for autonomous work teams to plan their own time. We tried to model this interplay of ICT and HRM by including interactions of e.g. automation and advanced production technologies on the one hand and the high quality workplace on the other hand in the analysis. These interactions, however, did not yield any significant results, which indicate that effects of technologies on training incidence are the same in call centers with a high quality workplace and in call centers without such a HR strategy. It should be noted, however, that the number of cases in the analyses was limited, which could result in non-significant results. It therefore would be interesting for future research to further develop the theoretical framework on how ICT, HRM, and training are intertwined in call centers.

In addition, future research could improve our insights in the relationship between ICT and training by looking not only at production technologies, but also at the second dimension of ICT we distinguished in this paper: domain specific production technologies. These technologies refer to the complexity of products the call center is providing service for. This complexity relates to inherent characteristics of products (product scope) and to the number and variety of products supported (product scale). It is not difficult to imagine that more complex products raise CSRs' skill demands and training needs. Unfortunately, the international dataset we employed does not contain direct measures of product technology complexity. We suggest to develop data on indicators such as frequency of product updates, extensiveness of CSR's product portfolio, level of training curriculum, and amount of product documentation.

References

Anton, J. (2000). The past, present and future of customer access centers. *International Journal of Service Industry Management*, 11(2), 120-130.

Appelbaum, E. & R. Batt (1994). *The New American Workplace: Transforming Work Systems in the US*, Ithaca, New York: Cornell ILR Press.

Appelbaum, E, P. Berg, T. Bailey, & A.L. Kalleberg (2000) *Manufacturing advantage. Why high-performance systems pay off.* Ithaca: ILR Press.

Arthur, J.B. (1994) Effects of Human Resource Systems on Manufacturing Performance and Turnover, *Academy of Management Journal*, 37 (3), 670-687.

Arzbächer, S., U. Holtgrewe & C. Kerst (2002). Call Centres: Constructing Flexibility. In: U. Holtgrewe, C. Kerst & K. Shire (Eds.) *Re-Organising Service Work: Call Centres in Germany and Britain.* Aldershot: Ashgate, 19-41.

Athey, S. & S. Stern (2002). The impact of information technology on emergency health care outcomes. *Rand Journal of Economics*, 33, 399-432.

Autor, D.H., F. Levy & R. J. Murnane (2003). The Skill Content Of Recent Technological Change: An Empirical Exploration, *The Quarterly Journal of Economics*, 118, 1279-1333.

Barron, J.M., M.C. Berger & D.A. Black (1997). How well do we measure training? *Journal of Labour Economics*, 15 (3), 507-528.

Bartel, A.P. (1995) Training, Wage Growth, and Job Performance: Evidence from a Company Database**,** *Journal of Labor Economics* , 13, 401-425.

Batt, R. (2002) Managing Customer Services: Human Resource Practices, Quit Rates, and Sales Growth, *Academy of Management Journal* 45 , 587-597.

Batt, R., A. Colvin, H. Katz, & Keefe (2000) *Telecommunications 2000. Strategy, HR Practices & Performance*, Ithaca, NY: Cornell University.

Batt, R., V. Doellgast & H. Kwon (2005). *The U.S. Callcenter Industry 2004. National Benchmarking Report.* Ithaca, NY: Cornell University.

Batt, R., L.W. Hunter, & S. Wilk (2003). How and When Does Management Matter? Job Quality and Career Opportunities for Call Center Workers. In: E. Appelbaum, A. Bernhardt, & R. J. Murnane (Eds.), *Low-Wage America. How Employers Are Reshaping Opportunity in the Workplace*. New York: Russell Sage Foundation, 270-313.

Batt, R., L. Moynihan, (2002) The viability of alternative call centre production models, *Human Resource Management Journal,* 12 (4), 14-34.

Becker, B.E. & M.A. Huselid (1998) High performance work systems and firm performance: a synthesis of research and managerial implications. In Ferris, G.R. (ed.), *Research in Personnel and Human Resources*, 16, Stamford, CT: JAI Press, 53-101.

Belt, V., R. Richardson, & J. Webster. (2000) Women's Work in the Information Economy: The case of telephone call centers, Information, Communication and Society, 3 (3), 1-19.

Belt, V., R. Richardson, & J. Webster. (2002) Women, social skills and interactive service work in telephone call centers. *New Technology, Work and Employment*, 17 (1), 20-34.

Bishop, J. (1997). What We Know About Employer-Provided Training: A Review of the Literature. *Research in Labor Economics*, 16: 19-87.

Black, S.E. & L.M. Lynch (2001) How to Compete: The Impact of Workplace Practices and Information Technology on Productivity, *The Review of Economics and Statistics*, 83 (3), 434-445.

Borghans, L. & B. Ter Weel (2006). The division of labour, worker organisation, and technological change. *Economic Journal*, 116, F45-F72.

Braverman, H. (1974). *Labor and Monopoly Capital: The Degradataion of Work in the Twentieth Century.* New York: Monthly Review Press.

Breaugh, J.A. (1981) Relationships between recruitment source and employee performance, *Academy of Management Journal*, 24, 142-147.

Bresnahan, T.F., E. Brynjolfsson & L.M. Hitt (2002). Information Technology, Workplace Organization, and the Demand for Skilled Labor: Firm-Level Evidence, *Quarterly Journal of Economics*, 117, 339-376.

Callaghan, G. & P. Thompson (2002). 'We recruit attitude': The selection and shaping of routine call centre labour. *The Journal of Management Studies*, 39, 233.

Casper, S. & R. Whitley (2004). Managing competences in entrepreneurial technology firms: A comparative institutional analysis of Germany, Sweden and the UK. *Research Policy*, 33, 89-106.

Cena, F. & I. Torre (2006). Adapting the interaction in a call centre system. *Interacting with Computers*, 18, 478-506.

Cooley, M. (1986). *Architect or Bee*. London. Abacus.

Crome, M. (1998). Call Centers: Battery Farming or Free Range? *Industrial and Commercial Training*, 30 (4), 137-141.

Deery, S. & N. Kinnie (2004). *Call Centres and Human Resource Management. A Cross-National Perspective*, Houdmills/New York: Palgrave Macmillan.

De Grip, A., I. Sieben. & D. Van Jaarsveld (2006) *Labour Market Segmentation Revisited: A study of the Dutch Call Centre Sector*, Maastricht: Research Centre for Education and the Labour Market (mimeo).

Dekker, R., A. De Grip & J.A.M. Heijke (2002). The effects of training and overeducation on career mobility in a segmented labour market. *International Journal of Manpower*, 23, 106-125

Delery, J.E. & D.H. Doty. (1996) Modes of theorizing in strategic human resource management: tests of universalistic, contingency, and configurational performance predictions, Academy *of Management Journal*, 39 (4), 802-835.

Deutsche Direktmarketing Verband (2005). *Wirtschaftszahlen im Bereich Direktmarketing/Telefon-marketing*. Wiesbaden.

Doeringer, P.B. & M.J. Piore (1971). *Internal labor markets and manpower analysis.* Heath Lexington Books, Lexington.

Doms, M., T. Dunne & K.R. Troske (1997). Workers, wages, and technology. *Quarterly Journal of Economics*, 112, 253-290.

Fairris, D. (2004). Internal Labor Markets and Worker Quits. *Industrial Relations*, 43 (3), 573-594.

Fernie, S. & D. Metcalf (1998). *(Not) Hanging on the Telephone: Payment Systems in the New Sweatshops*. London: Centre for Economic Performance, LSE.

Frenkel, S.J., M. Tam, K.A. Shire & M. Korczynski (1999). *On the Front Line: Organization of Work in the Information Society*. Ithaca, NY: Cornell University Press.

Gherardi, L. (1999). The impact of technology on call center training. *Call Center Solutions, Aug.*.

Goose, M. & A. Manning (2003). *Good Jobs and Bad Jobs: Changes in UK Employment 1975-2000*. London: CEP/LSE.

Groot, L.F.M. & A. de Grip (1991). Technological Change and Skill Formation in the Bank Sector, *Economics of Education Review*, 10, 57-71.

Hall, P. & D. Soskice, D. (2001). An introduction to varieties of capitalism. In: Hall, P., Soskice, D. (Eds.) *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford University Press, Oxford, UK, 1-68.

Heckman J.J. (2000). Policies to foster human capital, *Research in Economics*, 54 (1), 3-56.

Hersch, J. (1991). Education Match and Job Match. *Review of Economics and Statistics*, 73, 140-144.

Holman, D., C. Chissick & P. Totterdell (2002). The Effects of Performance Monitoring on Emotional Labor and Well-Being in Call Centers. *Motivation and Emotion*, 26, 57-81.

Holman, D., S. Wood. & C. Stride. (2005). *Human Resource Management in Call Centres*. University of Sheffield: Institute of Work Psychology.

Holtgrewe, U. (2005). *Callcenters in Germany. Preliminary findings from the Global Call Centre Project.* Duisburg: Essen University.

Holtgrewe, U., H. Mottweiler, & J. Scholten (2005). Wir brauchen erstmal die Begeisterung. Informatisierte Arbeit und unsichtbare Qualifikation in Callcentern, *Fiff-Kommunikation*, 4, 15-23.

Holtgrewe, U. & J. Scholten (2005). *Call centres in a co-ordinated economy: Flexible skill, skilled Flexibility.* Paper presented at NWO/SISWO Conference "ICT, the Knowledge Society and Changes in Work", The Hague, June, 9-10, 2005.

Houlihan, M. (2000). Eyes wide shut? Querying the depth of call centre learning. *Journal of European Industrial Training*, 24, 228-240.

Huselid, M.A. (1995) The impact of human resource management practices on turnover, productivity, and corporate financial performance, *Academy of Management Journal*, 38, 635-672.

Ichniowski, C. & K. Shaw (2003). Beyond incentive pay: Insiders' estimates of the value of complementary human resource management practices. *Journal of Economic Perspectives*, 17, 155-180.

Ichniowski, C., K. Shaw, & G. Prennushi (1997) The effects of human resource management practices on productivity: A study of steel finishing lines, *American Economic Review*, 87, 291-312.

Kern, H, & M. Schuhmann (1984). *Das Ende der Arbeitsteilung? Rationalisierung in der Industriellen Produktion*. Munich: Beck.

Lautsch, B. A. (2002). Uncovering and explaining variance in the features and outcomes of contingent work. *Industrial & Labor Relations Review*, 56, 23-43.

Layton, E. T. (1974). Technology as Knowledge. *Technology and Culture*, 15 (1), 31-41.

Lindbeck, A., & D.J. Snower (2000) Multitask Learning and the Reorganization of Work: From Tayloristic to Holistic Organization, *Journal of Labor Economics*, 18 (2), 353-376.

Lynch, L.M., & S.E. Black (1998) Beyond the Incidence of Employer-Provided Training, *Industrial and Labor Relations Review,* 52, 64-81.

MacDuffie, J.P. (1995) Human resource bundles and manufacturing performance: Organizational logic and flexible production systems in the world auto industry, *Industrial and Labor Relations Review*, 48, 197-221.

McKelvey, R.D. & R. Zaviona (1975). A Statistical Model for the Analysis of Ordinal Level Dependent Variables. *Journal of Mathematical Sociology*, 4, 103-120.

Nelson, R.R. (ed) (1993). *National Innovation Systems*. New York: Oxford University Press.

OECD (1999) *Employment Outlook June 1999*, Paris.

Orlikowski, W.J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science* 11 (4), 404-428.

Osterman, P. (1982). Employment Structures within Firms, *British Journal of Industrial Relations*, 20, 349-361.

Osterman, P. (1994). How common is workplace transformation and who adopts it?. *Industrial and Labor Relations Review*, 47, 173-188.

Osterman, P. (2000) Work reorganization in an era of restructuring: Trends in diffusion and effects on employee welfare, *Industrial and Labor Relations Review*, 53, 179-196.

Porter, M. (1990). *Competitive Advantage of Nations*. New York: Macmillan Press.

Richardson, R. & A. Gillespie. (2003). The call of the wild: Call centers and economic development in rural areas. *Growth and Change*, 34, 87-108.

Roland, T. (2000). Call Centres in Europe: Part One. *European Industrial Relations Review*, 320, 13-20.

Sanders, J. & A. De Grip (2004) Training, task flexibility and the employability of low-skilled workers, *International Journal of Manpower*, 25 (1), 73-89.

Shaiken, H. (1985). *Work transformed*. New York: Holt, Rinehart and Winston.

Shields, M. (1998). Changes in the determinants of employer-funded training for full-time employees in Britain, *Oxford Bulletin of Economics and Statistics*, 60, 189-214.

Shire, K., U. Holtgrewe & C. Kerst (2002). Re-Organising Customer Service Work: An Introduction. In U. Holtgrewe, C. Kerst & K. Shire (Eds.) *Re-Organising Service Work: Call Centres in Germany and Britain*. Aldershot: Ashgate, 1-18.

Sicherman, N. (1991). 'Overeducation' in the Labor Market. *Journal of Labor Economics*, 9, 101-122.

Sørensen, O. & N. El-Salanti (2005). *Call Centres in Denmark 2004: Strategy, HR Practices & Performance.* Technical University of Denmark: Department of Manufacturing, Engineering and Management.

Spenner, K.I. (1985). The upgrading and downgrading of occupations: Issues, evidence, and implications for education. *Review of Educational Research*, 55, 124-154.

Taylor, P. & P. Bain (1999). 'An Assembly Line in the Head': Work and Employee Relations in the Call Centre. *Industrial Relations Journal*, 30, 101-117.

Taylor, P., G. Mulvey, J. Hyman & P. Bain (2002). Work Organization, Control and the Experience of Work in Call Centres. *Work, Employment and Society*, 16, 133-150.

Terpstra, D & E. Rozell, (1993) The relationship of staffing practices to organizational level measures of performance, *Personnel Psychology*, 46, 27-48.

Thompson, P., C. Warhurst & G. Callaghan (2000). Human Capital or Capitalising on Humanity? Knowledge, Skills and Competencies in Interactive Service Work. In: C. Prichard, R. Hull, M. Chumer & H. Willmoth (Eds.). *Managing Knowledge. Critical Investigations of Work and Learning*. London: Macmillan, 122-140

Thompson, P. & G. Callaghan (2002). Skill Formation in Call Centres. In: U. Holtgrewe, C. Kerst & K. Shire (Eds.) *Re-organizing Service Work. Call Centres in Germany and Britain*, Aldershot, 105-122.

Thurow, L.C. (1975). *Generating Inequality,* New York: MacMillan.

Van Smoorenburg, M.S.M. & R.K.W. van der Velden (2000). The Training of School-Leavers, Complementarity or Substitution?, *Economics of Education Review*, 19 (2), 207-217.

Veum, J.R. (1995). Sources of Training and Their Impact on Wages. *Industrial and Labor Relations Review*, 48 (4), 812-826.

Walton, R. (1985) From "control" to "commitment" in the workplace, *Harvard Business Review*, 63 (2), 77-84.

Whitley, R. (1999). *Divergent capitalisms: The social structuring and change of business systems*. Oxford: Oxford University Press.

Wilson, J. (2006). *Training and Skills in Contact Centres*. Paper presented at the 7th International Conference on HRD Research and Practice Across Europe. Tilburg.

Wood, S. (1999*)* Human resource management and performance*, International Journal of Management Reviews,* 1 (4), 367-413.

Wood, S., D. Holman, & C. Stride (2006). Human Resource Management and Performance in UK Call Centers, British Journal of Industrial Relations, 44 (1), 99-124.

Youndt, M.A., S.A. Snell, J.W. Dean jr., & D.P. Lepak (1996). Human Resource Management Manufacturing Strategy and Firm Performance, *Academic of Management Journal*, 39 (4), 836-866.

Zuboff , S. (1988). *In the age of the smart machine. The future of work and power*. New York, Basic Books.

Table 1 GCCP dataset on call centers

	Denmark	Germany	UK	US
Number of cases	118	154	167	464
Response rate (percentage)	52.2	51.3	30.1	62.0
Percentage of in-house call centers	72.9	32.7	73.1	86.2
Average number of employees	61.2	141.2	156.8	204.6
Percentage of call centers with largest volume of calls being inbound	82.8	69.7	88.8	85.5
Average number of weeks for full-time CSRs to become fully competent	16.8	16.9	25.8	17.8

Table 2 Training in call centers

	Denmark		Germany		UK		US	
	In-house	Subcontr.	In-house	Subcontr.	In-house	Subcontr.	In-house	Subcontr.
Number of training days for CSRs:								
in initial training in the first year[a]	21.1	19.0	21.8	17.9	27.3	18.8	21.6	13.3
in formal training after the first year[b]	5.9	6.6	11.2	10.8	8.0	8.8	9.8	12.7
Formal training for CSRs on (score 1-5)[c]								
updates on product or service information	3.5	3.6	4.1	3.9	3.8	3.8	-	-
customer interaction skills	3.0	3.4	-	-	3.3	3.1	-	-
interpersonal or team-building skills	2.6	2.4	2.9	2.7	2.6	2.6	-	-

[a] Including orientation/induction and job-related training

[b] Including on-line, vendor, classroom and other formal training

[c] Answering categories: 1 = none; 2 = a little; 3 = a moderate level; 4 = a lot; 5 = a great deal.

- n.a.

Table 3 ICT in call centers

	Denmark		Germany		UK		US	
	In-house	Subcontr.	In-house	Subcontr.	In-house	Subcontr.	In-house	Subcontr.
Customer interaction automation technologies								
Percentage of calls answered by VRU or IVR[b]	4.9	2.6	2.2	0.9	7.5	4.4	10.3	11.3
Speech Recognition[a]	0.0	5.0	10.0	8.0	6.1	9.3	-	-
Work-flow automation technologies								
Work-flow management[a]	11.0	15.0	42.0	43.3	30.4	39.5	-	-
Advanced production technologies								
Media Blending[a]	5.5	5.0	28.5	24.4	8.6	11.6	-	-
Electronic CRM[a]	34.2	40.0	44.0	52.5	27.4	28.6	36.5	42.6
Web-enablement[a]	10.9	20.0	34.0	28.6	14.0	45.5	55.8	56.3
Production technologies excluded from the analysis								
E-mail[a]	84.9	80.0	90.0	88.0	60.8	68.2	87.0	71.9
Fax[a]	61.6	60.0	86.0	86.0	59.8	68.2	91.3	87.5
Voice-over-IP[a]	20.5	35.0	16.0	17.2	14.7	18.6	21.0	19.4

[a] Percentage of call centers that have indicated that CSRs regularly use this type of technology in customer interactions.

[b] Average percentage of customers calls that are completed by Voice Recognition Unit (VRU) or Interactive Voice Response Unit (IVR).

- n.a.

Table 4 Incidence of human resource practices in call centers

	Denmark		Germany		UK		US	
	In-house	Subcontr.	In-house	Subcontr.	In-house	Subcontr.	In-house	Subcontr.
High quality workplace								
General discretion of CSRs (score 1-5)[a]	3.2	3.0	3.3	3.2	2.6	2.5	2.9	2.4
Percentage of CSRs in self-directed teams or quality circles[b]	26.6	25.1	36.2	30.6	22.8	14.1	27.5	17.3
Typical annual earning for CSRs (in euros)	44,026	37,742	34,311	27,241	28,345	29,995	31,326	26,505
Percentage of full-time permanent CSRs	83.0	68.0	61.2	56.4	71.6	70.4	83.2	57.6
Internal Labor Market								
Percentage of CSRs promoted within the call centre	2.8	5.2	4.5	4.6	3.7	6.7	7.9	7.3
Percentage of CSRs promoted within larger organization	3.6	2.0	4.4	2.4	6.6	2.5	3.4	2.8
Percentage of CSRs who quit	8.7	9.3	2.1	6.6	13.7	19.9	11.9	19.5
Quality selection at recruitment								
Percentage of CSRs selected using systematic selection tests	28.0	24.5	36.0	41.8	61.8	62.7	39.2	52.5
Percentage of applicants actually hired	21.9	28.0	24.3	21.9	27.6	41.8	25.6	41.3

[a] Average score based upon CSRs having discretion over (1) the daily work tasks they do; (2) the methods or procedures they use; (3) the speed at which they work; (4) what they say to a customer; (5) setting their daily lunch and break schedule; (6) handling additional requests or problems that arise unexpectedly; answering categories 1 = not at all; 2 = a little; 3 = a moderate level; 4 = a lot; 5 = a great deal

[b] Average percentage of CSRs (1) organized into self-managed or semi autonomous teams (that is teams in which employees supervise their own work and make their own decisions about tasks or work methods); (2) participate with supervisors and managers in task forces, problem solving groups or quality improvement committees.

Table 5 Results of OLS regression analyses on number of initial training days in first year (log transformed)

	Denmark		Germany		UK		US		Total	
	B	(s.e.)	B	(s.e.)	B	(s.e.)	B	(s.e.)	B	(s.e.)
Technology										
Customer interaction automation technologies[a]	.012	(.037)	.037	(.040)	-.009	(.022)	.042 **	(.017)	.026 **	(.012)
Work-flow automation technologies	-.046	(.141)	.011	(.084)	.089 *	(.048)	-	(-)	-	(-)
Advanced production technologies	.041	(.164)	-.023	(.146)	.030	(.083)	.024	(.044)	.023	(.036)
HRM										
High quality workplace	-.005	(.040)	.020	(.043)	.073 ***	(.023)	.002	(.018)	.020	(.013)
Internal labor market	.062 *	(.036)	.057	(.038)	-.007	(.025)	-.015	(.017)	.006	(.012)
Quality selection	.002	(.002)	.003 *	(.001)	.002 ***	(.001)	.002 ***	(.001)	.002 ***	(.000)
Controls										
Inhouse call center (ref. subcontractors)	.045	(.098)	-.003	(.083)	.094 *	(.051)	.173 ***	(.051)	.093 ***	(.032)
Number of employees (in hundreds)	.011	(.061)	.001	(.017)	.001	(.001)	.001	(.000)	.001	(.000)
Largest volume of calls being inbound (ref. outbound)	.201 *	(.120)	.176 **	(.087)	.146 **	(.072)	.186 ***	(.048)	.177 ***	(.034)
Weeks for full-time CSRs to become fully competent	.008 ***	(.003)	.004 **	(.002)	.002 *	(.001)	.007 ***	(.001)	.006 ***	(.001)
Country dummies (ref. US)										
Denmark	-		-		-		-		.058	(.041)
Germany	-		-		-		-		.039	(.038)
UK	-		-		-		-		.087	(.034)
Constant	.755 ***	(.143)	.807 ***	(.094)	.887 ***	(.091)	.630 ***	(.070)	.719 ***	(.048)
R^2 (n)	.300 (n=82)		.152 (n=120)		.284 (n=141)		.227 (n=411)		.222 (n=757)	

[a] For US, customer interaction automation technologies only include use of VRU/IVR

* p < .100; ** p < .050; *** p < .010

- not included in analysis

Table 6 Results of OLS regression analyses on number of formal training days after the first year (log transformed)

	Denmark		Germany		UK		US		Total	
	B	(s.e.)	B	(s.e.)	B	(s.e.)	B	(s.e.)	B	(s.e.)
Technology										
Customer interaction automation technologies[a]	.030	(.040)	.021	(.035)	-.024	(.028)	-.001	(.018)	.001	(.013)
Work-flow automation technologies	.147	(.151)	-.054	(.074)	.005	(.059)	-	(-)	-	(-)
Advanced production technologies	-.017	(.177)	.159	(.127)	-.032	(.105)	.128 ***	(.046)	.110 ***	(.037)
HRM										
High quality workplace	.096 **	(.044)	.021	(.036)	.032	(.028)	-.009	(.019)	.009	(.013)
Internal labor market	.003	(.039)	-.031	(.034)	.052	(.032)	.023	(.018)	.010	(.013)
Quality selection	.000	(.002)	.003 ***	(.001)	.002	(.001)	.001	(.001)	.001 ***	(.000)
Controls										
Inhouse call center (ref. subcontractors)	-.041	(.104)	.037	(.073)	-.024	(.064)	-.078	(.053)	-.035	(.033)
Number of employees (in hundreds)	.073	(.066)	.001	(.015)	.001	(.012)	.001 *	(.000)	.001 **	(.000)
Largest volume of calls being inbound (ref. outbound)	-.221 *	(.128)	-.036	(.076)	.123	(.089)	-.066	(.050)	-.029	(.035)
Weeks for full-time CSRs to become fully competent	.000	(.003)	.002	(.001)	.001	(.002)	.001	(.001)	.001 *	(.001)
Country dummies (ref. US)										
Denmark	-		-		-		-		-.142	(.043)
Germany	-		-		-		-		.028	(.039)
UK	-		-		-		-		-.057	(.035)
Constant	.927 ***	(.154)	.729 ***	(.079)	.620 ***	(.112)	.900 ***	(.072)	.802 ***	(.049)
R^2 (n)	.144 (n=81)		.150 (n=120)		.088 (n=14)		.054 (n=406)		.080 (n=750)	

[a] For US, customer interaction automation technologies only include use of VRU/IVR

* p < .100; ** p < .050; *** p < .010

- not included in analysis

Table 7 Results of ordered probit regression analyses on type of training in Denmark

	Updates on product or service information		Customer interaction skills		Interpersonal and teambuilding skills	
	B	(s.e.)	B	(s.e.)	B	(s.e.)
Technology						
Customer interaction automation technologies	.116	(.275)	.169	(.271)	.183	(.230)
Work-flow automation technologies	-.959	(.887)	-1.405	(.998)	.234	(.895)
Advanced production technologies	.550	(1.066)	.066	(1.081)	-.111	(1.037)
HRM						
High quality workplace	.213	(.259)	.472 *	(.272)	.183	(.258)
Internal labor market	.110	(.232)	.232	(.230)	.419 *	(.231)
Quality selection	.023 *	(.012)	-.003	(.011)	.003	(.011)
Controls						
Inhouse call center (ref. subcontractors)	-.471	(.639)	.069	(.672)	1.164 *	(.648)
Number of employees (in hundreds)	-.099	(.004)	2.046 ***	(.676)	.700 *	(.392)
Largest volume of calls being inbound (ref. outbound)	-.044	(.781)	-3.100 ***	(1.004)	-.924	(.761)
Weeks for full-time CSRs to become fully competent	.018	(.019)	.004	(.020)	-.017	(.017)
Constant not at all / a little training[a]	-.920	(.921)	-3.561 ***	(1.120)	.151	(.921)
Constant moderate level of training[a]	.728	(.916)	-1.107	(1.062)	2.748 ***	(.981)
Nagelkerke Pseudo R^2 (n)	.132 (n=83)		.393 (n=83)		.173 (n=82)	

[a] Reference category for constants is 'a lot / a great deal of formal training'.

* p < .100; ** p < .050; *** p < .010

Table 8 Results of ordered probit regression analyses on type of training in the UK

	Updates on product or service information		Customer interaction skills		Interpersonal and team-building skills	
	B	(s.e.)	B	(s.e.)	B	(s.e.)
Technology						
Customer interaction automation technologies	-.229	(.183)	-.019	(.167)	.044	(.168)
Work-flow automation technologies	-.115	(.407)	-.658 *	(.359)	-.127	(.369)
Advanced production technologies	.429	(.740)	.356	(.626)	.514	(.636)
HRM						
High quality workplace	-.073	(.188)	-.116	(.168)	.294 *	(.176)
Internal labor market	.243	(.207)	.125	(.168)	.270	(.172)
Quality selection	.007	(.007)	.004	(.006)	.000	(.006)
Controls						
Inhouse call center (ref. subcontractors)	-.416	(.457)	-.104	(.380)	.435	(.403)
Number of employees (in hundreds)	.029	(.084)	.096	(.078)	.082	(.072)
Largest volume of calls being inbound (ref. outbound)	.332	(.625)	-.097	(.540)	-.222	(.554)
Weeks for full-time CSRs to become fully competent	-.015	(.010)	.000	(.009)	-.013	(.010)
Constant not at all / a little training[a]	-2.408 ***	(.810)	-1.103	(.679)	-.091	(.697)
Constant moderate level of training[a]	-.616	(.770)	.733	(.675)	1.820 **	(.716)
Nagelkerke Pseudo R^2 (n)	.058 (n=144)		.048 (n=144)		.083 (n=144)	

[a] Reference category for constants is 'a lot / a great deal of formal training'.

* p < .100; ** p < .050; *** p < .010

Appendix

Variables used in the analyses

Training

- Initial training: log transformation of the number of initial training days for CSRs in the first year.
- Ongoing training: log transformation of the number of formal training days for experienced CSRs per year.
- Type of training: amount of training provided for CSRs in the following areas: a) updates on product or service information; b) customer interaction skills (such as handling difficult customers, negotiating skills); c) interpersonal or team-building skills; answering categories: none or a little (combined); a moderate level; a lot or a great deal (combined).

ICT

- Customer interaction automation technologies: index constructed out of the mean of two variables (standardized per country):
  - percentage of daily customer calls completed by a Voice Recognition Unit (VRU) or Interactive Voice Response Unit (IVR);
  - regular use of speech recognition by CSRs to interact with customers (yes/no); information not available for the US.
- Work-flow automation technologies: regular use of work-flow management by CSRs to interact with customers (yes/no); information not available for the US.
- Advanced production technologies: index constructed out of the mean of three variables:
  - regular use of media blending by CSRs to interact with customers (yes/no);
  - regular use of electronic Customer Relationship Management by CSRs to interact with customers (yes/no);
  - regular use of web-enablement (joint browsing, chat, instant messaging) by CSRs to interact with customers (yes/no).

HRM

- High quality workplace: index constructed out of the mean of four variables (standardized per country):
  - average score on extent to which CSRs typically have discretion over a) the daily work tasks they do; b) the methods or procedures they use; c) the speed at which they work; d) what they say to a customer; e) setting their daily lunch and break schedule; f) handling additional

requests or problems that arise unexpectedly ; answering categories are 1 = not at all; 2 = a little; 3 = a moderate level; 4 = a lot; 5 = a great deal;

- average percentage of CSRs a) organized into self-managed or semi autonomous teams (that is teams in which employees supervise their own work and make their own decisions about tasks or work methods); b) participate with supervisors and managers in task forces, problem solving groups or quality improvement committees;.
- typical annual earnings for CSRs in euros;
- percentage of full-time permanent CSRs.

- Internal labor market: index constructed out of the mean of three variables (standardized per country):
  - percentage of permanent CSRs that were promoted to other jobs in the call center in the previous year;
  - percentage of permanent CSRs that were promoted outside the call center or transferred to other parts of the business in the previous year;
  - inverse of percentage of permanent CSRs that quit in the previous year.
- Quality selection: index constructed out of the mean of two variables:
  - percentage of CSRs that have been selected using systematic selection tests (such as psychometric tests or aptitude tests);
  - inverse of percentage of people who apply for CSR jobs at the call center that actually get hired

Controls

- In-house call centers: call center described by respondent as an in-house centre providing services to own company (as opposed to a subcontractor providing services to other companies – reference category).
- Size of call center: total number of employees, divided by 100.
- Inbound calls: largest volume at call center being inbound calls (as opposed to largest volume of calls being outbound calls – reference category).
- Job complexity: number of weeks it takes full-time CSRs to become fully competent on the job, e.g. so that they are able to train someone else.

Notes

[1] Osterman (1994, 2000) defines these 'core workers' as the largest group of non-supervisory, non-managerial workers at the establishment of a firm who are directly involved in making the product or providing the service.

[2] We excluded skill requirements in our definition of a high quality workplace because we intend to analyze the relation between HR practices and CSRs' training participation without running the risk of ending up with a tautology. Moreover, the data we have on CSRs' educational backgrounds has some drawbacks, as it is measured as the typical educational level of CSRs. Qualitative information from several case studies in e.g. Denmark and Germany, however, shows that most call centers employ both low and high educated CSRs, which makes it difficult for call center managers to asses the typical educational level for CSRs. In addition, the four countries studied here all have different educational systems, which make it difficult to compare CSRs educational backgrounds across countries.

[3] As mentioned in note 1, the measurement of CSRs' educational backgrounds is problematic.

[4] The correlation between the number of initial training days in the first year and the number of formal training days after the first year is significantly positive: r = .44 for Denmark; r = .23 for Germany and the UK; r = .13 for the US.

[5] The number of weeks it takes CSRs to become fully competent in their jobs seems to be the most direct measure of job complexity in the dataset. Information is available on other variables that could be proxies for job complexity too, such as customer segment, call duration, and CSRs' educational level. However, these variables turn out to be not very closely related to each other. For example, call duration might be very high in subcontracting call centers that perform standardized survey services, which is not complex work at all.

[6] For the US, information about regular use of speech recognition is not available. To make sure that this does not obscure the outcomes, we also performed regression analyses with use of speech recognition not included in the customer interaction automation technologies index in Denmark, Germany, and the UK. The results of these regressions lead to the same conclusions: customer interaction technologies do not affect initial training in these countries.

[7] Information about work-flow management is not available for the US. We estimated regression analyses without work-flow management for the other countries too, but this didn't influence the results. In addition, analyses without the inclusion of customer interaction automation technologies also showed about the same outcomes.

[8] Originally, the answers to the question "how much formal training do you provide for the typical core employee in the following areas: a) updates on product or service information; b) customer interaction skills; c) interpersonal or teambuilding skills?" were 1 – none, 2 – a little, 3 – a moderate level, 4 – a lot, 5 – a great deal. We collapsed these categories into three because of the low number of call centers reporting none or a great deal of training.

[9] The questions on type of training were not asked to call center managers in the US. In Germany, we only have information about formal training on updates of product or service information and on interpersonal and teambuilding skills. However, the number of call centers providing none or a little training on product or service updates is so small, that the model cannot be estimated for Germany.