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9. LIFELONG LEARNING AND SKILLS DEVELOPMENT IN THE CONTEXT OF INNOVATION PERFORMANCE

An International Comparison

INTRODUCTION

Thematically this article is located at the intersection of three broader topics: the changing demographics in the workplaces, particularly workforce ageing; job-related skills and competence, and; learning, creativity and innovation for individual and societal productivity and prosperity. The starting point here is the situation in which the proportion of ageing workers (40-plus) in workplaces is increasing. This trend is accelerating in many countries in the years to come (UN, 2013). This is happening at a time when "skills have become the global currency of 21st century economies" (OECD, 2012a), the key to productivity and employment (ILO, 2008), and innovation activity is both accelerating and being sought for economic progress, prosperity and well-being (OECD, 2012b) – and when a modest economic recovery is forecast for Europe towards 2020 (EC, 2014a). The European Union's growth strategy *Europe 2020* (EC, 2010) addresses these issues through at least two of its seven flagship initiatives, An Agenda for New Skills for New Jobs and Innovation Union.

While there is a solid body of research on the relationship of job-competence and innovation, research connecting the relationship explicitly to workforce ageing is very limited. However, some studies do exist. Examples are an analysis of the relationship between employee age (older workers) and attitudes and reaction to implementation of a new information technology initiative/innovation in a workplace, seeking to "promote innovative processes that may help organizations be more competitive in the modern marketplace" (Rizzuto, 2011: 1612), and Henseke and Tivige's (2007) research on innovation patents as a function of age of the innovators and sector.

From the research on the three themes separately, a rather ambiguous view emerges on ageing workers, and how their job-performance could be related to the call for higher skills and promotion of innovation ability and activity (Tikkanen, 2011a). Predominantly, though not only, we could expect older workers – with their 'lacking' and/or 'obsolete' skills – to report of stronger learning and development needs, but at the same time – with their 'less positive learning attitudes' and 'eroded learning skills' – lower interest in skills development than younger workers. The Science-Technology-Innovation (STI) approach (OECD,

B. Schmidt-Hertha et al. (Eds.), Learning across Generations in Europe, 95–120.

2010a), presents innovation as an activity carried out in higher education institutions, by young people, and inseparable from development of high technology and sciences. As Henseke and Tivig (2007) point out, if we are to believe that science and engineering are only for young people, the ageing society will pose a serious concern for innovation and creativity.

It is to these challenges that this article aims to contribute to with an empirical study, based on a new data from the *Programme for the International Assessment of Adult Competencies (PIAAC)* by the OECD (2013a). Two research questions will guide the study. Firstly, to what extent is there age-related variation in employees' job-related learning needs and skills development practices? Secondly, to what extent, if any, is the age-relationships with learning needs and skills development related to innovation performance in Europe? There is evidence from previous research (Cedefop, 2012a; Lundvall & Lorenz, 2012) on a link between learning at workplaces and innovation on a national level. This study aims to provide new knowledge by examining this relationship further against workforce ageing in Europe.

The chapter is structured into four main parts. The first part illuminates existing research and theoretical approaches on the three overlapping themes, divided into three sections accordingly. Section one describes the greying of the workplaces in the light of statistics, section two the concept(s) and status of skills, competence, job performance of ageing workers. Job performance has been given more attention, due to its centrality in the context of innovation capability. The third section highlights skills development practices through lifelong learning participation in the context of older workers' employment and national innovation performance and creativity. The second part of the article presents the research methodology and the third research findings. The final part is discussion and describing conclusions with a suggestion for further research.

WORKPLACES ARE GETTING GREY

Population ageing is expected to pose a serious threat to macroeconomic performance and competitiveness in European countries (European Foundation, 2008), and the pace of this change is expected to accelerate in the coming years (UN, 2013). The age-group 60-plus years is increasing and already exceeds 25% of the population in Germany, Italy and Japan, which have the highest median ages in the world (already in 2010 more than 50% of the population in Japan was over 45 years of age) (UN, 2013). European population median age is expected to rise to 49.3 years by 2060 from 40 years in 2010 (Statistical spotlight, 2013). Due to the demographic trends of ageing of the baby-boomers and simultaneous decline of young people under 30 years of age, from 2013/2014 onwards the European working age (15-64 year olds) population has started to shrink (EC, 2011). It is expected to fall by about 50 million, to 56% of the total population, while the population older than 65 will increase by more than 60 million, to 30% of the total population, within the next about 40 years by 2050. As baby-boomers will exit the workforce at about the same time, a critical labour shortage is

expected, already by 2030 of some 20.8 million people of working age in the European Union. (European Foundation, 2008), most significantly in high-skill occupations (Cedefop, 2012b). The trend is global. According to the estimations by McKinsey (2012) by the year 2020 there will be a potential shortage of about 16–18 million high-skill workers in advanced economies (high in GDP per capita and high educational attainment) and of another 23 million college-educated workers in China alone.

Meanwhile, workplaces are getting grey. Historically, this is a completely new situation (OECD, 2006), calling in itself for new knowledge, creative thinking and innovative solutions (Tikkanen, 2011a). The demographic trends have been active for long, but the outcomes have really started to show in a larger scale only recently. In the future, the age group 60+ years is expected to remain in working life still a good many years to help to balance the labor market imbalance (Cedefop, 2010a) – a point made explicit in the recent pension reforms in many European countries. Furthermore, for many older workers personal financial reasons (Brown, 2012; Sok, 2010) make it necessary to keep on working towards their late 60s and even beyond.

Clearly, employers and management, as well as societies as whole, will face major new challenges – and opportunities – along with the demographic change (EC, 2007; OECD, 2006). Many countries are facing a situation where securing adequate labour force in the future requires either increasing the immigration of (young) skilled labour (Zaidi, 2008) or extending the job careers of senior workers – or both. There are examples of both kinds of development already taking place (Tikkanen & Billett, 2014). There is also evidence, showing that companies' human resources policies have started to change as they work towards attracting and retaining high-skilled labour, especially in the areas of skills-in-demand (Restrepo & Shuford, 2012; Shapiro et al., 2011).

WORKPLACE LEARNING FOR SKILLS AND COMPETENCE DEVELOPMENT

Skills and Competence

The concept of skills has entered the economic and socio-political agenda the last years for fostering innovation (McKinsey, 2012; OECD, 2011, 2012b, 2013a). In the on-going competition for talents and "best heads", as well as the strong focus on skills and competence, the demographic development is a strong undercurrent. While there are generic skills or domain-independent knowledge, a relevant question in this context is to what extent is it possible or makes sense to make general arguments about older workers' skills and their sufficiency, given the variety of domain specific knowledge and job-related skills, as well as their wealth of experience-based knowledge. What do we mean by skills and competence?

The concepts *competence* and *skills* are often used interchangeably (OECD, 2013b). Yet, competence (in singular) is generally, and particularly in the Nordic countries, understood as a significantly larger concept comprising of knowledge, skills, and attitudes. Although widely and commonly used, an exhaustive,

unanimous definition of the concept in this broad sense is difficult, regardless of the many efforts made (for an analysis, see OECD, 2013b: 93-98). Beside the challenges in its theoretical conceptualization, in an international context additional challenges are introduced by the cultural, lingual and socio-economic differences. Consequently, many meanings are attached to *job-competence* (Ellström, 1997; Ellström & Koch, 2008). This fact makes it also difficult to measure job-competence in a reliable way. Consequently, an emphasis of the choice for the narrower concept of *skills* (or job-skills) by for example the European Commission (Cedefop, 2012b) and the OECD (2012a, 2013a, 2013b) in their recent work, is highly understandable.

In this paper we have used the two concepts side-by-side, yet the concept of job-competence in the broad sense described above. With skills we refer to narrower, specific elements in one's total competence. Thus, we follow the recent OECD's definition. Their current program on adult learning is titled *the Programme for the International Assessment of Adult Competencies* (PIAAC), but the empirical survey carried out as a part of it is titled *Survey of Adult Skills* (OECD, 2013b). In PIAAC the two concepts are used interchangeably (OECD, 2013b).

The prevailing theoretical perspectives on competence propose that it is the workplace where the most important, continuous learning and job-competence development – as well as competence stagnation – takes place (for an overview, see Malloch et al., 2011). In this view, the discussion of the competence and job-performance of older workers – or workers of any age, for that matter – cannot be separated from the context of their jobs and work organizations. By time, a person's initial competence at the time of recruitment is shaped by his or her job-tasks, on the context of the job-tasks, workplace and organization. Thus, albeit often treated as an individual matter, especially in the case of older workers, job-competence at any point of time should be treated as a shared responsibility between the individual and his or her organization (employer/management). Thus, a definition of *skills* and *job-competence* is crucial when thinking about the job-performance of ageing workers and its development.

In line with Ellström's (1997) conceptualization of "competence-in-use", job-competence is here understood as a process rather than an end state, and a person's potential, rather than something that an individual, or collective, has or has not (as can be the case with single skills). What we give of ourselves at our work at any time (competence-in-use), can vary a good deal from day to day and periodically in our lives, depending both on individual, job-related, and organizational factors. To an extent, then, a person's job-competence can be viewed as socially constructed (Ellström, 1997). Therefore, an assessment of job-performance of ageing workers is not only a matter of setting their particular knowledge, skills and attitudes/ aptitudes (OECD, 2013b) under the loop, but as importantly their job and organization-related aspects, including the social and socio-cultural context.

Job-performance of Ageing Workers

Limited research, stereotypes prevail. Conceptual and methodological challenges are largely behind the limited research and thereby systematic, 'objective' knowledge on the *overall* job-performance of ageing workers. Consequently, much of the discussion has been colored by stereotypic thinking on ageing and older people. Age-stereotypes in the context of workplace can be powerful in influencing on both co-workers' attitudes and management's decisions on recruitment and lay-off situations, as well as on human resources development and provision of job-related learning opportunities. As known, even older workers by themselves may carry and live these attitudes as self-fulfilling prophesy. The most commonly held stereotypes on older workers depicts them as with a decline in competence and vitality, on the one hand, and with gains in wisdom and experience on the other hand (Hummert, 2011). The former views have been dominating, especially concerning ageing workers in non-managerial positions, setting their job-performance in ambiguous light (McDaniel et al., 2012; Posthuma & Campion, 2009; Skirbekk, 2003). Negative attitudes are still widespread, especially among employers, and there is evidence of ageism even in the public employment services in several countries (Eurobarometer, 2012; Furunes & Mykletun, 2007; OECD, 2006; Rix, 2005; Taylor & Walker, 1994; Tikkanen, 2011b; Walker, 1997; Zaidi, 2008). Job-skills of older workers have been viewed as obsolete and/or lacking, their learning attitudes less positive, with weaker learning and other mental abilities, and they have been generally viewed less adaptable and as less fit for their work (Cedefop, 2010a; OECD, 2006; Posthuma & Campion, 2009; Taylor & Walker, 1994), particularly due to physiological decline and health limitations (Findsen, 2006) compared to their younger counterparts. However, stereotypes vary across cultures. For example Asian cultures have more positive views on ageing than Western countries (Hummert, 2011).

Often viewed as less productive, but the picture is ambiguous. Not surprisingly then, it is commonly believed, particularly by employers, that ageing workers are less productive than younger workers (Henseke & Tivig, 2007; OECD, 2006; Posthuma & Campion, 2009). Yet, there is no systematic knowledge on how age is related to productivity (Zacher et al., 2010). Indeed, measuring this relationship is complex (McDaniel et al., 2012), not least due to the broad spectrum of behaviors forming job-performance (Ng & Feldman, 2008). Existing research suggests that there is a moderate positive relationship between age and performance (Waldman & Avolio, 1986), that age is largely unrelated to performance (McEvoy & Cascio, 1989), and that age-performance relationship has an inverted U-shape (Sturman, 2003, quoted in Ng & Feldman, 2008). Reasons suggested for these different findings are that studies have focused on different behaviors, and overall, narrowly so, and that research methodology as well as data and data-collection characteristics have been different, e.g. focusing on different types of work within different research designs (Ng & Feldman, 2008).

More coherent picture with meta-analyses, though methodological challenges prevail. To provide a more coherent picture of the age-performance relationship, Ng and Feldman (2008) carried out a large meta-analysis (380 studies reviewed), including ten dimensions of job-performance. They found out that age was generally unrelated to core tasks performance, creativity, and performance in training programs. A stronger relationship was revealed to the other seven dimensions. Job performance of older workers was more positive than that of younger workers in a number of key dimensions. Older workers were slightly more likely to help other employees (pro-social behaviour), more likely to comply safety rules, less likely to experience work injuries, less likely to participate in counterproductive work behaviour, less likely to be aggressive, less likely to participate in substance abuse, much less likely to be tardy or to be absent from work, and were slightly more likely to have sickness-related absences.

A more recent meta-analysis by McDaniel and colleagues (2012) showed that the message from the literature on age-related decline in capacities is clearer than that on the job-performance of older workers. Furthermore, an inverted U-relationship between age and job performance has been shown to be 'most likely' is in the area of cognitive aging (McDaniel et al., 2012: 280). While this view has dominated the research on age-stereotypes for over 30 years (Hummert, 2011), it has been criticized for some methodological weaknesses. This research shows that cognitive development (as human development overall) is highly individual, generally starting to take place on healthy individuals only after the age of 60 years or even 70 years, and it is strongly dependent on the job context and organizational factors, as well as individual lifestyle (Eurobarometer, 2012; Krampe & Charness, 2006; Warr, 1994).

To illustrate the complex interrelatedness of age, job-performance and job characteristics, Warr (1994) has developed a simple taxonomy (Table 9.1).

Table 9.1. Warr's (1994) taxonomy of age, job performance, job characteristics. Adapted from McDaniel, Besta and Banks (2012).

Job-related capacities decline with age	Job experience aids job performance	Relationship between performance and age	Illustrative job content
No	Yes	Positive	Knowledge-based judgments with no time pressure
Yes	Yes	No relationship	Skilled manual work
Yes	No	Negative	Continuous, paced data processing
No	No	No relationship	Relatively undemanding activities

The model introduces two moderators that interact with age to influence job-performance. One is the extent of job-related capacities' decline with age, as discussed above, and the other the extent to which job experience affects job-performance. The model suggests that in efforts to maintain older workers' job performance, it is important to work with these moderators.

Age-decline in skills proficiency? Findings from the new PIAAC-study (OECD, 2013a) provide a very recent, more nuanced and likely more reliable picture of older workers' skills compared to younger workers than perhaps any study ever before. The study is the largest ever skills survey conducted, comprising of 100,000+ adults in 24 countries, and with a rigorous sampling design. It included a comprehensive background questionnaire, allowing for *subjective* skills/competence measurements. Furthermore, a comprehensive cognitive skill battery was included as an *objective* skills measure. These two allow for comparing objective and subjective measurements of skills/competence and their matches.

Skills proficiency was measured in regards literacy, numeracy and problem-solving in technology rich environments (PS-TRE). The findings showed a general, relatively steady decline in all three skills proficiency domains from the youngest (16 years) to the oldest age (65 years) after adjusting for educational attainment, language and foreign background. However, there was large variation across countries, although most variation was observed within countries. For example, in literacy Japan scored best of all countries in the oldest age group (55-65 years) – and even better than the youngest (16-24 years) in the UK, Ireland, Italy, Spain and the USA. Further, gender differences in skills proficiency were found mainly among the older age groups (35 years and onwards), with women scoring lower than men in most countries.

In numeracy the age-trend was similar but the gap between youngest and oldest age groups was smaller than in literacy, and again the country differences were large and gender differences largest among the oldest (55-65 years). Worryingly, in two countries, the UK and the USA, numeracy proficiency among the oldest (55-65 years) was higher than in the youngest age group (16-24 years). This suggests that their education systems have not improved at a rate comparable to that in other OECD countries.

When it comes to *skills use at work* (subjective measures), older workers used less information processing skills (comprising reading, writing, numeracy, ICT and problem-solving) than prime-age workers (25-54 years) but more than the youngest workers (16-24 years). Surprisingly, older workers used even more information and communication technology (ICT) skills than the youngest workers. The use of generic skills (task discretion, learning at work, skills in influencing, cooperation and self-organizing, dexterity, physical skills) was more common among older than prime-age workers.

When interpreting these results, one needs to keep in mind that, due to the cross-sectional research design, the age-differences are not necessarily an indication of an evolvement of skills as a function of age. Rather they are colored by

generational and cohort effects (e.g. development of educational systems throughout the times).

Ageing workers and skills mismatch. Besides skills as such, the thematic of skills mismatch has gained increasing attention the recent years. The rationale here is that skills, even high skills, alone do not turn into productivity unless they are put in proper use, matching with job's requirements (OECD, 2013a). This perspective is highly relevant in regards competence of older workers. If we are to believe the stereotypes of ageing workers, they should be more often underskilled (not adequate skills to perform their job) than overskilled (have skills to perform more demanding tasks than what the current job requires). Cedefop (2010a) has carried out a study of skills-mismatch of the "silver workers". Their findings showed that firstly, (self-reported) underskilling was lowest (around 10%) among the oldest workers (50+). Secondly, ageing workers were also less likely to be overskilled than prime age workers. However, when they held degrees, they were more likely to be overskilled than those with lower qualifications. Furthermore, overeducation (higher formal qualifications than work requires) was more prevalent for older than younger men.

More generally, skills obsolescence is shown to be more common in high-tech than low-tech industries, and greater among more educated workers. There is evidence that it is the type of education rather than its length that matters for skills obsolescence (less skills depreciation with academic than with vocational degrees), and that skills obsolescence is more strongly related to knowledge-based job tasks (especially technical knowledge) than experience-based job tasks (Cedefop, 2010a). Interestingly, while it is reasonable to expect training to contribute to new skills and skills development, as well as to a better skills-match, this does not seem to be the case. In Cedefop's (2010a) analysis, training did not reduce skills mismatch, nor lead to less underskilling. Furthermore, overeducated workers received training more often, but the relationship was less clear for ageing workers.

An area where skills mismatch (underskilling) of ageing workers is perhaps most salient is information technology (IT) and computer skills. The "grey digital divide" points to the gap between the actual and needed IT-skills among older adults, a gap expected to be widening in the future (Rizzuto, 2011). PIAAC (OEDC, 2013a) showed that in nearly all countries at least 10% (range 7-27%) of adults lack the most elementary computer skills (e.g. the ability to use mouse). Older people generally had lower proficiency in problem solving in technology-rich environments, but in some countries differences between older and younger people were very small.

In sum, the picture of the job-performance of older workers is ambiguous. There is some evidence for both age-increase and age-decline in regards the various job-related skills. In the absence of longitudinal studies on the age-relationship, again, we should be careful in making strong conclusions about the effects of age *per se*. Rather, job-performance of mature workers seems conditioned by the demand for and use of their skills in their job tasks, nature of work and industry, as well as by

development opportunities at work, various organizational factors, and even the country where they work.

Skills Diversity Promoting Innovation

Human resources management will be increasingly challenged by a more diverse workforce, not only due to the ageing of the labour force, but also due to increased labour mobility and labour participation of women. Inasmuch, workforce diversity is important to creativity and innovation as suggested by the DUI (doing-using-interacting) approach to innovations (Lorenz & Lundvall, 2009; Lundvall & Lorenz, 2012), great opportunities lie in this new situation. The diversity edge is at the core in knowledge management and in age-diversity management (age-management). Both aim at tackling the skills challenge, and the consequences from the demographic development to companies' skills pools, and their capability for knowledge creation and innovation (Cedefop, 2010a; Naegele & Walker, 2006; Tikkanen, 2011a).

Clearly, employers' attitudes towards older workers and their views on productivity and capability beyond midlife (Zaidi, 2008), as well as their success in managing the workforce diversity will play a major role in to what extent ageing workforce will turn out to be opportunity rather than a threat (Tikkanen, 2011a). Indeed, employers' negative attitudes may have an adverse effect on the official efforts to promote the employment of older workers (Rix, 2005). Unfortunately, there is some evidence showing that stereotypes on ageing workers, held by management, are a main factor behind the modest result from age-diversity management in the new millennium (Furunes & Mykletun, 2007).

SKILLS DEVELOPMENT AND INNOVATION ABILITY IN EUROPE

Productivity, skills, and continuous learning in and for work are highly interrelated. The EU strategic goals (benchmark) for participation in lifelong learning (LLL), formulated in the *Education and Training 2020 Programme* (ET2020) (EC, 2013), is set at an average of at least 15% of adults (age group 25-64). Several countries are already there, in particular in the Northern Europe, while many others still have a long way to go. Cooperation across the traditional disciplinary boundaries is called for in efforts to effectively combine LLL, innovation, creativity and entrepreneurship. In this chapter we will take a "cross-disciplinary" look at the situation of ageing workers in Europe, on the one hand, on the context of participation in LLL, including continuing vocational education and training (CVT), and in employment. On the other hand, we shall make national and cross-national comparisons of this performance against indicators of creativity and innovation used by economists. This analysis will, firstly, give us information about the status of ageing workers' participation in skills development in different countries. Secondly, it allows us to find out about possible connections between skills development and employment rates among ageing workers, on the one hand, and between their skills development and creativity and innovation, on the other

hand. Thirdly, it allows comparison across European countries. The data is presented in Table 9.2.

Ageing Workers' Participation in Skills Development in Europe

Ranking of the countries in Table 9.210.2 is made on the basis of LLL participation among those aged 45-54 years. Participation rates are presented in three age groups: prime age workers (25-49 years) and younger-older (45-54 years) and older-older workers (50-74 years). Due to the categorizing that was available in Eurostat database, there is some age-overlap between the categories. The statistics show a negative relationship with age in LLL participation (Table 9.2). Secondly, there is key variation in LLL participation across the Europe. Thirdly, the countries can be grouped into four different levels according to their participation rates in the age-group 45-54 years. The highest rates, from above 20% to closer 30%, are found in the Nordic countries, with the exception of Norway. The second group comprises of countries with participation rates between 15 and 20% (NO, FR, UK, NL), and the third from closer to 10% to less than 15% (LU, AT, SL, CR, ES, EE, PT). The remaining countries with lowest participation rates, about 5% and below, present half of all the remaining countries. As LLL here refers to all education and training in general, the rates for participating in CVT[I] provided by employers in enterprises, are shown separately. CVT is likely to be the most important channel for skills development of older workers.

Table 9.2. Participation rates in lifelong learning (LLL)[A] and continuing vocational training (CVT) by age, innovation performance, as well as employment rates of older workers in Europe. Ranking by the LLL participation in the age-group 45-54 years (in %).

Country	Participation				Employ-ment rate 55-64 yrs	Innovation performance (2014) [B]	Creative workers from population[C]
	Lifelong learning			CVT[D]			
	25-49	45-54 (*rank*)	50-74 (2013)	55+ yrs (2005)			
EU28	12.6	8.7	8.2	(33)	50.1	Moderate	51[C]
Denmark	35.5	28.7	26.1	38	61.7	Leader	70
Sweden	31.8	25.8	21.6	41	73.6	Leader	82
Finland	30.0	24.0	20.0	38	58.5	Leader	66
Iceland	28.9	23.0	19.9	n.a.	81.1	Follower	n.a.
Norway	23.9	18.1	15.7	39	71.1	Moderate	n.a.
France	20.3	16.6	14.7	n.a.	45.6	Follower	63
UK	18.1	15.8	13.5	30	59.8	Follower	51

Netherlands	20.9	15.2	13.3	27	60.1	Follower	67
Luxembourg	17.6	12.1	8.1	39	40.5	Follower	60
Austria	17.1	11.5	9.3	25	44.9	Follower	50
Slovenia	15.7	9.2	9.9	37	33.5	Follower	50
Czech Republic	11.8	8.7	7.8	60	51.6	Moderate	40
Spain	13.2	8.2	6.9	36	43.4	Moderate	35
Estonia	16.4	8.1	6.7	19	62.6	Follower	58
Portugal	12.6	7.3	5.7	31	46.7	Moderate	46
Belgium	8.2	5.4	5.6	37	41.7	Follower	60
Ireland	8.7	5.3	3.7	n.a.	51.3	Follower	58
Germany	10.6	5.0	3.7	27	63.5	Leader	52
Malta	9.9	4.9	5.4	39	35.9	Moderate	70
Latvia	8.2	4.5	4.1	14	54.8	Modest	53
Cyprus	8.5	4.4	4.4	20	49.6	Follower	42
Italy	7.7	4.3	4.9	38	42.7	Moderate	37
Lithuania	7.3	3.8	3.5	16	53.4	Moderate	35
Poland	6.3	2.1	1.9	23	40.6	Moderate	43
Slovakia	3.8	1.8	1.9	48	44.0	Moderate	33
Hungary	4.3	1.8	1.2	13	38.5	Moderate	44
Greece	4.1	1.4	2.1	15	35.6	Moderate	39
Romania	2.7	1.1	1.7	21	41.5	Modest	35
Croatia	4.4	0.6	0.8	n.a.	36.5	Moderate	n.a.
Bulgaria	2.6	n.a.	n.a.	21	47.4	Modest	39

[A)] Lifelong learning refers to persons of the indicated age-groups who stated that they received education or training in the four weeks preceding the survey (EC, 2013). [B)] Innovation Union Scoreboard (IUS) 2014 (EC, 2014b). [C)] Creativity at work in EU27 (Lorenz and Lundvall, 2009); [D)]As a percentage of employees in enterprises. Source: Eurostat/EC (2014b) [B] – Updated from Tikkanen (2011a) (Cedefop, 2010b).

Compared to LLL, the cross-country differences in the participation rates of ageing workers (55+) are smaller and the rate of older workers' participating in CVT throughout Europe is generally higher. The highest rates are found in Czech Republic (60%) and Slovakia (48%). The next level, participation around 40%, is common in a range of countries, while in the remaining countries the rates vary between around 13 and 30%. Clearly, Europe seems still divided into several layers when it comes to making LLL a reality, not only but also for its ageing population.

Skills Development and Employment Rates vs. Creativity and Innovation

The employment rates of ageing workers (55-64 years) in Europe show also large cross-country differences (Table 9.2). The highest rates (70-80%) are found again in the Nordic countries. There are a range of countries with employment rates around 60%, followed by those on around 30-40%. The cross-country differences are smaller than with LLL. Yet, there seems to be a positive relationship between ageing workers' employment rates and their participation in LLL in Europe. Finally, Table 9.2 allows us to compare the participation rates in skills development and employment of ageing workers with innovation performance and creativity. For innovation performance the Innovation Union Scoreboard (IUS) 2014 (EC, 2014b) rankings were used (for the sets of performance indicators, see EC, 2014b).

Of the four levels, the best performing countries, Innovation Leaders, are highlighted in the table (EC, 2014b). Creativity is also used to indicate a country's innovation performance. The measure is developed by Lorenz and Lundvall (2009). It describes a nation's 'capacity for knowledge development' with a range of variables (problem-solving activities, learning new things, undertaking complex tasks, using one's own ideas, able to choose one's work methods and the order of one's tasks). *Creative workers* were those scoring high (high activity) in these variables. The measure is based on the fourth *European Working Conditions Survey* from 2005 (European Foundation, 2007), and shows the proportion of creative workers from the country's population.

Innovation performance varies greatly across the countries (Table 9.2). The variation in creativity seems less pronounced, yet notable. Interestingly, with the exception of Germany, all Innovation Leaders are also countries where the rates for LLL and ageing workers' employment are among the highest, as are the rates of creative workers in the population. Correspondingly, the countries with lowest innovation performance (Modest Innovators) are also countries were participation in LLL and CVT of ageing workers are among the lowest. The performance of Germany, one of Europe's four Innovation Leaders, ranks on a European average in creavity and skills development, thus with a large difference to the other three Innovation Leader countries. Lorenz (2012) has suggested that an explanation to this may be related to the different welfare regimes between the Nordic countries and Germany: the latter with a conservative welfare regime, while in the former a combination of active labour market policies through lifelong learning and continuous vocational training "to promote mobility of workers from unproductive

to productive occupations and sectors" (Lorenz, 2012: 77). Furthermore, the "flexibility of [the Nordic countries'] local labour markets, which promote diversity in the enterprise knowledge base", as Lorenz (2012: 77) suggests, may be related to their success in innovation (high-tech sectors, ICT). The higher rates of ageing workers' employment rate in those countries may be a reflection of this.

A deeper analysis of these interesting intersections is beyond the scope of this paper. What we can conclude here is that although the data presented in Table 9.2 comes from different sources, they seem consistent: in the countries which succeed in linking LLL, innovation and creativity, also older workers' participation is high in learning and work.

METHODOLOGY

Data

The study presented here is part of an ongoing (2014-2017) research project, *Skills development for realizing the workforce competence reserve* (SkillsREAL), financed by the Norwegian Research Council. The data used in SkillsREAL and the analysis presented in this paper are from the *Programme for the International Assessment of Adult Competencies* (PIAAC) by OECD (2013a). PIAAC is continuation to the previous adult education surveys by OECD: the *Adult Literacy and Lifeskills Survey* (ALL) and the *International Adult Literacy Survey* (IALS). The data was collected face-to-face through interviews from around 166.000 adults, aged 16-64 years, from more than 20 countries (OECD, 2013a). The analysis presented here is limited to those aged 40-65 years and currently working and by country/region. We selected only those PIAAC countries, which were also included in the IUS in Europe (EC, 2014b). This selection resulted in a total sample size of about 45000.

Measures

The variables included in the analysis are from the PIAAC background questionnaire (OECD, 2013a). Dependent variables are learning needs at work and job-related skills development practice. Two variables were chosen to measure learning needs: a general measure "*Do you feel that you need further training in order to cope well with your present duties?*" (y/n), and a specific measure related to use of information and communication technology (ICT) at work: "*Do you think you have/had the computer skills you need/needed to do your job/last job well?*" (y/n). Skills development practices were measured with two questions. One was participation rates in formal or non-formal education and training for job-related reasons (y/n). The second was a sum-indicator built from three questions about job-related learning. These questions covered intensity ("*how often* …") of learning at work from co-workers or supervisors, from learning-by-doing (from the job-tasks performed), and about keeping updated with new products or services. A Likert-scale was used for answers: never (=1), less than once a month (=2), less than once

a week but at least once a month (=3), at least once a week but not every day (=4), and every day (=5). A new combined variable (LEARNACTIVE) was formed from these by summing them up. The sum-variable was scaled back to a range of 1-5.

Age and innovation performance clusters were used as independent variables. Education, gender and type of work were used as controls. For age, the PIAAC-variable AGEG5LFS was used, grouping age into 5-year intervals (40-44, 45-49, 50-54, 55-59, 60-65 years). For education, the PIAAC derived variable EDLEVEL3 was used: 'low' level covered ISCED categories from 1 to 3 (shorter than two years), 'medium' categories 3 (2 years or more) to 4, and 'high' categories 5 to the 6A (PIAAC Background Questionnaire). For type of work, four occupational skill level categories were used (PIAAC derived variable ISCOSKIL4): skilled (=1), semi-skilled white-collar (=2); semi-skilled blue-collar (=3), and elementary occupations (=4). The categories were based on the *International Standard Classification of Occupations* (ISCO) by the International Labour Organization (ILO). Distributions of these variables by age are shown in Table 9.3. All variables showed a statistically significant relationship with the age (Chi-square for all sig. at p<.001).

Table 9.3. Distributions of the background variables by age-groups (%) (all X^2p<.001).

Variable		Age-groups (years)					
		40-44	45-49	50-54	55-59	60-65	All
Innovation Performance							
	Leaders	22.2	22.8	20.8	18.6	15.5	100
	Followers	25.2	24.8	22.0	18.8	9.2	100
	Moderate	27.2	26.1	21.7	16.5	8.5	100
Gender	Females	25.9	25.9	21.9	17.8	8.5	100
	Males	26.1	24.9	21.7	17.3	10.1	100
Type of work	Skilled	26.4	24.6	22.0	17.5	9.6	100
	Semi-skilled white-collar	26.5	24.7	22.9	16.9	9.0	100
	Semi-skilled blue-collar	26.1	26.0	21.6	18.1	8.2	100
	Elementary	23.8	28.1	19.4	18.9	9.7	100
Education	Low	21.8	24.5	21.0	20.1	12.6	100
	Medium	25.2	26.2	23.0	17.9	7.7	100
	High	31.1	24.6	20.4	14.6	9.2	100

The selected (PIAAC and IUS) countries were grouped into three clusters according to their innovation performance in the IUS. Besides that clustering made the analyses less complex, main points of departure here were that lifelong learning and skills development are considered crucial for countries innovation ability in the learning economy (Lundvall & Lorenz, 2012) and that "knowledge excellence" has

been found as one of the factors causing large differences between the EU Member States (EC, 2014b). Based on their innovation performance, measured with 25 indicators (see EC, 2014b: 10), the IUS 2014 ranked the European Union Member States into the following four groups: (1) "*Innovation leaders*" (Denmark, Finland, Germany, Sweden) with their innovation performance well above the EU average; (2) "*Innovation followers*" (Austria, Belgium, Cyprus, Estonia, France, Ireland, Luxembourg, the Netherlands, Slovenia, United Kingdom) with their innovation performance above or close to the EU average; (3) "*Moderate innovators*" (Croatia, Czech Republic, Greece, Hungary, Italy, Lithuania, Malta, Norway, Poland, Portugal, Slovakia, Spain) with their innovation performance below the EU average; (4) "*Modest innovators*" (Bulgaria, Latvia) with their innovation performance well below the EU average (EC, 2014b).

As a consequence from matching the country selection with the PIAAC survey participants, not all IUS-countries were included in our analysis. None of the countries from the last group, *Modest innovators*, participated in the PIAAC. Therefore, only three European innovation clusters were formed. The countries included in each cluster, is shown in Figure 9.1.

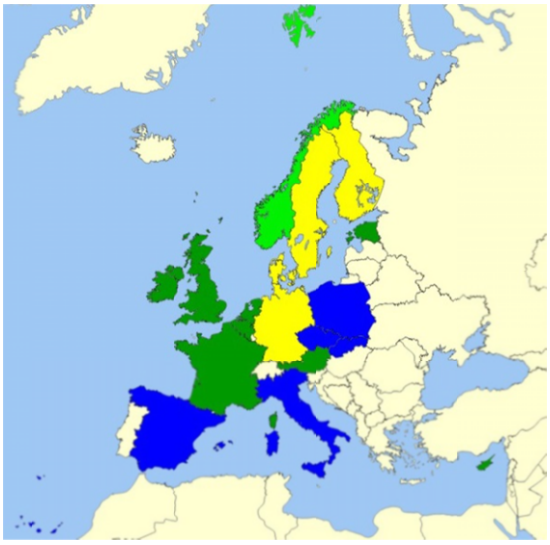

Figure 9.1. Innovation performance clusters in the analysis. Elaborated from IUS (EC, 2014b) and PIAAC (OECD, 2013a).

Data Analysis

While Norway actually ranks among the *Moderate innovators* in the IUS (EC, 2014b), in the analyses here it has been placed among *Innovation followers*. This is

because in terms of education, Norway performs on the level closer to the *Moderate innovators* (EC, 2014b). Furthermore, the country's performance in the PIAAC is closer to the other Nordic countries (*Innovation leaders* in the IUS) than the rest of the European countries (OECD, 2013a). For the current analyses, a new *Innovation Region* variable was created, comprising of the three European innovation clusters described above. All the PIAAC questions and variables are described in detail in the report *PIAAC Background questionnaire* (OECD, 2010b).

Data was analyzed using the Statistical Package for the Social Sciences (SPSS). Chi-square tests were used to explore bivariate associations between dependent, independent and controlling variables. A binary logistic regression analysis using SPSS was carried out to examine the effects of the innovation regions and age categories on learning needs (general and ICT-specific) and skills development (learning participation). Multiple linear regression was used to explore differences between innovation regions and age categories on the frequency of learning activities at work (combined variable). Regression models (binary logistic and multiple linear) explored main effects of innovation regions and age category. The models were analyzed both unadjusted and adjusted for gender, education and type of occupation (occupational skill level). Regression analyses used an adjusted weight created using the PIAAC final full replicate weight (SPFWT0), adjusted to the restricted sample size.

RESULTS

Learning Needs

The questions used to assess learning needs were *need for training in order to cope well with one's present duties* and *having the computer skills to do one's job well* or not. Overall, need for training was not very prevalent, reported by only about a third of all the respondents (mean 32.5%) (Figure 9.2). Age had a statistically significant effect on *training needs*, overall, and separately in all innovation groups. Training needs were reported twice as often (close to 40%) by the youngest (40-44 years) compared to by the oldest employees (60-65 years) in all innovation groups (21%). The youngest were more than twice as likely to have training needs as the oldest, even after adjusting for gender, education and type of occupation. Controlling for gender did not have an effect in the two best performing innovation groups (Leaders and Followers), but did so among the Moderate innovators ($p<.05$).

The age differences in training needs across innovation performance clusters were not very large (Figure 9.2), but they were still statistically significant. In the oldest age group only about one in five of the Innovation Leaders and Followers, and one in four of the Moderate Innovators reported training needs. Both in the youngest and two oldest age groups the training needs were most often reported in the least innovative countries (Moderate Innovators), although the difference was not very large (3-4 percentage units). Also after adjusting for gender, education and

type of occupation, Moderate Innovators were 1.4 times more likely to report of training needs than the Innovation Leaders.

There were also some differences in the pattern of the decrease in training needs by age across the three innovation performance groups (Figure 9.2). Among the Innovation Followers, the decline started from the age 50 years while among Innovation Leaders somewhat later, from the age of 55 years. Among the Moderate Innovators the training needs were dropping first steadily until the 50 years of age, then platooning until 59 years, and thereafter declining again.

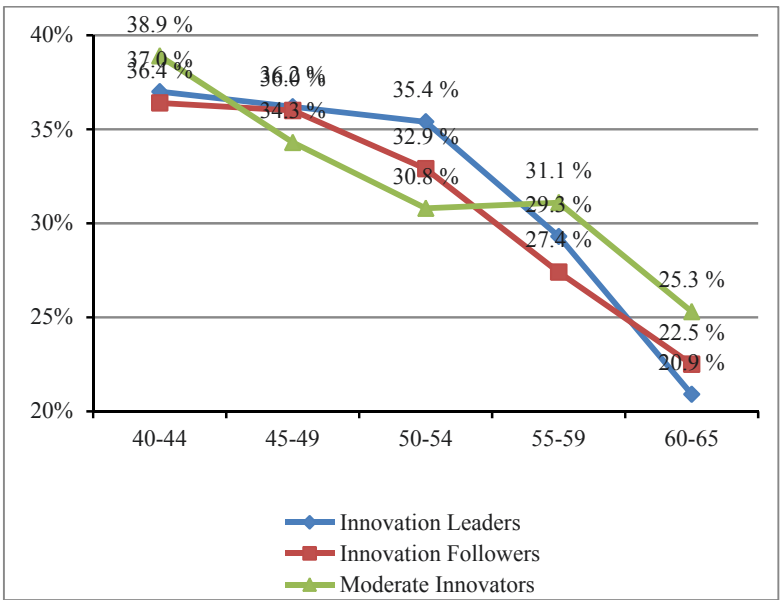

Figure 9.2. Need for more training by age and innovation performance (% yes). Data: PIAAC.

A great majority (87%) of all the respondents had the *computer skills needed to do their job well*. Conversely, the rate of those *not* having the computer skills needed to do their job well (Figure 9.3) was modest (13%). Not unexpectedly, age did have a statistically significant, positive effect on the lack of computer skills, overall and in each innovation group. Compared to the youngest age group, the two oldest age groups were 1.6-1.7 times more likely to report of not having sufficient computer skills after adjusting for gender, education and type of occupation.

Also innovation performance was related to the lack of computer skills (Figure 9.3). There was a clear level difference between the Moderate Innovation countries and countries in the two best performing innovation clusters. Moderate innovators were significantly ($p<.05$) less likely, while Innovation Followers were

significantly ($p<.05$) more likely to report of lacking computer skills in their work than Innovation Leaders, after adjusting for gender, education and occupational type. The fact that lack of computer skills was least often (mean 9.8%) reported in countries with lowest innovation performance (Moderate Innovators), across all age groups, is likely to be related to less access to/use of computers at work in these countries than in the countries with better innovation performance (mean 14%, both clusters).

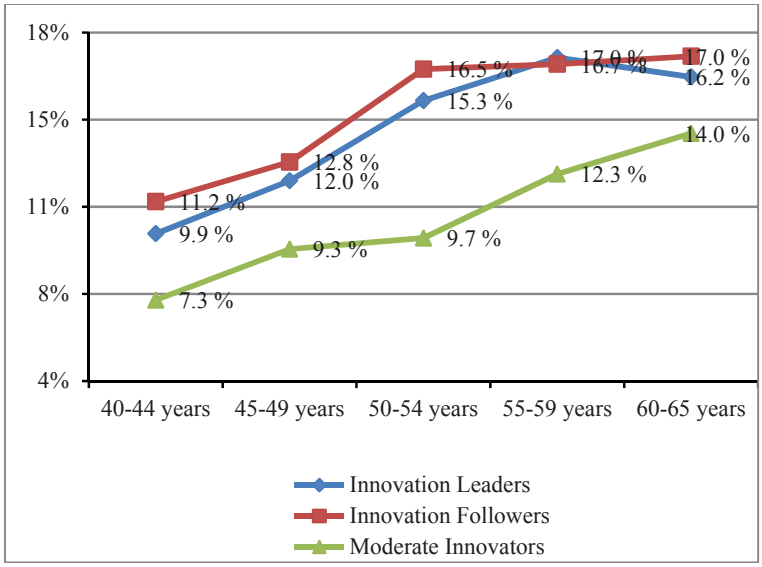

Figure 9.3. Rate of those not having the computer skills needed to do one's job well, breakdown by age and innovation performance. Data: PIAAC.

Lack of computer skills was reported least often of all (7.3%) by the youngest in the Moderate Innovator countries, and most often (17%) in the oldest in the Innovation Follower countries.

Skills Development

Skills development was measured by two variables. The first was participation rate in formal or non-formal education and training (E&T) for job-related reasons. The majority (65.7%) of the respondents had *not* participated in this kind of training. As could be expected from earlier cross-sectional studies (for an analysis, see Tikkanen, 1998), age had a significant negative effect on participation in E&T, also after the controls (Figure 9.4). People in the youngest group (40-44 years) had participation rates several fold higher than in the oldest age group (60-65 years), the ratio increasing with decreasing innovation performance. Compared to the oldest age group (60-65 years), the youngest people (40-44 years) were 2.26 times

more in the Innovation Leader countries, and 3.3 and 4.5 times more among the Innovation Followers and Moderate innovators respectively, to participate in training. After controlling for gender, education and type of work, people in the youngest age group were still more than twice more likely to participate in training than people in the oldest age group (Figure 9.4).

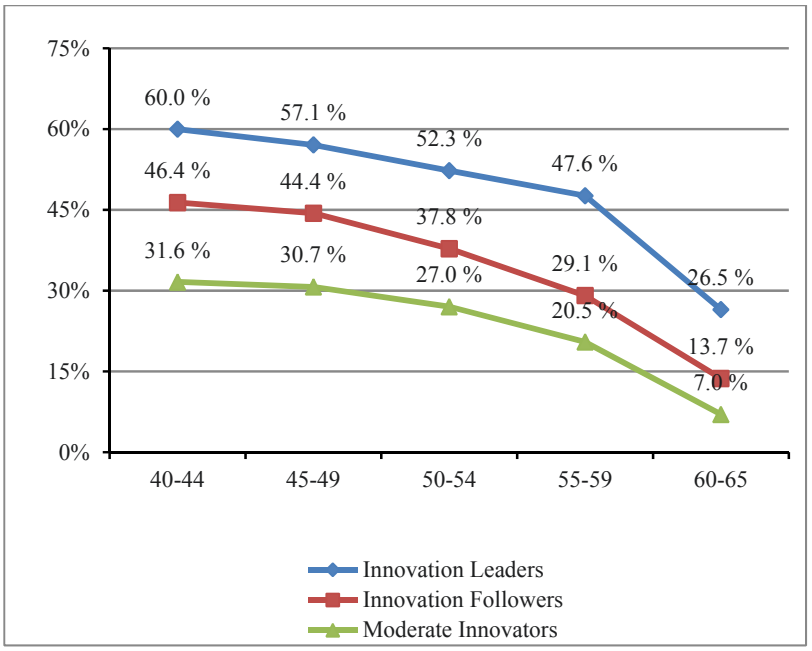

Figure 9.4. Participation in formal or non-formal education and training for job-related reasons by age and innovation performance (%). Data: PIAAC.

There was also a significant relationship between training participation and country clusters' innovation performance (Figure 9.4). The average participation rate was the highest among the best innovation performers (Innovation Leaders), 47.1%, followed by Innovation Followers and Moderate Innovators, 34 and 22.5% respectively. In the youngest age-group, participation rate in the Innovation Leader countries was about two times higher (60%) than among Moderate Innovators (31.6%), while in the oldest group it was almost four times higher (26.5 vs. 7%). After controlling for gender, education and type of work, Innovation Leader countries were more than three times more likely to participate in formal and non-formal E&T for job-related reasons than Moderate Innovators[2] (Figure 9.4).

The second variable measuring skills development practices was *intensity of learning activities at work.* This was a combined measure with an overall mean 3.2 (s.d.=1.04). To some extent the results resemble those for E&T participation rates.

Age had a negative effect in reported learning intensity at work (Figure 9.5). The age differences in the mean scores were statistically significant (p<.001) in all three innovation groups.

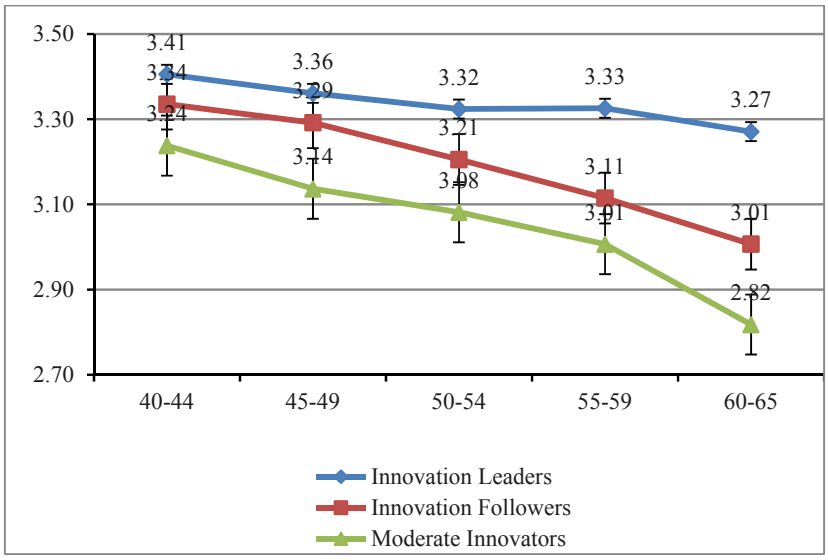

Figure 9.5. Intensity of learning activities at work (combined measure) by age and innovation performance groups. Data: PIAAC.

Learning intensity at work was highest among the Innovation Leaders, followed by Innovation Followers, and being the lowest among Moderate Innovators, in all age groups. In the Innovation Leader countries intensity of workplace learning is above the mean (3.2) also in the oldest age groups. In the Innovation Follower countries the learning intensity declines below the average about after the age of 50, in the Moderator countries it is below the average in all but the youngest age group. The standard deviations were smallest in the Innovation Leader countries (s.d.=.93), and largest in the Moderate Innovator countries (s.d.=1.15). The age-patterns in learning intensity were quite similar among the countries in the two lower innovation performers (Followers and Moderate). However, there was a level difference between them. In the Innovation Leader countries the age-decline in learning intensity at work was the smallest, and significantly different from the two other innovation groups.

The effects of both age and country clusters' innovation performance on learning intensity at work were statistically significant (p<.001), also after controlling for gender, education and type of work (Table 9.4).

Table 9.4. Binary logistic regression model for not having the required computer skills to perform one's job satisfactorily.

	Learning needs		Skills development	
	General	ICT	AET ppt	Learning at work
	OR^	OR^	OR^	b^
Age (Ref: 40-44 yrs)	***	***	***	– 0.071***
45-49	0.912**	1.098	1.029	
50-54	0.801***	1.372***	0.901**	–
55-59	0.668***	1.663***	0.763***	–
60-65	0.430***	1.761***	0.425***	–
EU Innov. Region (Ref: Leader)	***	***	***	
Follower	0.839***	1.185*	0.430***	– 0.149***
Moderate	1.365***	0.855*	0.348***	– 0.223***
Gender (Ref: Male)				
Female	0.974	1.109*	0.989	– 0.078***
Education (Ref: Low)		***	***	
Medium	1.333***	0.869*	1.583***	0.074***
High	1.553***	0.711***	3.087***	0.258***
Occupation type (Ref: Elementary)	***	***	***	
Skilled	2.706***	0.797	4.310***	0.871***
While-collar	1.848***	0.704**	2.067***	0.612***
Blue-collar	1.499***	1.449**	1.428***	0.284***
Model				
Constant (b)	-1.633	-1.755	0.476	3.216
Nagelkerke R^2	0.072	0.031	0.220	0.118

*<0.05; **≤0.01; ***≤0.001. ^Not applicable for Constant (b) and Nagelkerke R2

DISCUSSION

The purpose of this study was to give new knowledge on job-related learning needs and skills development among ageing workers in the context of innovation performance in Europe. The results showed that age was a significant moderator of learning needs and skills development, even after controlling for education, gender and type of occupation. The oldest workers (55-65 years) reported least often learning needs and skills development activity. The only exception was computer skills. Training needs were the highest (36-39%) in the youngest age group (40-44 years), while lack of computer skills was highest (16-17%) in the oldest age group (60-65 years). Skills development by participation in E&T was on a moderate level; about a third of the respondents had participated in formal or non-formal

education and training (E&T) for job-related reasons during the last 12 months. Skills development through informal workplace learning was more intensive.

On the one hand, the findings support some of the common views (stereotypes) on ageing workers and learning, as described in the first part of this article. On the other hand, the findings support earlier research, showing for example that underskilling is the lowest among older workers 50+ (Cedefop, 2010a). The lack of skills in computer use at work was more pronounced in the oldest age groups, yet still on a rather modest extent. It may be that compute use in workplaces is only required on rather simple level for most ageing workers, and they master it. It is also possible that ageing workers have better computer skills as required by their jobs, than what the stereotypic views tend to suggest. This was also implied by the overall PIAAC findings, which showed that older adults use ICT more than younger adults (OECD, 2013a). When the job-related learning needs are as moderate as shown in this study, it is perhaps not surprising that raising the LLL participation rates towards the EU2020 benchmark remains a challenge (EC, 2013). However, learning at work was more intensive, although with large variation across, and within, countries. The Education and Training Monitor in Europe showed corresponding findings (EC, 2013).

The cross-disciplinary study presented in this article was rather experimental in that it contextualized the more common analysis of the age-learning-skills relationship on innovation performance in Europe. The findings were interesting, although they should be taken only indicative for further research. There were significant differences in the age-patterns and the levels of learning needs and skills development practice across the three innovation clusters, even after controlling for education, gender and type of occupation. In all age groups shortages in computer skills at work were lowest in the countries with lowest innovation performance (Moderate Innovators). In Innovation Leader countries also older workers were more active in skills development, especially in informal learning at work, than in countries with lower innovation performance. This finding is not surprising, given that of the four Innovation Leader countries three are Nordic countries (DK, SE, FI), which generally outperform other European countries in learning participation, especially in the older age groups (EC, 2013; OECD, 2013a). Germany, the fourth Innovation Leader country, generally performs only on a European average level when it comes to employees' engagement in creative work activity (Lorenz & Lundvall, 2009), as well participation in LLL and CVT, and below the average in older age groups. Thus, Germany has had an impact on the performance of the Innovation Leaders in this study, but the impact may have been less than could have been expected.

The findings give support to the link between skills development and countries' innovative performance found in earlier research (Cedefop, 2012a; Lorenz & Lundvall, 2009). Countries, with high innovation performance, tended also to have higher participation rates in learning and work, also among ageing workers, than countries with lower innovation performance. Besides with measures on learning and creativity, the link has also shown to exist when using more classic measures of innovative performance (e.g. number of patent applications) (Lorenz &

Lundvall, 2009). Though the analysis here does not allow for causal relationships, the findings suggest that also ageing workers can make an important contribution to innovation activity and productivity. In high-innovation countries the higher levels of participation in continuous learning and E&T of ageing workers, is likely to help them to maintain their job-performance. In return, their experience-based competence contributes to competence diversity in their workplaces, potentially helping to foster innovative activity. Earlier research has suggested that women may need specific attention in this context: they are only about 40% as likely to be engaged in creative work activity as men (Lorenz & Lundvall, 2009).

In order to keep the ageing workers motivated to learn and work, a precondition is that work invites to and stimulates learning. However, not all workplaces are learning-intensive or even learning-friendly (Cedefop, 2012a), some environments being enabling and some constraining (Ellström, 2011). This may particularly be the case with ageing workers. Future research should explore learning needs of ageing workers and their job performance in relation to different sectors and types of work. For, as pointed out by Lorenz and Lundvall (2009), the most important bottleneck to improved innovation capability and performance in Europe may not be so much about the level of R&D investments, as organizations' ability to "provide a fertile environment for learning and problem-solving", to stimulate "pro-innovation organizational practice" (Lorenz & Lundvall, 2009: 176).

NOTES

[1] CVT refers to persons employed by enterprises with the following qualifying criteria: "the training must be planned in advance; the training must be organized or supported with the specific goal of learning; the training must be financed at least partly by the enterprise." (Eurostat, 2010: 270). The findings presented here are from the third CVT survey in Europe, carried out in 2005.

[2] This is not surprising as lifelong learning among those aged 25-64 is one indicator included in the IUS, which is behind the three innovation score groups. However, the measure by Eurostat (EC, 2013), used in the IUS, has a much shorter time-reference for participation (four weeks preceding the survey) than in PIAAC, the data used in this study (OECD, 2013a) (the last 12 months). The result, suggest that there is a strong consistence between these two different participation measures.

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