Employee-driven innovation/ entrepreneurship and Lifelong Learning

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EMPLOYEE-DRIVEN INNOVATION/ ENTREPRENEURSHIP AND LIFELONG LEARNING

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EXECUTIVE SUMMARY

According to the Global Entrepreneurship Monitor (GEM), almost one out of ten adults in Europe was in 2013 involved in starting or already running a new business (Amorós & Bosma, 2014). Also daily work at mature organizations is increasingly spiced with entrepreneurial challenges, which ask for employee-driven entrepreneurship and innovation. However, although the broader workforce is needed to identify, pursuit, and exploit business opportunities, the GEM results show that entrepreneurial employee activity is still scarce. Therefore, in this work package, we focussed on the defining, initial steps of the entrepreneurial process and the necessary competencies employees need to deal with the entrepreneurial challenges they are increasingly confronted with.

Scholars agree that innovation and human capital are interdependent. In our work package we, hence, zoomed in at the role of a key, entrepreneurial competence for independent and employee-driven innovation and entrepreneurship: opportunity competence. Since competencies are subject to learning and development, we also investigated whether organizations that are committed to learning, have higher levels of opportunity competence (Lumpkin, 2005). And, finally, because of the centrality of complex problem solving in the LLLight'in'Europe programme as a modern, transversal skills for effective learning and working, we also investigated the relation between opportunity competence and complex problem solving.

To sum up, in this work package we investigated the broader research question: 'what is the relation between specific human capital (i.e. opportunity competence), innovation performance and organizational learning? In order to disentangle this research question more precisely, the following sub-questions were added:

1. What is opportunity competence?

2. What is the relation between opportunity competence and complex problem solving?

3. What is the relation between opportunity competence and innovation performance?

4. How can the relation between opportunity competence and innovation performance be explained by organizational learning?

Methods used

To investigate these research questions, data was collected among 257 latent, early-stage entrepreneurs, and among 234 employees from 12 small, medium, and large companies in the agricultural, food, and fibre industry . A performance assessment was developed to measure opportunity competence on an individual and group level. Furthermore, questionnaires and interviews were conducted to gain insight into innovation performance and organizational learning on the individual, group and organizational level.

Conclusions in relation to the research questions

1. We asserted that the first phase of the opportunity process, benefits from people who are competent in generating business ideas (i.e. opportunity identification) and evaluating business ideas for their potential success (i.e. opportunity evaluation). Our results from the student sample confirm that there are differences in opportunity identification and evaluation. The results suggest that some individuals perform better at generating business ideas, which involves creativity and divergent thinking, while others perform better at evaluating business ideas for their potential success. In addition, the company data underline the importance of teamwork in opportunity evaluation, as teams in organizations outperform individuals here.

2. Our results show that complex problem solving incrementally predicted the abilities to identify and evaluate opportunities, explaining 2.3% to 5.7% additional variance. This result underlines our argumentation that the identification of a first, rudimentary business idea provides the set-up for a complex problem situation.

3. Most of the variance in innovation performance of individual employees is explained by innovative work behaviour. Differences between high and low engagement in innovative behaviour by employees in the sampled companies, in turn, can be explained into more detail by specific human capital variables: opportunity competence, believe in the own creative capability, and the importance attached to social networks.

4. The data on workplace learning factors illustrate that there are differences between employees who successfully introduce many ideas to their management (i.e. 3 or more) versus those who introduce only a few. These differences can be directly explained by learning-related variables, for instance:

    a. Employees who introduce 3 or more ideas, more often face complex problems in their daily work that take at least 30 minutes to find a good solution than the group that introduces a low number of ideas

    b. If an employee introduces 6 ideas or more, we find a relation with the instructions the employees receive regarding the process according to which daily tasks should be performed

    c. Those who successfully introduce ideas to their superiors experience more variety, autonomy and newness in their tasks

Altogether, stimulating employee-driven entrepreneurship and innovation performance can follow at least two routes, directly via task-related measures (e.g. problem demand) or indirectly via stimulating specific activities (i.e. innovative work behaviour), via competence development programs focussing on human and social capital development.

Recommendations for policy makers

Although focused, mostly, on one industry, the results of this study likely have broader applicability to wide variety of industries.

- The results underline the complex interplay between human capital, innovation, and work-related learning. Therefore, cooperation across the traditional disciplinary boundaries is hence called for in efforts to effectively combine lifelong learning, human capital, and innovation.

- The engagement in innovative work behaviour was, by far, the strongest predictor of outcomes of employee-driven innovation and entrepreneurship (i.e. number of ideas adopted by the management), which underlines the importance of task characteristics of employees.

- In particular, specific attention should be paid to the creation of challenging jobs that require a certain job complexity, since job complexity contributes significantly to individual's innovative performance.

- As the results of this study show, opportunity identification and opportunity evaluation are separate abilities. Therefore, innovation teams should include team members that perform well on different abilities.

- Groups seem to outperform individuals on opportunity evaluation. Hence, programs as well as organizations themselves should invest in team activities and team incentives.

- The results show the importance of specific human capital, rather than general human capital. Typically this set of specific human capital is a result of social mediated, informal, work-related learning activities, such as learning-by-doing, vicarious learning, experiential learning and action learning. In line with CEDEFOP (2012), we would recommend to organize support programmes that invest directly in specific human capital as well as those that are geared towards relational capital. The key to get such programs running is in the hands of the management in small and medium sized firms, and should be a shared responsibility between the individual and the organization.

ACRONYMS

CIS	Community Innovation Survey
CPS	Complex problem solving
EC	European Commission
GEM	Global Entrepreneurship Monitor
OC	Opportunity competence
OCAT	Opportunity competence assessment test
OECD	The Organisation for Economic Co-operation and Development
SLAM	The Strategic Learning Assessment Map
UNCSD	United Nations Conference on Sustainable Development
PCA	Principal component analysis

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1. INTRODUCTION[1]

In today's society, facing entrepreneurial challenges has become part of every-day's working and learning life (EC, 2006). According to the Global Entrepreneurship Monitor (GEM, which captures all entrepreneurial activity worldwide) almost one out of ten adults (18-64 years old) in Europe was in 2013 involved in the process of starting or already running a new businesses (Amorós & Bosma, 2014). Also daily work at more mature organizations is increasingly spiced with entrepreneurial challenges: a trend is discernible towards 21st century tasks that require innovation, more autonomy, and a decrease of routines (Autor, Levy, & Murnane, 2003; Hornsby, Kuratko, Shepherd, & Bott, 2009). The predominant incremental nature of innovation in most firms points to the role of the broader workforce in the identification, pursuit and exploitation of business opportunities (Toner, 2011). In other words, employee-driven entrepreneurship is a main interest of employers. In the context of employee-driven entrepreneurship and innovation, the GEM has coined the term Entrepreneurial Employee Activity (EEA) defined as *"employees developing new activities for their main employer, such as developing or launching new goods or services, or setting up a new business unit, a new establishment or subsidiary"* (Bosma, Wennekers, Guerrero, Amorós, Martiarena, & Singer, 2013, p. 7). Nonetheless, data from 2011 and 2012 show that EEA is much scarcer than independent early-stage entrepreneurship (Singer et al. 2015); only 7.2% of employees from innovation-driven economies is actively involved in innovation-related activities (Bosma et al., 2013).

Thus, getting more insight into the defining, initial steps in the early entrepreneurial process, the necessary competence, support structures and competence development within companies seems to be valuable. From a theoretical point of view, studying the initial stages in entrepreneurship has become prominent in entrepreneurship literature (Shane & Venkataraman, 2000). Whether it concerns an independent start-up or innovation within a larger company, it all starts with the identification of high quality business opportunities and further transformation of them into something new, such as a product or a service, that creates value. The identification and pursuit of opportunities, echoing a process perspective on entrepreneurship, opens up the door for studying entrepreneurship in relation to individual's perceptions of opportunities, their capacity to act upon them and the conditions in the (work) environment that hinder or foster this process.

Knowledge, skills and competencies and their development are often claimed to be crucial for opportunity identification. Literature on innovation seems to agree on a general level that innovation and human capital are interdependent and seem to influence each other positively (CEDEFOP, 2012; Lundvall & Lorentz, 2012).

[1] Partly adapted from Baggen, Y., Mainert, J., Lans, T., Biemans, H. J. A., Greiff, S., & Mulder, M. (accepted). Linking complex problem solving to opportunity identification competence within the context of entrepreneurship. International Journal of Lifelong Education. doi: 10.1080/02601370.2015.1060029; and policy brief E6.

However, more fine-grained, interdisciplinary, research to the relationship of entrepreneurship, innovation and human capital is necessary, as their relationship seems to be more subtle than often claimed in research and policy reports (CEDEFOP, 2012; Toner, 2011). As Jones and Grimshaw (2012) state, the conceptual interest on human capital in the innovation literature stays at a rather implicit, superficial level. In our research we, hence, zoomed in at the role of a key competence for independent and employee-driven entrepreneurship and innovation namely opportunity competence (OC): *The ability of individuals to identify and evaluate ideas for new products, processes, practices or services in response to a particular pain, problem or new market need. I*t is assumed that those who are able to identify and evaluate entrepreneurial opportunities can contribute significantly to personal, professional, and/or business development (EC, 2006; Ireland, Camp, & Sexton, 2001).

Since competencies are subject to learning and development (Biemans, Nieuwenhuis, Poell, Mulder, & Wesselink, 2004; Lans, Hulsink, Baert, & Mulder, 2008; Mulder, 2001), the assumption is that an organization committed to learning, is likely to have higher levels of individual OC in its organization (Lumpkin, 2005). Studies from the classroom indeed find positive effects of education on the development of OC (DeTienne & Chandler, 2004). However, competence development can be stimulated in different ways, not only through (initial) formal education and training, but also through informal, work-related learning (Lans, Biemans, Verstegen, & Mulder, 2008; Mulder, Lans, Verstegen, Biemans, & Meijer, 2007). Unlike school-based learning, learning in organizations is interwoven with, difficult to separate from, and a prerequisite for working and developing (Eraut, 2004; Tynjälä, 2008). As such work-related learning is often dependent on the type of work, how work is organized and the context in which employees are working. When people and subsequently organizations learn they can develop new knowledge, new networks, competencies and capabilities; with this knowledge they can create innovations (Sanchez, De Pablo, Gonzalez, Del Campo & Skerlavaj, 2011). In other words, learning in organizations it its broadest sense seems to be conducive to entrepreneurial competence development and, subsequently, innovation performance (Dess et al., 2003).

To sum up, in this work package we were mainly interested in employee-driven entrepreneurship and innovation. More specifically, in this work package we investigated the broader research question: 'what is the relation between specific human capital (i.e. opportunity competence), innovation performance and organizational learning? In order to disentangle this research question more precisely, the following sub-questions were added:

1.

2. What is opportunity competence?

   What is the relation between opportunity competence and complex problem solving?

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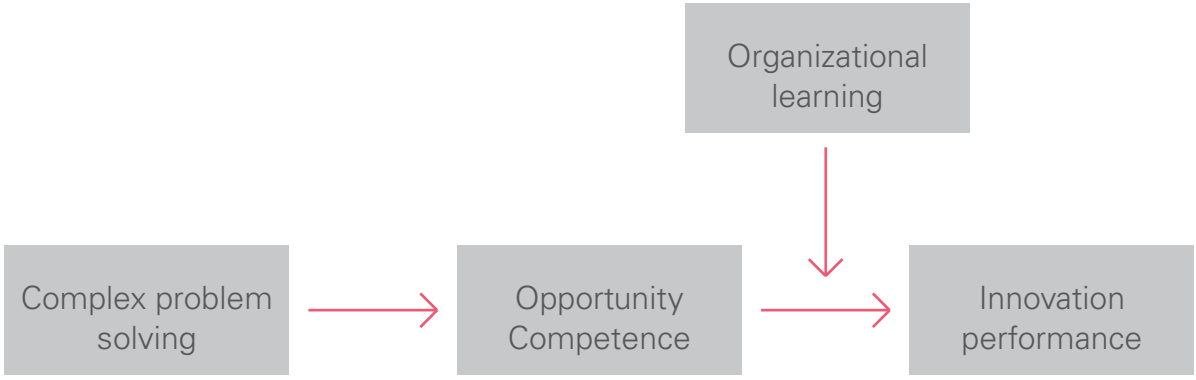
2. THEORETICAL FRAMEWORK

Figure 1 shows the main research interests of wp 6. As stated, entrepreneurship scholars generally agree that there are individual differences in OC (Short, Ketchen, Shook, & Ireland, 2010), due to differences in experience and prior knowledge (Baron & Ensley, 2006; DeTienne & Chandler, 2004). In addition, studies from smaller firms suggest a relation between entrepreneurial competence and innovation performance (Bird, 1995; Chandler & Jansen, 1992; Lans, van Galen, Verstegen, Biemans, & Mulder, 2014; Man, Lau, & Chan, 2002). Furthermore, the literature suggests that organizational learning often acts as a bridge between innovation output and its antecedents (Anderson, Covin, & Slevin, 2009; Dess et al., 2003; Hitt, Ireland, Camp, & Sexton, 2001; Rhee, Park, & Lee, 2010). Thus, the broader assumption of this research (figure 1) is that the influence of specific human capital, OC in this study, on innovation performance is not only a direct one but also mediated by learning. Moreover, the relations between OC, learning and innovation should be studied on different levels, individual, group and firm level (Crossan, et al., 1999; Dutta & Crossan, 2005), especially in larger organization where the direct influence of owner-managers is decreasing. In general, research on firm-level differences which invokes constructs like capabilities, competencies, processes and routines tend to neglect individual-level heterogeneity (Rothaermel & Hess, 2007). Therefore, we adopt a multilevel lense in how the different antecedents to innovation performance (i.e. organizational learning, OC) impact innovation performance and each other on different levels of analysis: namely on individual, group and firm level.

In this section, the core concepts and their underlying connections are elaborated upon from a theoretical point of view.

Figure 1: core concepts of our research and their underlying (expected) relations.



2.1 Innovation performance

It was Schumpeter who argued that competition posed by innovation has more impact on survival than price changes of existing products (Schumpeter, 1934). According to Schumpeter (1934) innovators are creative destructors who destroy the old market with their innovation. Nonetheless, how a company innovates can be very versatile; a company can develop a new product or service, a new production technology, a new operation procedure or even a new management strategy (Sanchez et al., 2011). Accordingly, there are many definitions of innovation, all focusing on a different aspect of innovation. These aspects are, for example, novelty, necessity and sufficiency, intentionality, beneficiary and implementation/exploitation (Crossan & Apaydin, 2010). There is no single overarching definition of innovation (Baregheh, Rowley, & Sambrook, 2009). Baregheh and colleagues (2009) found 60 different definitions of innovation in their literature review. These definitions had, however, one thing in common, namely the concept of new. Thus, simply said, innovations are about newness, for instance new products, new methods of production, new sources of supply, the exploitation of new markets, or new ways or organization. Although new to whom remains a salient point. A helpful view on newness is the classification by Cooper and Kleinschmidt (1993), who make a distinction of innovations based on newness to the company and/or newness to the market. Moreover, innovation is not only about a new idea, but also about successfully applying and exploiting it. This makes innovations different from inventions; an innovation brings something into new use, not only into existence (Rogers, 1983). Innovation is according to many authors more than outcomes, it is also about the process leading to a new product, process or service. It is about bringing change. It requires the generation of new ideas, making decisions, taking action, carry out actions and pursuing them (Hornsby, Kuratko, Shepherd, & Bott, 2009; Hornsby, Kuratko, & Zahra, 2002). In short: it requires entrepreneurship (Shane & Venkataraman, 2000).

Traditionally, entrepreneurship has been associated with new business creation by the individual entrepreneur. The need for the development of business opportunities and entrepreneurial behaviour within existing organizations, regardless of size, has been stressed in the work on corporate entrepreneurship or intrapreneurship (Guth & Ginsberg, 1990). Sharma and Christman (1999) define corporate entrepreneurship as 'the process whereby an individual or a group of individuals, in association with an existing organization, create a new organization or instigate renewal or innovation within that organization'. Corporate entrepreneurship does not exclusively focus on innovation but also includes (1) the birth of new firms within (internal corporate venturing) or adjacent to (external corporate venturing) the existing organization and (2) includes strategic renewal, for example, changing the key ideas on which the organization is built (Sharma & Chrisman, 1999). Accordingly, entrepreneurship is more than innovation. Innovation can be seen as an entrepreneurial process, but it is not a prerequisite for (corporate) entrepreneurship because strategic renewal or organizational creation can also occur without innovation. Nonetheless, depending on the exact definition of innovation, corporate venturing and strategic renewal are often in harmony with innovation. This can be seen in the abundance of definitions of innovation which do not solely focus on introducing something new to the market place, but also include elements of strategic renewal (e.g., new business practice). We follow the OECD definition of innovation which is *"the implementation of a new or significantly improved product, or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations"* (OECD, 2005, p 46). From this definition it becomes clear that innovations become visible in concrete products, processes, methods and networks. Furthermore, innovations can differ in terms in newness, from radical to more incremental. Both these types of innovation will be taken into account in this research. Contrary to micro firms (e.g. firms with less than 10 employees) where the entrepreneur is the sole decision maker, individual innovative performance outcomes and organisational innovative performance outcomes can be very different (many factors influence this, of which organizational learning is one, as explained in the following sections) in small (<50 employees), medium (<250 employees), and large firms.

2.2 Opportunity competence[2]

More in-depth understanding of the individual contribution to the early stages of introducing new products, processes or services comes from the work on opportunities, one of the central concepts in the field of entrepreneurship (Shane & Venkataraman, 2000). What post-hoc may be called a real business opportunity is in its rudimentary form often an ill-defined market need, a technology or invention for which no market has yet been defined, or an idea for a product or service (Ardichvili, et al., 2003). Depending on the underlying theoretical assumptions of the opportunity concept, different aspects of the opportunity process are put in the core.

[2] Partly adapted from Baggen, Y., Mainert, J., Lans, T., Biemans, H. J. A., Greiff, S., & Mulder, M. (accepted). Linking complex problem solving to opportunity identification competence within the context of entrepreneurship. International Journal of Lifelong Education. doi: 10.1080/02601370.2015.1060029

Proponents of the 'objective' viewpoint claim that opportunity identification is a matter of discovery either by surprise or as a result of successful search. In essence, opportunities are there for everyone. At the other side of the opportunity spectrum are the proponents of the 'constructed' viewpoint, who argue that opportunities are more or less actively constructed by individuals. Those who attribute a passive role to the individual consider the identification of opportunities as a matter of entrepreneurial alertness which reflects the idiosyncratic individual knowledge base of the entrepreneur. Those who take a more active, constructivist position on opportunities go beyond the single-insight notion of opportunity identification and ascribe an important role to perception, interpretation, understanding and creativity in the opportunity process (DeTienne & Chandler, 2004; Dutta & Crossan, 2005).

Following the more constructivist position on opportunities, Wood and McKinley (2010) suggest that the opportunity 'production' process consists of two phases: *opportunity objectification* and *enactment of the opportunity*. The first phase concerns *opportunity objectification*. In this phase, a set of initial ideas develop in the mind of an individual, and the ideas objectify into an opportunity. To come up with ideas, an individual continuously reflects upon the social world he or she lives in. To discover the potential of an idea, the individual starts a process of sense-making: he or she shares the idea with peers such as friends, family, and other close people. As a result, abandonment or the objectification of an idea takes place (Dimov, 2007; Wood & McKinley, 2010). Whether an idea gets abandoned or objectified depends on the suggestions of others and the agreement among peers about the potential of the idea. The second phase concerns the *enactment of the opportunity*. During this phase the opportunity is further development, based on suggestions and support of relevant stakeholders (Wood & McKinley, 2010). Relevant stakeholders are, for instance, investors or potential customers. In a process of intense interaction and negotiation with stakeholders, the individual creates a shared understanding of the opportunity. This process might result in the objectification of the opportunity for the stakeholders and the further development of the opportunity into a new product, process, service, or practise (Sarasvathy et al., 2010). The two discerned phases by Wood and McKinley (2010) also resonate with the phases discerned by the GEM in their measure of entrepreneurial employee activity, making a distinction between 'idea development for a new activity' and 'preparation and implementation of a new activity' (Bosma et al., 2013, p. 7).

Opportunity competence is used as an overarching term for opportunity identification and evaluation, and is earlier defined as *The ability of individuals to identify and evaluate ideas for new products, processes, practices or services in response to a particular pain, problem or new market need* - seems to be especially important in the first phase of the opportunity process: in the objectification process. Although the importance of OC is recognized, a scientific, golden, standard to assess OC is missing. Several studies have measured OC in different samples using different instruments (e.g. Corbett, 2007; DeTienne & Chandler 2004; Gielnik et al., 2014; Ozgen & Baron, 2007). For instance, researchers used a self-assessment questionnaire to explore the OC of participants by asking questions such as 'To what extent do I have a special "alertness" or sensitivity toward new venture opportunities?'

(Ozgen & Baron, 2007; Wang, Ellinger & Wu, 2013). Next to questionnaires, conducting interviews is a commonly-used method. For instance, participants were asked: 'How many opportunities for creating or purchasing a business have you identified within the last five years?' (Gielnik et al., 2014). Furthermore, DeTienne and Chandler (2004) asked participants to think back for the last 24 hours and to list all business opportunities they had observed. Finally, several authors made an attempt to measure OC based on more experimental approaches, focussing on the actual behaviour related to the identification of opportunities. For instance, Corbett (2007) asked participants to list as many new business or product opportunities as possible, based on a case related to Bluetooth technology. The number of generated ideas was an indicator for OC.

There are two major concerns with the use of the instruments that already exist. The first concern relates to the use of self-assessments and the recall of memories in interviews, which is debatable because of recall-biases and retrospection (Corbett, 2007; Grégoire et al., 2010; Shepherd & DeTienne, 2005). Therefore, several authors (Gaglio & Katz, 2001; Shepherd & DeTienne, 2005) suggest to use experimental designs to explore OC. Experimental designs allow to focus closely on opportunity identification and to control for extraneous variables. Until now, as we know of, only Corbett (2007) offers an experimental design to explore OC. The second concern relates to how OC is operationalized: most studies only focus either on idea generation or idea evaluation. However, based on the opportunity process, we would aim to use an instrument that includes opportunity identification and evaluation. Also Corbett's (2007) instrument only covers the opportunity identification part of OC. As Corbett (2007) mentions 'it must be stressed that this study focused on only one part of the process of entrepreneurship: the initial identification of opportunities'. Therefore, we decided to develop the Opportunity Competence Assessment test (OCAT), a performance test that includes both opportunity identification and evaluation. In the methods section, the instrument is further explained.

2.3 Organizational learning

Learning is broadly acknowledged to be of importance for the survival of organisations by management scholars. Through organisational learning, strategies can be adapted in line with the demands of the external environment, which has a positive effect on performance. In the literature different approaches towards learning in organizations are used. Much of the scientific work can be found in the fields of organizational learning and workplace learning (Shipton, 2006). Literature on organizational learning has a strong scientific, mostly conceptual, basis departing from the organization as the level of analysis (Huber, 1991). Workplace learning literature, departing from an individual level of analysis, emphasizes the work environment as an important learning site (Billett, 2001; Fenwick, 2003; Tynjälä, 2008). The reason being that learning is embedded in everyday work practices of professionals.

[3] A paper on the development and application of the instrument is in development and will be handed in at a methodological journal.

On the organizational level we draw on the Canadian work initiated by Crossan colleagues. (1999) and further developed by a.o. Bontis, Crossan and Hulland (2002). Besides the fact that is it the most cited article in organizational learning, their work is also of specific value by the fact that they explicitly link organizational learning to learning at other levels of analysis (i.e. individual, group and organization). Similar to much work on organizational learning and strategic renewal is the work of Crossan and colleagues (1999) which departs from the exploration-exploitation dichotomy. Explorative learning emphases search, variation, risk taking, experimentation, play, flexibility, and discovery. Exploitative learning is about refinement, choice, production, efficiency, selection, implementation and execution. The basic assumption is that there is a tension between assimilating new learning (exploration) and using what has already been learned (exploitation) (Crossan et al., 1999; March, 1991). Exploration and exploitation are fundamentally different learning logics that not always go easy together. Modern literature supports this view, suggesting that high performing firms are so-called ambidextrous, they balance explorative and exploitative learning. Such a view on organizational learning has long been considered by many as impossible. However, empirical support has been found for the co-existence and benefits (i.e. firm performance) of exploitation and exploitation (De Visser et al., 2010).

More in detail, according to the Canadian school of organizational learning, organizational learning comprises of two essential dimensions, namely what is learned (learning stock) and its associated learning processes (how it is learned, learning flows). The learning stock dimension refers to *the stock of knowledge on the individual, group and organizational level* (Bontis et al., 2002). On the individual level this encompasses individual knowledge and competencies; on group level this encompasses the shared understanding or collective mind; and on organizational level this encompasses the non-human aspects of the organization such as systems, structures, procedures and strategy (the organizational memory) (Bontis et al., 2002). The learning flow dimension refers to *the learning processes that influence and create (new) learning stocks on individual, group and organizational level*. Feed forward is *"whether and how individual learning feeds forward into group learning and learning at the organizational level* (e.g. changes to structure, systems, products, strategy, procedures, culture) (Bontis et al., 2002, p445). Feedback learning is defined as *''Whether and how the learning that is embedded in the organization* (e.g. systems, structure, strategy) *affects individual and group learning"* (Bontis et al., 2002, p445). Thus, feed forward/feedback processes involve learning moving from the individual level, via the group level to the (inter) organizational level (feed forward) and back (feedback).

Feed forward and feedback learning can be further specified in several underlying 'socio-psychological' processes which explain the learning moving from the individual, via the group to the organizational level (and vice versa). These processes include: intuiting, attending, interpreting, experimenting, integrating, institutionalizing and intertwining (Crossan, Lane, & White, 1999; Jones & Macpherson, 2006; Zietsma, Winn, Branzei, & Vertinsky, 2002). The development of new insights, depending on and resulting in (generic) knowledge and competencies is called 'Intuiting' (Crossan et al., 1999).

Intuiting is a relative passive process, which enables individuals to perceive patterns and know how to act without conscious, deliberate, or explicit thought (Schulze et al., 2011). Besides intuiting, individuals can also follow a more active process of information seeking, search from the environment, which is called 'attending' (Zietsma, Winn, Branzei, & Vertinsky, 2002). At this stage the idea is still very rudimentary or even fuzzy (Dutta & Crossan, 2005). After the search for information, individuals combine their competencies, motivations, and goals to give meaning to these new insights (Interpreting) (Crossan, et al., 1999). When interpreting, individuals create and refine their language through conversations with others, making it a social activity (Schulze, et al., 2011). A parallel activity of integrating is 'experimenting'. The results of experiments of groups or individuals give form to the ideas (Zietsma, et al., 2002). If individuals enter into a dialog and/or joint problem solving by sharing their interpretations of the new insights, common understanding can be formed (Integrating). Institutionalizing is the step in the process where all the learning is embedded into the organization (Schulze et al., 2011). This step is also where the exploitation of knowledge takes place, which is crucial because without exploitation there will be no innovation (Sanchez, De Pablo, Gonzalez, Del Campo & Skerlavaj, 2011).

Finding an appropriate balance in explorative and exploitative learning is rendered difficult by the fact that the same issues occur at different levels of a nested system. The tension between exploration and exploitation should be managed on a continuous basis. Active involvement of managers can stimulate explorative and exploitative behaviour, for instance, through fostering information exchange, joint decision-making and influencing informal social interactions of their staff (Raisch & Birkinshaw, 2008). However, this should be done on and aligned with all learning levels. For instance if explorative learning is not recognised or rewarded at the organizational level, then the feedforward process will stop at the group level. Therefore Bontis and colleagues (2002) assert that *'the misalignment between the stocks and flows results in learning bottlenecks for the organization'.* As they show in their research, these bottlenecks affect business performance. More concretely, a firm may have high levels of learning stocks on individual, group and organizational level but relatively low levels of feedback and feed forward flows. In another case the firm has moderate learning stocks on all levels, but also moderate levels of feedback and feed forward learning. Although in both cases the overall organizational learning is the same (stocks + flows), in the latter case they will be better able to leverage that learning in innovation. Whereas in the latter case, the firm is unable to benefit from their high stocks since the learning will not transfer from one level to another.

The described nature of individual, group and organizational learning in the context of innovation and entrepreneurship emphasises the importance of the work environment as an important learning environment. Formal education and training are rarely mentioned as drivers for innovative and entrepreneurial learning and performance in companies (Fenwick, 2003; Lans et al., 2008). Many different terms are used in the literature to refer to the work context as an important learning environment such as workplace learning, work-based learning, work-related learning, informal learning and on-the-job learning.

What these studies have in common is that they acknowledge that there are differences in the way they invite and support employees to learn. Research in this field broadly distinguishes between the nature and organization of tasks that characterise a job as well as the broader social and cultural relations that characterize the organization. Examples of the former are task novelty, freedom, autonomy, responsibility and task complexity (Hornsby, Kuratko, & Zahra, 2002; McCauley, Ruderman, Ohlott, & Morrow, 1994). Examples of the latter are collegial support and availability, interdependence in work and exposure to customer demands (Billett, Hernon-Tinning, & Ehrich, 2003). Holman and colleagues (2012) for instance examined if job characteristics of employees affected employee-level innovation processes in manufacturing firms through their influence on individual learning processes. More specifically, they looked at job control and problem demand. Job control was operationalized as the extent to which employees have discretion over methods used; for example, if the employee could decide how to get the job done (Holman et al., 2012, p. 182). Problem demand was operationalized as the frequency and difficulty of task problems; for example, if the employee has to deal with problems which are difficult to solve (Holman colleagues, 2012, p. 182). Holman et al. (2012) found that both factors had a direct positive and independent association with work-based learning strategies; and also an indirect association with idea generation through work-based learning strategies. Problem demand also had a direct association with idea generation and idea promotion, which is necessary to go from the individual level to group level learning. Similar to the results of Homan colleagues (2012) on the individual level, Lantz and Brav (2007) found that job design was positively associated with learning in groups.

In sum, organizational learning was in this study studied as a multilevel phenomenon following the Canadian school of organizational learning which describes the process in terms of interconnecting learning stocks and learning flows. Moreover, we acknowledge that organizational learning on different levels can be stimulated by task-related factors (e.g. job control) as well as cultural/social relations (e.g. networks, teamwork).

2.4 Relation between opportunity competence and complex problem solving

In the context of the LLLight'in'Europe project we were specifically interested in the relationship between OC and Complex Problem Solving. The association between OC and problem-solving is not new. According to Nickerson and Zenger (2004) the opportunity process involves key efforts that are similar to problem solving. For instance, to establish a 'new means-end relationship' individuals have to identify, define and structure novel solutions to 'open-ended' problems (Shane, 2003, p 56). Stevenson and Jarillo (1990, p. 23) already argued in the nineteen nineties that 'basic entrepreneurial skills' involve accumulated knowledge that 'assist[s] in problem-solving'. (Complex) problem solving has received broad interest as an important generic skill to function in modern society in the last decade. According to Fischer and colleagues (2012) CPS can be understood as the process of solving problems that have to be considered "complex" (i.e., containing many highly interrelated elements).

However, until now most of the work on CPS has been carried out in the context of education, rather than the work environment (Fischer, Greiff, & Funke, 2012). What CPS and OC seem to have in common is that some types of opportunities have, in their rudimentary form, more the character of complex problems; they are difficult to pin down and do not always have definitive solutions. On example is opportunities with regard to sustainability (Lans, Blok, & Wesselink, 2014). These opportunities are more complex than business opportunities which address a one dimensional problem. As Lans and colleagues (2013) argue: *"...because sustainability problems have no closed form and concern complex systems in which cause and effect are uncertain or unknown, no simple solutions exist for them, or no solution at all...."*

According to Fischerand colleagues (2012) the CPS process consists of two distinct, different phases, namely knowledge acquisition and (goal-oriented) knowledge application. From the perspective of the opportunity process the entrepreneur knowingly identifies or unknowingly stumbles upon a problem, like a market need and/or underemployed resources that he/she can solve (Ardichvili, Cardozo, & Ray, 2003; Hsieh et al., 2007). The entrepreneur will then try to solve the problem by deliberately searching for a high-valued solution to this problem or finding one in the form of a fortuitous discovery (Hsieh, et al., 2007). To do so, the entrepreneur has to gather information and integrate this information, the first step of problem solving. Second, the entrepreneur recognizes and creates a "fit" between the identified problem and specified resources (Ardichvili, et al., 2003). This process seems to resonate with the stage of knowledge application, where an individual makes forecasts and checks whether this is a valuable route or that additional knowledge acquisition is necessary (Fischer, Greiff, & Funke, 2012).

For more background on CPS, please read the thematic report "Learning to Lifelong Learn" from wp 3. See also the conceptual article by Baggen and colleagues (in press) on the relation between OC and CPS.

2.5 Relation between opportunity competence and innovation performance

In whatever way corporate entrepreneurship, intrapreneurship or innovation is viewed, studies always highlight the role of individual employees' intentions, drives and activities in various levels of the business hierarchy (Bosma et al., 2013). However, lack of innovation performance does not directly mean lack of OC. The majority of (small) firms tend to stay a relative stable level of operation after the founding phase. Agri-food sector statistics from the Netherlands show for instance that only 2.5% of all Dutch horticulture companies introduce innovations truly new for the country (Pannekoek et al., 2005).

Secondly, it is important to acknowledge that the relationship between competence and performance may not be a direct one, but influenced by other variables such as motivational factors like strategies, goals and self-efficacy. Concerning the former, studies from small business show for instance that the relation between owner-managers' entrepreneurial competence and business performance also depends on the type of strategy they pursue. This is in line with the Giessen-Amsterdam model of entrepreneurial success, which states that the relation between human capital and entrepreneurial success is moderated by strategy (Rauch & Frese, 2007). Concerning the later, in particular, feelings of efficacy (i.e. confidence, self-belief) and individual goals have been associated with entrepreneurial intentions and entrepreneurial learning (Zhao, Seibert, & Hills, 2005).

Thirdly, when investigating OC at the individual level it is important to use comparable performance constructs reflecting firm innovation level. In the earliest phases of the innovation process, the idea moves from key individuals within the organization towards the corporate decision-making level (Reid & De Brentani, 2004). According to Reid and De Brentani (2004) ideas and action on the individual level have to subsequently move through three critical decision-making interfaces, the boundary (idea gains ground in the company), gatekeeping (idea is leveraged to corporate level decision makers) and project interface (a project is organised). The project interface encompasses the concrete organization of a first project; a first screening phase of an innovation which usually rest with senior managers at the organizational level. At this point the idea is considered to be a potential new product, service or process and becomes part of the innovation portfolio of the firm. Thus, whereas final innovations outcomes are company-wide implemented products, processes, or methods, early innovation outcomes on the individual and group level are for instance new projects for new or a significantly improved products, processes or methods.

2.6 Relation between organizational learning, opportunity competence and innovation performance

Learning is important for OC (Short, Ketchen, Shook, & Ireland, 2010). People can strengthen their OC as for instance DeTienne and Chandler (2004) showed in their research in entrepreneurship education. With training they could teach students to generate more ideas for entrepreneurial opportunities and their ideas were also found to be more innovative. However, this research took place in a classroom setting. What seems to be clear in the entrepreneurial learning literature is that learning-related activities associated with the ongoing entrepreneurial process are neither exclusively individual by nature, nor exclusively social, but include a combination of both (Dimov, 2007). Study groups, business visits, learning from colleagues, self-analysis, engagement in networks of external relationships, immersion within the industry, observation, experimentation, and reflection are all recorded as powerful entrepreneurial learning-related activities (Mulder et al., 2007). These learning activities emphasize the importance of the informal learning and the work environment to foster this. We thus expect that task-related characteristics as well as the existence of cultural social relations are positively related to the level of OC.

It is unclear whether and how OC is also influenced by organisational learning, although it has been theorized by influential scholars that organizational learning can enhance the competence to recognize opportunities and effectively pursue them (Dess et al., 2003; Dutta & Crossan, 2005; Lumpkin, 2005). Dutta and Crossan (2005) combined the insights from the organizational learning theory from Crossan and colleagues (1999) with opportunity theory and synthesized its relations as follows: *"Learning begins when individuals develop an intuition with respect to a business opportunity on the basis of their prior experience and recognition of patterns as external events unfold. The individual uses these patterns to make sense of what is going on – to interpret an insight or an idea and to put it into words. Individual interpretation can be strengthened or reinforced by sharing it with a group who can then engage in joint exploration, interpretation, and integration of the idea, to develop it into a shared understanding of a feasible business proposition. Over time, shared understanding can be institutionalized at the organizational level in the form of systems, structures, strategy, and procedures, for example"* (Dutta & Crossan, 2005, p. 434-435).

Based on the above mentioned studies, the assumption of this research is that OC is related to organizational learning. In particular we assert that OC is related to learning stocks, as learning stocks represent the overarching knowledge and competencies the company has. Moreover, as OC supports the initial phases in the opportunity production process, we also expect a positive association with learning flows, in particular with feed forward learning (e.g. whether individual learning moves to group learning).

3. METHODS

In this section, we elaborate on the participants, how we measured and analysed OC, innovation performance, organizational learning, and CPS. Next, we elaborate on how we analysed the results. Finally we report conclusions and points for discussion.

3.1 Setting and participants

The collected data for WP6 can be divided into two groups of participants:

1. Students from two universities (University 1 and University 2)

2. Employees from companies from the agricultural, food and fibre industry

3.1.1 Group 1: Students from University 1 and University 2[4]

At University 1, a convenience sample of 115 MSc students in the Life Sciences domain agreed to participate voluntarily in our study. The students followed a course on entrepreneurship or career development and planning. These courses are meant as an appetizer for students who are, at the most, latent or dormant entrepreneurs. Students from all life-science domains, representing many nationalities, follow this course together. For this reason, the language adopted was English. The MSc program of the students was either related to natural sciences (80.7%) or to social sciences (19.3%). The students were, on average, 23.5 years old (SD = 1.97). The majority of the students (70.6%) was female.

The participants from University 2 were selected from the Faculty of Human Kinetics. A convenience sample of 142 first year BSc students (31.7% from Psychomotor Rehabilitation, 9,9% of Dance and 58,4% of Sport Sciences) agreed to participate voluntarily in our study. The students were, on average, 19.2 years old (SD = 3.48). Of the students, 51.5% was female. As this group of student is at the very first start of their higher education program, there was no explicit selection on entrepreneurial intentions.

3.1.2 Group 2: Companies

Participants from group 2 represented employees from small, medium and large companies in the agricultural, food and fibre industry. The agri-food industry is mostly known for its large multinationals like Unilever and Nestlé. The agri-food industry is a complex industry due to its multifaceted supply chain. It is composed of a diverse range of companies operating in different markets and selling a variety of fast products (including beverages) to meet the demands of different customers. The supply chain connects primary production (agriculture), the processing industry and distribution (wholesale, caterers and retail). Despite the importance of innovation, the agri, food and fibres industry scores relatively low on indicators such as the level of R&D expenditures or number of patents. For instance the level of R&D investment in the European food industry was 0.30% of the production value in 2001. This percentage is way below the European average of 1.89% and comparable with the wood, pulp and metal industry (EC, 2007). However, these innovation proxies only reveal part of the complex picture of innovation in the agri-food industry. R&D does not necessarily result in the development of new products or processes, many innovative firms do not perform R&D, a large faction of innovations are not patented and the importance of patenting varies between sectors (Arundel, Lorenz, Lundvall, & Valeyre, 2007). Experts warn to be careful when benchmarking industries purely based on indicators like R&D expenditure or patents (Jensen, Johnson, Lorenz, & Lundvall, 2007). For instance recent data from the FoodDrinkEurope (2011) report high activity of innovation activities and innovation goals in the European food industry.

[4] A paper on the development and application of the instrument, for which the student sample is used, is in development and will be handed in at a methodological journal.

Most product innovations in the agri-food industry are incremental. Important, not mutually exclusive, challenges for the agri- food and fibres industry are i) in the area of sustainability, ii) the fast changing consumer preferences, iii) increasing the competiveness of the industry as a whole and iv) attracting and keeping appropriate and qualified personnel (EC, 2007). Although these challenges are not exclusive for this sector, these challenges and opportunities have an extra dimension due to the complexity of the supply chain.

Eleven companies from the agricultural, food, and fibre industry participated in our research. One company was from a different manufacturing industry, the metal industry. Although this is clearly a different sector we decided to include this company as in terms of organization and innovation structure, size and educational level this company was comparable with the other organizations. In total, 234 employees participated. As the participants partly worked in groups, a total amount of 53 groups participated in our research. Of the participants, 75.6% was male. The average age of the participants was 40.84 (SD = 9.89). Furthermore, 39.3% followed university education, 29.1% vocational education. As table 1 shows all companies are active and successful in innovation on company level (company innovation performance column), ranging from the introduction in the past three years of 1 to up to 30 new or significantly improved goods, services, and/or processes. At the time of this research innovation performance of company 11 was still unknown.

An overview of the participating companies is given in table 1.

Table 1: overview of the participating companies and their characteristics.

#	Main product	Country	# Employees	Company Innovation Performance*	# Participants
1	Paper	The Netherlands	185	1	16
2	Paper	The Netherlands	40	5	8
3	Seeds	The Netherlands	220	4-5	25
4	Chrysanthemum	The Netherlands	100	10	29
5	Union seeds	The Netherlands	62	4	28
6	Trade & distribution vegetables and fruits	The Netherlands	38	3	16
7	Orchids	The Netherlands	70	6	30
8	Substrates	Germany	370	14	29
9	Trade & distribution vegetables and fruits	The Netherlands	43	30	12
10	Champignons	The Netherlands	100	4	15
11	Trade & distribution vegetables and fruits	The Netherlands	450	-	13
12	Metal	The Netherlands	70	3	13

** Number of new or significantly improved goods, services, and/or processes during the last 3 years.*

In summary, based on the data collected among novices (students University 2), latent, early stage entrepreneurs (master students from University 1 following entrepreneurship education programs), and managers/employees who have to show entrepreneurial behaviour in the companies they work for, we aim to give insight into the complete entrepreneurial process.

3.2 Instruments

3.2.1 Measurement innovation performance

Outcomes or success of employee-driven innovation and entrepreneurship were operationalised in this study as 'the number of new ideas that have been *adopted* by the management over the last three years'. This measure serves as an indicator of the employees performance in the initial stages of opportunity process rather than as a record of all types of innovations that are implemented by the company (Hurley & Hult, 1998).

At the companies an interview was organized with an employee (or the director) who had a complete overview of the innovation performance of the organization. In general, the interviews were about 45 minutes of length. The main topics of the interviews were:

- General information on the organization
- Financials
- Compensation/performance
- Innovation

Concerning innovation, in order to standardize 'innovation performance' on the company level and to compare our companies with overall innovation performance we followed the questions that are asked about innovation performance in the Community Innovation Survey 2010 (CIS, 2010).

3.2.2 Measurement opportunity competence[5]

To measure opportunity identification and evaluation, two distinct tasks were developed which comprised the Opportunity Competence Assessment Task (OCAT). Task 1 focussed on opportunity identification, and we used business idea generation as a proxy for opportunity identification (compare Corbett, 2007). The instrument as proposed by Corbett (2007) was used as a starting point. In his study, Corbett (2007) asked participants to generate business ideas related to (Bluetooth) technology. For the formulation of the particular problem case, a complex, ill-defined problem was searched for, that is familiar for many people.

[5] A paper on the development and application of the instrument is in development and will be handed in at a methodological journal.

This way, the subject 'sustainable development' was chosen. In the case, sustainable development was defined as *"Development that meets the need of the present without compromising the ability of future generations to meet their own needs'* (UNCSD, 2012). In the problem case, the challenges of sustainable development in the area of people, planet, and profit were explained. Several specific examples were given of what these challenges might concern (e.g. energy, climate change, education, etc.). The participants were asked: 'Imagine that you are asked to give input for business ideas for new startups, in the area of sustainable development. These business ideas can concern people, planet and/or profit, and may lead to social, environmental and/or economic gains. What ideas for new startups come up in your mind?' A startup was defined as a new independent venture or a new project within an organization.

To develop Task 2, in which opportunity evaluation was measured, the work of Baron and Ensley (2006) was used. They asked novice (first-time) and experienced entrepreneurs (who started on average 2.6 companies) 'describe the idea on which your new venture was based' and 'why did you feel this was a good idea – one worth pursuing?' (Baron & Ensley, 2006, p. 1334). Also, they asked novice and experienced entrepreneurs what business idea they rejected in the past and why. Based on the results, Baron and Ensley (2006) designed prototypes of an experienced and a novice entrepreneur that indicate how they tend to determine the potential for success of a business opportunity. According to these prototypes, experienced entrepreneurs focus more on elements directly related to actually starting a business. Novice entrepreneurs pay more attention to the 'newness' or 'uniqueness' of ideas.

Based on the prototypes, three existing business ideas were selected that are in line with the novice prototype and three that are in line with the experienced prototype. As a result, in the first part of Task 2 a list with six existing business ideas was presented and the participants were asked to select the three business ideas which they think have the most potential for success. The main purpose of this part of the task was to stimulate participants to evaluate what they thought was a business idea with potential for success. Therefore, the results of this part of the task will not be reported on. Next, a list with ten arguments was presented which were directly extracted from the prototypes of an experienced and a novice entrepreneur. For instance, the arguments 'solving a customer's problem' and 'manageable risk' were extracted from the prototype of an experienced entrepreneur. The arguments 'how novel the idea is' and 'potential to change the industry' were extracted from the prototype of a novice entrepreneur. The participants were asked to select the five arguments the participants think are most important when determining the potential for success of the business ideas (instead of to rank the arguments). The participants worked for eleven minutes on Task 2.

In short, the OCAT consists out of the following tasks:

Individual tasks:

1. Task 1: Participants are asked to generate as much ideas as possible within ten minutes.

2. Task 2A: Participants receive a list with six existing business ideas. They are asked to select the three business ideas they think have the most potential success.

3. Task 2B: Participants receive a list with ten arguments. Now, they are asked to select the five arguments they think are most important in determining the potential success of the business ideas (step 2).

In order to investigate OC on the group level, the participants worked on similar group tasks too:

1. The group receives the list with six existing business (the same list as used in step 2 of the individual tasks). In ten minutes, the participants are asked to select the three ideas they (as a group) think has the most potential success.

2. Then, the group also has to select the five arguments they think are most important in determining the potential success of the ideas as a group (step 3 individual tasks).

3.2.3 Measurement organizational learning

As a final step, the company participants filled in a questionnaire including questions on organizational learning (based on the model of Dutta & Crossan, 2005). In line with earlier work of Crossan and colleagues (1999), and Bontis and colleagues (2002) a description of the organizational capability to learn can be made by means of two essential dimensions underlying beneath of the concept, namely what is learned (learning stock) and its associated learning processes (how is learned, learning flows). Both constructs are measured using the SLAM: The Strategic Learning Assessment Map proposed by Crossan and Hulland. The questionnaire contains five theoretical constructs: three learning stocks – individual, group and organization; and two learning flows – feed forward and feedback.

The items were measured using a 7 point Likert-scale ranging from 1 (disagree) to 7 (agree). Examples of items were: *I am aware of the critical issues that affect my work (individual stock), We share our successes within the group* (group stock), *The organizational structure allows us to work effectively* (organizational stock), *Recommendations by our groups are adopted by the organization* (feed forward), *Company goals are communicated throughout the organization* (feedback).

Furthermore, additional questions in relation to human capital (i.e., individual and social factors) as well as workplace learning questions were added.

Measurement properties were assessed with principal component analysis (PCA) and reliability analysis (Cronbach's Alpha). The PCA of each separate scale measure should give support for a one component solution. Concretely this means that a minimum of 50% of the variance of the items is explained by the first component and the Eigenvalue of the second component should be smaller than 1 (Hair et al. 2010). Moreover, all items should have a loading on the first component higher than 0.6. Finally the reliability of the scale as indicated by Cronbach's Alpha should be higher than 0.6. Table 2 provides a summary of the used scales and their measurement properties.

Table 2. Measurement properties of the used scales

Scale	Source	# items	Cronbach 's Alpha
Individual stock	Bontis et al. (2002)	9	.77
Group stock	Bontis et al. (2002)	8	.87
Organizational stock	Bontis et al. (2002)	7	.90
Feed forward	Bontis et al. (2002)	7	.87
Feedback	Bontis et al. (2002)	6	.76
Creative self-efficacy	Tierney & Farmer, 2002	3	.66
Social networks	Wang, Ellinger, & Wu, 2013	3	.79
Prior knowledge	Based upon Grégoire, Shepherd, & Lambert, 2009	8	.82

Innovative work behaviour	De Jong & Den Hartog, 2000; Hurley & Hult, 1998	6	.79
Job control	LLLight-in-Europe BQ	1	N.A.
Problem demand	LLLight-in-Europe BQ	1	N.A.
Perceived pressure at work	LLLight-in-Europe BQ	3	.68
Task characteristics	LLLight-in-Europe BQ	8	.81

** N.A. = not applicable.*

Finally, in addition to the quantitative data collected on organizational learning qualitative interviews were organized at two companies that performed highly on organizational learning: a paper mill company and a plant breeding company. During the interviews, the directors of the companies were asked how they organize learning and innovation activities. In general, the interviews were about 45 minutes of length. The interviews were audio-taped. More specifically, topics that were elaborated upon:

- Companies' policy related learning and innovation
- Informal ways of learning
- Job characteristics
- Selection and support new employees
- The innovation process: how are new ideas developed? And how are existing processes, products, services and methods evaluated/improved?

3.2.4 Measurement CPS

In the thematic report "Learning to Lifelong Learn", the computer-based CPS assessment is thoroughly explained. Please read the thematic report of wp 3 for further information on the CPS assessment.

3.3 Analysis

3.3.1 Analysis of individual innovation performance

To measure individual level innovation performance, the participants were asked how many of their ideas have been adopted by the management over the last three years. The participants that indicated that more than 10 ideas were adopted, were recoded into a score of 10. Furthermore, if participants were ambiguous in their answers (e.g. indicating multiple numbers), the result was coded as a missing value. This way, wrong interpretation of answers was avoided. And finally, the respondents that did not work for their current employer for 3 years, were not included in the analysis. To be able to compare innovativeness among groups of employees, tertiles were created to compare employees of whom many ideas were adopted, and employees of whom less ideas were adopted.

3.3.2 Analysis opportunity competence[6]

The generated ideas were processed in Excel. Next, the ideas were scored on the criteria comprehensibility, concreteness, and flexibility:

1. Comprehensibility: ideas that were not comprehensible (or too much interpretation was needed to understand the idea) were scored 0, the comprehensible ideas were scored 1. If an idea was scored as being not comprehensible, it was excluded from further analysis.

2. Concreteness: the comprehensible ideas were scored on their concreteness: the degree in which it was possible to visualize or apply the idea (1 = concrete, 0 = not concrete). The proportion concrete ideas each participant generated was calculated: the percentage concrete ideas of the total number of comprehensible ideas (number of elaborated ideas / number of comprehensible ideas).

3. Flexibility: a high score on flexibility indicates that a participant is able to generate ideas in many different categories. For instance, 'use solar energy' and 'wear a sweater extra and turn down the heating' are both related to energy. However, the ideas 'use local products in the canteen', 'reuse clothes' and 'organize back-to-basic school camps to make youth aware of their (over)consumption' all relate to different categories, indicating a higher flexibility. The categories were formulated based on the examples related to sustainable development as given in the case of OCAT Task 1. Each idea was scored into one category only. The final categories were: affordable and adequate food supply, decent housing, energy, climate change, education, and personal health and safety. To calculate the flexibility score, the following formula was applied: number of scored categories / maximum number of categories (6).

[6] A paper on the development and application of the instrument is in development and will be handed in at a methodological journal.

To analysis opportunity evaluation, the selected arguments in line with the prototype of an experienced entrepreneur were scored 1, resulting in a minimum of 0 (no arguments selected in line with the prototype of an experienced entrepreneur) and a maximum of 5 (all arguments selected in line with the prototype of an experienced entrepreneur).

3.3.3 Analysis of organizational learning

Descriptive statistics for individual, group, and organizational level learning, feedback and feedforward learning were used to analyse how the participants experience the learning potential of their organization.

3.3.4 Analysis of the relationships between the core concepts

In order to analyse the (hypotheses) relationships between the different outcome and predictor variables three different analysis were used.

To test whether CPS predicted opportunity identification and opportunity evaluation beyond several control variables (i.e. proactivity, prior knowledge, and problem-solving self-concept), multiple regression analyses were conducted. First, the relation between opportunity identification and CPS was explored, and next, the relation between opportunity evaluation and CPS.

To investigate differences between groups, for instance high and low performing employees, or students from different universities, simple t-test were used in the case two groups were compared and an ANOVA was performed when three or more independent groups were compared.

To investigate the relations between outcome (e.g. innovation performance) and predictor variables (e.g. OC, human capital) systematically, linear, hierarchal regression analysis was performed. Based on the literature the different explanatory variables were added to the model. In the first step the background, demographic variables were entered into the model. These variables included education and work experience. In the second step also more specific human capital variables were added. In the last step, finally, work-context factors were added.

Finally, as the qualitative interviews with the two high performing companies were solely organized to gain more insight into how learning and innovation is organized in practice (and not to use in any further research purposes), the interviews were not transcribed.

4. FINDINGS

4.1 Opportunity competence

4.1.1 Student sample University 1

In table 3, the descriptive statistics for OCAT Task 1 are given.

Table 3. Descriptive statistics for OCAT Task 1, University 1, sample size, mean, standard deviation, minimum and maximum.

	N	*M*	*SD*	*LL*	*UL*
Number of generated ideas	115	6.43	3.61	0	24
Number of comprehensible ideas	115	6.25	3.53	0	23
Categories					
Affordable and adequate food supply	113	.87	1.07	0	4
Decent housing	113	.25	.58	0	4
Energy	113	1.12	1.29	0	5
Climate change	113	2.24	2.03	0	12
Education	113	1.39	1.44	0	6
Personal health and safety	113	.50	.84	0	4
Number of concrete ideas	113	5.72	3.19	0	19
Concreteness	112	.90	.17	0	1
Flexibility	113	.52	.18	0.17	1

Note. N: sample size, M: mean, SD: standard deviation, LL: lower limit, UL: upper limit.

In sum, 115 participants of University 1 generated 719 comprehensible ideas. On average, 90% of the comprehensible ideas of a participant were also concrete. As the table shows, the highest number of ideas were scored into the category 'climate change', while a relatively low number of ideas were scored into the category 'decent housing'. The average flexibility score (mean = .52) means that the participants scored, on average, ideas in three of the six different categories.
To investigate the relation between flexibility and concreteness, a Chi-square test was conducted. The results show that concreteness and flexibility related ($p < .01$). However, the relation was not linear as Pearson's r was insignificant ($p < .72$).

In Table 4, the descriptive statistics for OCAT Task 2 are given. Please note that the participants of the very first trial were asked to rank the ten arguments, instead of to select the best five. The arguments are ordered according to their importance, as ranked by the participants.

Table 4. Descriptive statistics for OCAT Task 2, University 1, sample size, mean, and standard deviation.

	N	M	SD
Items (arguments)			
Solving a customer's problem*	111	3.14	2.72
Ability to generate positive cash-flow*	111	4.28	2.61
Superiority of product/service	111	4.31	2.60
How novel the idea is	111	5.25	2.81
Manageable risk*	111	5.44	2.23
Others in your network with whom to develop the venture*	111	6.21	2.66
Intuition or gut feeling	111	6.26	2.96
Potential to change the industry	111	6.48	2.73

Speed of revenue generation*	111	6.48	2.53
Extent to which idea is based on new technology	111	7.15	2.31
Average number of arguments in line with prototype of experienced entrepreneur in top five	111	2.77	.97

*Note: The arguments with a *, are arguments extracted from the prototype of an experienced entrepreneur.*

The observed scores for all items ranged between 1 and 10 (except for the total ranking, here the lowest score was 1 and the highest 5). The argument 'solving a customer's problem' is ranked highest by the participants. The argument that is ranked lowest, is 'extent to which idea is based on new technology'. The average number of arguments in line with the prototype of an experienced entrepreneur (mean = 2.77) suggested that the participants scored a bit more like an experienced entrepreneur instead of a novice entrepreneur.

4.1.2 Student sample University 2

Table 5 presents the descriptive statistics of OCAT Task 1 for the participants from University 2.

Table 5. Descriptive statistics for OCAT Task 1, University 2, sample size, mean, standard deviation, minimum and maximum.

	N	M	SD	LL	UL
Number of generated ideas	142	2.28	1.48	0	10
Number of comprehensible ideas	140	2.24	1.44	1	10
Categories					
Affordable and adequate food supply	140	.19	.43	0	2

Decent housing	140	.14	.38	0	2
Energy	140	.43	.74	0	4
Climate change	140	.85	.97	0	6
Education	140	.19	.51	0	3
Personal health and safety	140	.44	.73	0	4
Number of concrete ideas	140	1.89	1.35	0	9
Concreteness	140	.84	.32	0	1
Flexibility	140	.28	.13	.17	.83
Rest category	141	.12	.42	0	3

Note. N: sample size, M: mean, SD: standard deviation, LL: lower limit, UL: upper limit.

The 142 participants from University 2 generated 313 comprehensible ideas. On average, 84% of the comprehensible ideas of a participant were also concrete. The highest number of ideas were scored into the category 'climate change', and the lowest number of ideas into the category 'decent housing'. The average flexibility score (mean = .28) indicated that the participants scored, on average, ideas in about two of the six different categories.

Chi-square test showed that concreteness relates to flexibility ($p < .01$). However, as the results showed, Pearson r is non-significant ($p = .91$) meaning that the relation between concreteness and flexibility was non-linear.

The descriptive statistics for OCAT Task 2 are presented in Table 6, ordered according to how often the participants selected the arguments (with the most selected argument on top).

Table 6. Descriptive statistics for OCAT Task 2, University 2; sample size, mean, and standard deviation.

	N	M	SD
Items (arguments)			
Solving a customer's problem*	142	.89	.31
Ability to generate recurring revenues*	142	.72	.45
Potential to change the industry	142	.59	.49
Superiority of product/service	142	.49	.50
Existence of an ecosystem (other companies, persons) with whom to develop the idea*	142	.47	.50
Cost of customer acquisition*	142	.44	.50
How novel the idea is	142	.42	.50

Extent to which idea is based on new technology	142	.31	.46
Manageable risk*	142	.23	.42
Intuition or gut feeling	142	.16	.37
Selection arguments in line with experienced entrepreneur	142	2.75	.89

*Note: The arguments with a *, are arguments extracted from the prototype of an experienced entrepreneur.*

The observed scores for all items ranged between 0 and 5 (except for the selection of arguments in line with an experienced entrepreneur, here the lowest score was 1 and the highest 5). The participants of University 2 chose 'solving a customers' problem' as the most important argument. The argument 'intuition or gut feeling' is selected the lowest number of times, this argument was in line with the prototype of a novice entrepreneur. The mean score for the selection of arguments in line with an experienced entrepreneur (mean = 2.8) suggested that the participants scored slightly more in line with the prototype of an experienced entrepreneur.

4.1.3 Comparison of the students from University 1 and University 2

Although the samples from the two universities were not purposefully sampled for in-depth investigating differences between e.g. study programs, prior knowledge or cultural differences, in terms of instrument development it was interesting to see whether differences were detectible. The differences between the sample from University 1 and University 2 for OCAT Task 1 were calculated based on an independent sample t-test for the number of comprehensible ideas, concreteness, and flexibility. The results, as presented in Table 7, showed that the participants of University 1 scored significantly higher than the participants of University 2 on all aspects of OCAT Task 1.

Table 7: Independent t-test for the differences between the participants from University 1 and University 2 for fluency, elaboration, and flexibility.

	Sample				
	1	2	t	df	p
OCAT Task 1					
Number of Comprehensible ideas	6.25 (3.53)	2.24 (1.44)	-11.45	145.20	< .001
Concreteness	.90 (.17)	.84 (.32)	-2.13	223.99	.032
Flexibility	.52 (.18)	.28 (.13)	-11.77	201.12	< .001

Note: Standard deviations appear in parentheses behind means.

4.1.4 Relation between OCAT Task 1 and Task 2

To explore whether OCAT Task 1 and Task 2 related to one another, a Chi-square test was conducted. The results showed that OCAT Task 2 did not relate to the number of comprehensible ideas (p = .27), (proportion) concreteness (p = .36), and flexibility (p = .66). Also the data from University 2 did not show any significant relation between OCAT Task 2 and the number of comprehensible ideas (p = .29), (proportion) concreteness (p = .16), and flexibility (p = .91).

4.1.5 Company sample

On average, the employees generated 4.83 ideas (standard deviation = 2.87), which is in between the average of the novice (2.2) (university 2) and the latent, early-stage entrepreneurs (6.3) (university 1) we found in our student samples. Table 8 shows the descriptive statistics for OCAT Task 2 measured on the individual level, ordered according to how often the participants selected the arguments (with the most selected argument on top).

Table 8: Descriptive statistics for OCAT Task 2, employees sample individual level; sample size, mean, and standard deviation.

	N	M	SD
Items (arguments)			
Ability to generate recurring revenues*	233	.70	.46
Solving a customer's problem*	233	.65	.48
Existence of an ecosystem (other companies, persons) with whom to develop the idea*	233	.56	.45
Superiority of product/service	233	.55	.50
Manageable risk*	233	.49	.50
Potential to change the industry	233	.43	.50
How novel the idea is	233	.42	.49
Extent to which idea is based on new technology	233	.41	.49
Intuition or gut feeling	233	.38	.49
Cost of customer acquisition*	233	.29	.46
Selection arguments in line with experienced entrepreneur	233	2.70	1.02

Table 9 shows the descriptive statistics for OCAT Task 2 measured on the group level, ordered according to how often the groups selected the arguments (with the most selected argument on top).

Table 9: Descriptive statistics for OCAT Task 2, employees sample group level; sample size, mean, and standard deviation.

	N groups	M	SD
Items (arguments)			
Ability to generate recurring revenues*	53	.92	.27
Solving a customer's problem*	53	.75	.43
Manageable risk*	53	.65	.48
Existence of an ecosystem (other companies, persons) with whom to develop the idea*	53	.62	.49
Superiority of product/service	53	.62	.49
Potential to change the industry	53	.41	.49
Intuition or gut feeling	53	.32	.47
How novel the idea is	53	.28	.45
Extent to which idea is based on new technology	53	.23	.42
Cost of customer acquisition*	53	.20	.40
Selection arguments in line with experienced entrepreneur	53	3.14	.87

On an individual level, no significant differences were found in opportunity evaluation as a mixture of arguments were used. Compare to the student sample, employees seem to attach more value to their network in the evaluation of business ideas than students. In contrast students tend to include more the customers' perspective as well as attaching more value to novelty and superiority of the product or service. Furthermore, the results from the companies showed that the employees individually selected, on average, 2.7 arguments in line with an experienced entrepreneur.

As a group, the employees selected, on average, 3.1 arguments in line with an experienced entrepreneur, which is significantly higher than the individual scores. This suggests that groups outperform individuals when it comes to evaluating business opportunities. This seems to underline the importance of the team level in companies.

4.2 Organizational learning

Table 10 presents the descriptive statistics for the questions from the SLAM questionnaire, aggregated for the individual, group, and organizational level, feedback and feed forward.

Table 10: Descriptive statistics for the SLAM questionnaire with minimum, maximum, mean, and standard deviation.

Variable	N	M	SD	LL	UL
Individual level learning	233	5.44	.66	2.44	6.89
Group level learning	233	4.80	.81	1.50	6.75
Organizational level learning	233	4.76	1.01	2.14	7.00
Feedback	233	4.50	.91	1.67	6.83
Feed forward	233	4.41	1.00	1.71	6.71

Note. N: sample size, M: mean, SD: standard deviation, LL: lower limit, UL: upper limit.

The descriptive statistics show that in this sample employees perceive the highest scores on individual learning stocks. Lower scores are given to organizational learning, feedback and feed forward. The participants scored significantly higher on individual learning, compared to group and organizational learning stocks. The results for the two learning flows are not significantly different. Still, based on the mean scores, realizing feed forward and feedback learning processes seems to be most challenging for the organizations from our sample.

Contrary to our initial expectations no direct relation between the different elements of OC and the perceived learning stocks and flows in the organizations was found. However, the results did suggest that employees who perceived the individual learning stock in their organization as higher were also more successful in introducing new ideas to their management ($F(2, 158) = 7.13$, $p < .01$). The same effect was found for perceived feed forward learning flows (i.e. whether individual learning moves to group learning) and innovation performance ($F(2, 158) = 7.30$, $p < .01$). No significant differences were found for group and organizational level learning stocks and feedback learning for the number of ideas that have been adopted by the management during the last three years (low, medium and high).

Furthermore, the results suggest that work-related learning factors, in particular whether or not employees are confronted with complex tasks is significantly related to individual levels of opportunity identification and opportunity evaluation. In addition we found significant differences between job complexity (i.e., how often employees face complex problems in their daily work that take at least 30 minutes to find a good solution) and low, medium and high innovation performance, $F(2, 158) = 5.27$, $p < .001$. Those who were most successful in getting their ideas adopted by the (higher) management also faced a higher job complexity. In addition, also job control (i.e., the instructions the employees receive regarding the process according to which daily tasks should be performed) was different for low, medium and high innovation performance, $F(2, 156) = 4.59$, $p < .05$. Those who had less detailed instructions also were more successful in getting their idea's adopted by the higher management. In addition, we also find differences in low, medium, and high employee innovation performance for task characteristics, meaning that those who are more successful in getting their ideas adopted indicate their experience more variety, autonomy and newness in their tasks ($F(2, 158) = 14.09$, $p < .001$). We did not find differences for perceived work pressure ($F(2, 158) = 2.85$, $p = .06$), although the significance level is only slightly insignificant. Nonetheless, research on specific combinations of specific human capital, organizational, work-environment factors and innovation outcomes deserves more attention as our data suggest more complex patterns here which require more specialised data handling and sophisticated statistics such as structural equation modelling.

4.3 Opportunity competence and complex problem solving[7]

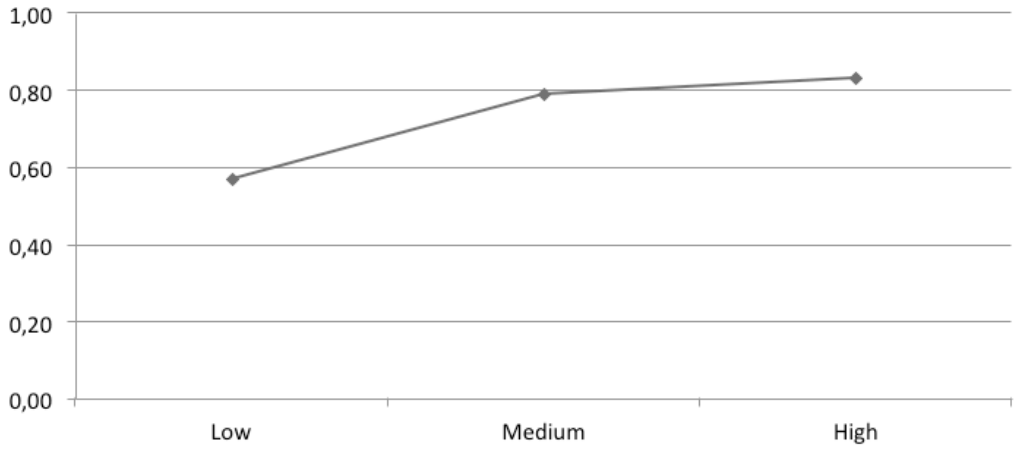
The multiple regression model with CPS as an predictor showed that CPS ($\beta = .16$, $p < .05$) significantly predicted opportunity identification. The model with CPS as predictor for opportunity evaluation, showed that CPS ($\beta = .24$, $p < .01$) also significantly predicted the ability to evaluate opportunities. Problem-solving self-concept ($\beta = -.16$, $p > .05$), prior knowledge ($\beta = -.04$, $p > .05$), and proactivity ($\beta = .01$, $p > .05$) did not predict opportunity evaluation significantly.

[7]A paper on the empirical comparison of OC and CPS is in progress and will be submitted to a journal in the field of entrepreneurship.

4.4 Opportunity competence and innovation performance

The results suggest that differences between innovation performance (i.e. number of ideas adopted by the management) of employees are mainly explained by innovative work behaviour of employees, rather than OC or more crude measures of human capital such as educational level and work experience. Innovative work behaviour includes all work activities carried out in relation to innovation development in an organization (De Jong & Den Hartog, 2010). The innovative work behaviour scale measures how often employees actively involved are in innovation related tasks such as idea generation, optimization, product development and strategic change. Logically, those who engaged in these tasks more frequently also more often saw their ideas being adopted by the management in their organization (see figure 2).

Figure 2: Mean engagement in innovation related activities work plotted against number of ideas that have been adopted by the management during the last three years (low, medium and high).



As such, innovative performance or success seems to be mediated by specific innovation activities (comparable to first phase entrepreneurial employee activities defined by the GEM, see Bosma et al. 2013). Difference between high and low engagement in innovative behaviour by employees in the sampled companies, in turn, can be explained into more detail by specific human capital variables.

Firstly, those who engaged frequently in innovation related activities (i.e. more than once a month) also performed better on the developed opportunity tasks. Performance differences between the low (less than once a month) and high group (more than once a month) were significant for task 1, opportunity identification ($t(232) = -1.81$, $p < .05$).

In addition, those who frequently engaged in innovative behaviour also scored significantly higher on self-efficacy (i.e. believe in their own opportunity ability) as well as the importance they accredit to social networks ($t(227.26) = -4.81$, $p < .01$).

Finally, also self-assessed self-efficacy in identifying opportunities was significantly different between employees who score either low or high in innovative work behaviour ($t(230) = -4.93$, $p < .01$). The importance of self-efficacy for (intended) behaviour is also not new and well documented in the literature. Belief in one's own (entrepreneurial) competence (Bandura, 1982) is one of the strongest individual level predictors for entrepreneurial success (Rauch and Frese, 2007).

Altogether, these above specific human capital variables (opportunity identification and evaluation competence, self-efficacy and social networks) together, explained almost 30% of the variance observed in innovation activities of employees when controlled for less specific human capital variables such as work experience and educational level.

4.5 Opportunity competence, innovation performance, and organizational learning

To further illustrate the (complex) interplay between learning, OC and innovation, data from the two high performing companies on both innovation and learning is illustrated below.

4.5.1 Example 1: the paper mill

The paper mill is a relatively small paper mill (40 employees) from the Netherlands. About 80% of the employees working at this company followed lower vocational education. At this paper mill employees scored significantly higher on the degrees in which they show innovative behaviour (self-perceived) than the other organizations from our sample (mean = 3.7 on a 5-points scale). An interview with the managing director was organized to gain more qualitative insight into how innovation and learning are organized at this company.

Since the company is a rather small paper mill, the managing director decided to focus on monopolistic niche products. The company thinks along with clients: clients need them, and they need the clients with unique, specific desires. The managing director described the innovation process as follows:

1. Innovation starts with ideas. Social networks play a key role in coming up with new business ideas. The managing director invested in building up a network, promoting the paper mill, and characterizing the mill as an innovative one in the market. Not only he, but also colleagues (from marketing and sales) look outside for new business opportunities. Moreover, because of the wide network, people with ideas now increasingly approach te paper mill. The managing director explains that he responds to every person that contacts him: each idea has potential, or could get potential in the future. Furthermore, searching on Google, writing down interesting thoughts and ideas, and talking to all kind of people helps to identify business ideas.

2. In his room, the managing director has three boxes:

   a. "Ideas to think about"

   b. "Ideas that need a decision"

   c. "Developments in 2015"

   Together with colleagues from several specialties (e.g. technical, marketing, sales, externals), the ideas are being discussed. The ideas that they do not agree about, are the ones that are further investigated. For the other ideas, it is clear from the brainstorm what to do with them.

3. The selected ideas are further explored and tested in the paper mill. Each week, 5 to 10 hours are scheduled to perform trials. Each trial is prepared with great care and afterwards directly evaluated. During the evaluation, it is decided whether a trial will be repeated, or that it has to be rejected after all. After several successful trials, scaling-up takes place and a new innovation is born.

Next, we elaborated upon what factors might contribute to the innovative capacity of the company. The following factors were identified:

- First of all, social networks: "Social networks are extremely important for my company", explains the managing director of the highly innovative paper mill. He also explains that the potential of networks is not always seen by company management. For instance, while he was still employed, his previous boss asked him: "why are you always on the road and not focussing on optimization of processes in the factory?" Whereas his next boss told him: "..., please go outsides and develop networks." By visiting fairs, seminars, the director expanded his network which has resulted now in the fact that when he took over the management five years ago people are able to find him when they start looking for innovative partners.

- The employees of the paper mill also scored high on self-efficacy. As the managing director explains when he talked about his continuous search for partners and social networks: "what I actually see is that for instance the lady from marketing and the guy from the technology department are enthusiastic about my approach and now start doing similar things". The example given here typically illustrates the power of observation learning (e.g. learning from the director as a role model) to increase specific self-efficacy (e.g. engage in opportunity production processes). Moreover, the example also shows the centrality of the owner-manager in small and medium sized companies for unleashing the learning potential of the work environment (Lans et al. 2008).

- An advantage of being small is that the organization is considerably flexible. The organization is flat, three people are in charge of daily work (including the director). As a consequence, the employees can work as one big team.

- Every day, a short meeting is organized to look back at the last 24 hours and look forward to the coming day. Furthermore, the managing director visits the paper mill on a daily basis and makes a chat with his employees: he asks how they are, how things are going, and for their opinion.

- Guts and passion were mentioned repeatedly by the managing director as being crucial elements for how he works, and what he expects from his employees. He wants his employees to enjoy their work, and to show passion for what they do.

- The managing director himself is described as visionary and inspiring by his colleagues. He is very clear, strict, and open towards his employees.

- The managing director stimulates autonomy and responsibility among employees. Some employees tend to rely on others when they have to do something new or make decisions, but the director increasingly stimulates employees to act in a responsible and autonomous way. Because the paper mill is growing, two new employees have recently been assigned to fulfil a supervisory role over the employees working at the floor. The processes in the mill could be further optimized, and the new employees will train their colleagues, help them to deal with new situations (e.g. during the trials), and share knowledge, so that the employees will be further enabled to work autonomously.

- Employees get as much freedom to learn as possible. For instance, a new employee has to learn how to colour paper (which is difficult to do). An experienced employee is able to colour the paper correctly within half an hour. The new employee needs 4 hours to create the right colour. However, the director does give him the space to learn and to experiment.

- Employees are allowed to make mistakes and to experiment in their work. Of course, not without limitations: risk-taking, and especially failure, can cost a lot of money. However, making mistakes with the goal in mind to gain progress in the future, is being encouraged.

- When selecting new employees, the learning attitude of the applicant is at least as important as the knowledge he/she has. As the managing director mentioned: "the right people need to be at the right spot". The director defined learning attitude as someone who is "interactive, pro-active, searching for solutions, and passionate".

Although these factors are closely related to the context of this company, small and medium-sized companies might learn from how innovation and learning are stimulated at this paper mill. The close collaboration and contact among colleagues are typical for the paper mill and seem to contribute to the considerably high scores for feedforward learning.

4.5.2 Example 2: the plant breeding company

On feedback learning processes, this plant breeding company scored higher than the other companies (except for one other company). The company is known for their world-wide expertise in propagating plant material. In sum, 62 (i.e. 50 fte) employees work for this family business (60% having a university degree). Idea generation and innovation are highly important for the company. Therefore, a certain creative atmosphere is needed and employees have to be fostered to come up with new business ideas. Based on an interview with one of the (two) directors, the following factors seem to contribute to the learning capacity and innovativeness of the company:

1. Organizational structure: the company is a flat organization: next to the directors (consisting of 2 persons) and the management team (MT) (additional 5 persons), there are no formal layers. The employees mainly work in teams. Because of the flat structure and the teamwork, employees experience high levels of responsibility. Also, the communication lines are short: they are in close contact with each other. Arundel, Lorenz, Lundvall and Valeyre (2007) confirm in their article that a flat, organic structure fosters innovativeness.

2. Autonomy: the importance of high levels of autonomy among employees is not only fostered by the organizational structure, but also a clear message from the directors. The director even mentioned an example, in which he explained that employees sometimes ask him what he would do in a certain situation. As the director explains: "I am willing to give my opinion, but I prefer to respond to a proposal of them [employees], because they are responsible. However, a short brainstorm is never a problem". The employees are not judged based on the number of hours they work, but based on results. In sum, employees receive high levels of responsibility and freedom, and the organization expects them to be able to deal with this.

3. Selection: when recruiting new personnel, the organization always aims to find team players. In their first two weeks, new employees get the opportunity to get to know the organization (i.e. in big lines: strategy, mission, vision, etc.) and (direct) colleagues. Thereafter, a programme follows based on the function of the employee.

4. Opportunities for promotion: offering employees the possibility to grow or get promoted in their work, is difficult for some functions (e.g. support).

With this in mind, it is striking that only 1 employee left the firm in the year before (because of retirement). As an explanation, the director refers to the great team spirit among his employees and the high levels of responsibility they receive. Besides, some employees do have the opportunity to get promoted. Breeders, for instance, can vary in their work by focussing on changing areas (i.e. Africa, America, etc.).

5. Physical environment: the company recently moved into a new building. The building is distinguishing from other (agricultural) buildings, and attention was paid to several main points:

    a. Transparency: the design is open, all doors (including those of the director's room) are transparent.

    b. Colour: it is striking that the logo and building have a deep, purple colour.

    c. Workplace: group of desks close to each other, comfortable environment, and planting.

6. Formal learning: Each and every employee is allowed to follow a training or course if he or she would like to do so. Almost 50% of the employees followed a course or training in the year before (on top of the 80% of employees who had to follow obligatory trainings). During the yearly performance interview, it is a standard topic on the agenda. The employees are aware of the fact that they can always follow a training or course, and that they have to be able to argue how the training will help them in their work. To stimulate employees to use their newly gained knowledge and skills in their work, the director sometimes asks employees to reflect upon their learning process in a report.

7. Informal learning: Next to these formal educational activities, several activities are organized to foster informal learning:

    a. Once a year, the complete team visits a comparable company (with a different core product) to learn from how they organize their work. At the end of the day, the team goes out for a joint diner, in order to promote team building informally.

    b. If deemed relevant, employees are invited to join journeys in order to learn and see the activities the company is involved in. The employee always has to formulate learning goals, and to write a travel report to reflect upon what he/she learned during the journey.

    c. The employees that support the breeders from the office, are invited to join the breeders in the field. By accompanying each other, the breeders and support are able to align their activities as good as possible.

d. Every morning, all present employees attend a joint coffee break. Employees of all kind of roles, functions, and departments get in contact with each other. On Monday mornings, news is being shared and discussed.

The flat structure, high levels of autonomy among employees, the inviting physical environment, and the stimulation of formal and informal learning, all seem to contribute to the high levels of feedback learning within De Groot en Slot. In addition, work processes are evaluated systematically: based on a visualisation of the complete process, each step in the process is being evaluated.

5. CONCLUSIONS & RECOMMENDATIONS

Three research questions guided the studies carried out as part of this work package, namely:

1. What is opportunity competence?

2. What is the relation between opportunity competence and complex problem solving?

3. What is the relation between opportunity competence and innovation performance?

4. How can the relation between opportunity competence and innovation performance be explained by organizational learning?

As stated in the introduction employee-driven entrepreneurship and innovation deserves attention as entrepreneurship seems to be an important element for peoples learning and working life and current levels of entrepreneurial employee activity, as measured by the GEM, are relatively low. In particular we were interested in the initial stages of entrepreneurial activity, which can lead to outcomes in term of independent ventures or outcomes in terms of innovation in existing companies. Student as well as employee data have gained more fine grained information on these research questions.

To start with the first question, what is opportunity competence, in-depth understanding of the individual contribution to the early stages of introducing new products, processes or services comes from the work on opportunities, one of the central concepts in the field of entrepreneurship (Shane & Venkataraman, 2000). We asserted that the first phase of the opportunity process, opportunity objectification, benefits from people who are competent in opportunity identification and evaluation. The results from the student sample confirm that there are differences in opportunity identification and evaluation, based on a newly developed performance assessment. The results suggest that some individuals perform better at generating business ideas, which involves creativity and divergent thinking, while others perform better at evaluating business ideas for their potential success.

This result is in line with the opportunity process, in which business idea generation and evaluation are commonly described as different parts of the opportunity process (Lumpkin & Lichtenstein, 2005; Wood & McKinley, 2010). In addition, the company data also underline the importance of teamwork in opportunity evaluation, as teams in organizations outperform individuals in opportunity evaluation.

In terms of the second research question, the argument is that the identification of a first, rudimentary business idea provides the set-up for a complex problem situation. Complex problem solving is relevant for the further objectification of the idea into an opportunity and the development of the opportunity into a concrete prototype, plan, format, and so on (i.e., opportunity enactment). As the results show, complex problem solving indeed incrementally predicted the abilities to identify and evaluate opportunities, explaining 2.3% to 5.7% additional variance.

With regard to the third research question we examined the relation between opportunity competence and innovation performance. Innovation performance, as an outcome or success measure, was operationalised as how many ideas were adopted by the management during the last 3 years. The regression analysis shows that the relation between this individual innovation outcome variable and specific human capital such as opportunity competence is probably not a direct one. Most of the variance in innovation performance of employees is explained by innovative work behaviour. Innovative work behaviour includes all work activities carried out in relation to innovation development in an organization (De Jong & Den Hartog, 2010). Differences between high and low engagement in innovative behaviour by employees in the sampled companies, in turn, can be explained into more detail by specific human capital variables. Those who engaged frequently in innovation related activities (i.e. more than once a month) indeed performed better on the developed opportunity tasks. Thus, the relation between specific human capital and individual innovation performance seems to be mediated by specific work behaviour. The latter, in turn, is influenced mostly by opportunity competence, belief in the own creative capability and the importance attached to social networks. The meaning of self-efficacy as well as networks for innovation and entrepreneurship are well documented in the literature. Belief in one's own (entrepreneurial) competence (Bandura, 1982) is one of the strongest individual level predictors for entrepreneurial success (Rauch & Frese, 2007). Networks are important for all sorts of entrepreneurial events like start-ups, mergers and acquisitions. Social networks provide access to resources (e.g. finance, knowledge) and can create legitimacy for new activities (Anderson & Jack 2002). Social networks emphasise the relevance of social competence of individuals, next to cognitive abilities. Moreover, recent studies suggests that social networks are a result of specific social competence of individuals, rather than the other way around (Baron & Tang, 2009; Lans et al., 2015).

Finally, concerning the last research question, the quantitative data illustrate clearly significant differences between learning stocks on the different levels. Furthermore the data on workplace learning factors illustrate that there are differences between employees who successfully introduce many ideas (i.e. 3 or more) versus those who introduce only a few. These differences can be directly explained by (work-related) learning-related variables. For instance, there are differences between employees who successfully introduce many ideas (i.e. more than 6) and those who hardly do so (less than 3), and their perception of available individual learning stocks and feed forward learning. In addition, employees who introduce 3 or more ideas, more often face complex problems in their daily work that take at least 30 minutes to find a good solution than the group that introduces a low number of ideas (i.e. problem demand). If an employee introduces 6 ideas or more, we also find a relation with the instructions the employees receive regarding the process according to which daily tasks should be performed (i.e. job control : the extent to which employees have the freedom to do their job as they would prefer to do). Moreover, those who successfully introduce ideas to their superiors experience more variety, autonomy and newness in their tasks. These results are in line with earlier research, such as the research of Holman and colleagues (2012), who showed that the job characteristics problem demand and job control are important antecedents of learning and employee-driven entrepreneurship on the individual level. Especially problem demand seems to be of importance as it also is significantly related to individual levels of opportunity competence. Also the stories from the two high performing firm provide more insight in the complex relationship between opportunity competence, learning and innovation, and in particular the important role of job control and problem demand. Altogether these findings highlight the crucial importance of informal, work-related learning for employee entrepreneurial competence and activity on the one hand and individual innovation success on the other.

Altogether, stimulating employee-driven entrepreneurship and innovation performance can subsequently follow at least two routes, directly via task-related measures (e.g. problem demand) or indirectly via stimulating specific entrepreneurial activities (i.e. innovative work behaviour) via competence development programs focussing on human and social capital development.

6. RECOMMENDATIONS FOR POLICY MAKERS

Although focused, mostly, on one industry, the results of this study likely have broader applicability to wide variety of industries. On the basis of the results of this study, some recommendations can be made. They are mainly addressed to policy-makers at national, regional and company levels.

Overall:

- Specific human capital, in particular opportunity competence, importance of social networks and specific motivation (i.e. self-efficacy) significantly contribute to engagement in innovative work behaviour, which, in turn, predicts innovative performance of employees. The results, hence, underline the complex interplay between human capital, entrepreneurial employee activity, innovation, and work-related learning. Stimulating innovation and entrepreneurship in its defining initial stage is not simply a matter of hiring high educated or experienced staff. Cooperation across the traditional disciplinary boundaries is hence called for in efforts to effectively combine lifelong learning, human capital, entrepreneurial employee activity, and innovation.

- Policy makers should be aware of how work should be designed in the future to challenge employees to learn and innovate, and to create challenging jobs that require a certain job complexity, so that they can facilitate organizations in achieving this. Furthermore, organizations should facilitate the learning, formally and informally, of their employees. However, as the examples show, a "one-size-fits-all" approach does not exist. Every organization has a different structure, and all people have different learning preferences. These should be taken into account when it comes to fostering entrepreneurial employee activity among employees within a specific company.

Individual level:

- The engagement in innovative work behaviour was, by far, the strongest predictor of outcomes of employee-driven innovation and entrepreneurship (i.e. number of ideas adopted by the management), which underlines the importance of task characteristics of employees.

- Earlier research shows that the work characteristics job control and problem demand are in particular important in the context of learning and innovation on the individual level. The results from our sample confirm that those employees who experience high levels of job control and problem demand, are more involved in activities related to innovation. Therefore, to foster innovativeness, policy could promote job complexity. As such this finding supports the recommendation in the CEDEFOP (2012) study to invest in programmes that address organizational structures and processes with a focus on the, individual, workplace level.

Team level:

- The results for learning on the group level are significantly lower than the results for learning on the individual level. Nevertheless, team work is highly important for the interpretation and further developments of ideas. Therefore, group formation, interaction within and outside groups, and teamwork should be supported and facilitated. As the results of this study show, opportunity identification and opportunity evaluation are separate abilities. For that reason, innovation teams should include team members that perform well on different abilities. In addition, groups seem to outperform individuals on opportunity evaluation. Hence, programs as well as organizations themselves should invest in team activities and team incentives. Also, by getting insight in the specific innovation abilities of teams, employers could get more grip on the strengths and weaknesses of the personnel and provide the right training to improve the organization's innovative capacity.

Organizational level :

- The results, furthermore, show the importance of specific human capital, rather than general human capital. Typically this set of specific human capital is a result of social mediated, informal, work-related learning activities, such as learning-by-doing, vicarious learning, experiential learning and action learning. This result supports the recommendation drawn by CEDEFOP (2012) to support programmes that invest directly in specific human capital as well as those that are geared towards relational capital.

- The key to get such programs running is in the hands of the management in small and medium sized firms. Thus, albeit human capital and task characteristics are often treated as an individual matter, in the context of innovation and entrepreneurship at any point of time they should be treated as a shared responsibility between the individual and his or her organization (employer/management).

5. REFERENCES

Amorós, J. E. & Bosma, N. (2014). Global Entrepreneurship Monitor 2013 Global report [PDF]. Retrieved from http://www.gemconsortium.org/docs/3106/gem-2013-global-report

Anderson, B. S., Covin, J. G., & Slevin, D. P. (2009). UNDERSTANDING THE RELATIONSHIP BETWEEN ENTREPRENEURIAL ORIENTATION AND STRATEGIC LEARNING CAPABILITY: AN EMPIRICAL INVESTIGATION. Strategic Entrepreneurship Journal, 3(3), 218-240. doi: 10.1002/sej.72

Anderson, A., and S.L. Jack. 2002. „The articulation of social capital in entrepreneurial networks: a glue or a lubricant?" Entrepreneurship and Regional Development no. 14:193-210.

Ardichvili, A., Cardozo, R., & Ray, S. (2003). A theory of entrepreneurial opportunity identification and development. Journal of Business Venturing, 18(1), 105-123.

Arundel, A., Lorenz, E., Lundvall, B. A., & Valeyre, A. (2007). How Europes economies learn: a comparison of work organization and innovation mode for the EU-15. Industrial and Corporate Change, 16(6), 1175-1210. doi: 10.1093/icc/dtm035

Autor, D. H., Levy, F., & Murnane, R. J. (2003). The skill content of recent technological change: an empirical exploration. The Quartery Journal of Economics, 118, 1279-1333. doi: 10.3386/w8337

Azadegan, A., Dooley, K. J., Carter, P. L., & Carter, J. R. (2008). Supplier innovativeness and the role of interorganizational learning in enhancing manufacturer capabilities. Journal of Supply Chain Management, 44(4), 14-35. doi: 10.1111/j.1745-493X.2008.00070.x

Bandura, A., 1982. Self-efficacy mechanism in human agency. American Psychologist. 37, 122-147

Baregheh, A., Rowley, J., & Sambrook, S. (2009). Towards a multidisciplinary definition of innovation. Management Decision, 47 (8), 1323-133p. DOI 10.1108/00251740910984578

Baron, R. A., & Ensley, M. D. (2006). Opportunity Recognition as the Detection of Meaningful Patterns: Evidence from Comparisons of Novice and Experienced Entrepreneurs. Managament Sciene, 52(9), 1331-1344. doi: 10.1287/mnsc.1060.0538

Baron, R. A. & Tang, J. (2009). Entrepreneurs' social skills and new venture perfor mance: mediating mechanisms and cultural generality. Journal of Manage ment, 35 (2), 282-306.

Biemans, H., Nieuwenhuis, L., Poell, R., Mulder, M., & Wesselink, R. (2004). Com petence-based VET in the netherlands: background and pitfalls. Journal of Vocational Education and Training, 56, 523-538.

Billett, S. (2001). Knowing in practice: re-conceptualising vocational expertise. Learning and Instruction, 11(6), 431-452.

Billett, S., Hernon-Tinning, B., & Ehrich, L. (2003). Small business pedagogic practces. Journal of Vocational Education & Training, 55(2), 149 - 168.

Bird, B. (1995). Towards a theory of entrepreneurial competency. Advances in Entrepreneurship Firm Emergence and Growth, 52-72.

Bontis, N., Crossan, M. M., & Hulland, J. (2002). Managing An Organizational Learning System By Aligning Stocks and Flows. Journal of Management Studies, 39(4), 437-469. doi: 10.1111/1467-6486.t01-1-00299

Bosma, N., Wennekers, S., Guerrero, M., Amorós, J. E., Martiarena, A., & Singer, S. (0213). The global entrepreneurship monitor. Special report on entrepreneurial employee activity [PDF]. Retrieved from http://www.babson.edu/executive-education/thought-leadership/premium/Documents/90246%20EEA%20 Report %202011.pdf

CEDEFOP (2012). Learning and innovation in enterprises. Research Paper 27. Luxembourg: Publications Office of the European Union.

Chandler, G. N., & Jansen, E. (1992). The founder's self-assessed competence and venture performance. Journal of Business Venturing, 7(3), 223-236.

Cooper, R.G., & Kleinschmidt, E.J. (1993). Major new products: what distinguishes the winners in the chemical industry?. Journal of Product Innovation Management 10, 90-111.

Corbett, A. C. (2007). Learning asymmetries and the discovery of entrepreneurial opportunities. Journal of Business Venturing, 22(1), 97-118. doi: http://dx.doi.org/10.1016/j.jbusvent.2005.10.001

Crossan, M. M., & Apaydin, M. (2010). A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature. Journal of Management Studies, 47(6), 1154-1191. doi: 10.1111/j.1467-6486.2009.00880.x

Crossan, M. M., Lane, H. W., & White, R. E. (1999). An Organizational Learning Framework: From Intuition to Institution. The Academy of Management Review, 24(3), 522-537.

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. Academy of Management Journal, 555-590.

De Jong, J. & Den Hartog D. (2010). Measuring innovative work behaviour. Creativity and Innovation Management, 19 (1), 23-36. Doi:10.1111/j.1467-8691.2010.00547.x

De Visser, M., de Weerd-Nederhof, P., Faems, D., Song, M., van Looy, B., & Visscher, K. (2010). Structural ambidexterity in NPD processes: A firm-level assessment of the impact of differentiated structures on innovation performance. Technovation, 30(5–6), 291-299.

Dess, G. G., Ireland, R. D., Zahra, S. A., Floyd, S. W., Janney, J. J., & Lane, P. J. (2003). Emerging Issues in Corporate Entrepreneurship. [Entrepreneurship: Past Accomplishments and Future Challenges]. Journal of Management, 29(3), 351-378.

DeTienne, D. R., & Chandler, G. N. (2004). Opportunity Identification and Its Role in the Entrepreneurial Classroom: A Pedagogical Approach and Empirical Test. Academy of Management Learning & Education, 3(3), 242-257.

de Visser, M., de Weerd-Nederhof, P., Faems, D., Song, M., van Looy, B., & Visscher, K. (2010). Structural ambidexterity in NPD processes: A firm-level assessment of the impact of differentiated structures on innovation performance. Technovation, 30(5–6), 291-299.

Dimov, D. (2007). From Opportunity Insight to Opportunity Intention: The Importance of Person-Situation Learning Match. Entrepreneurship Theory and Practice, 31(4), 561-583.

Dutta, D. K., & Crossan, M. M. (2005). The Nature of Entrepreneurial Opportunities: Understanding the Process Using the 4I Organizational Learning Framework. Entrepreneurship Theory and Practice, 29, 425-449.

European Parliament and the Council of the European Union (2006). Key competences for lifelong learning (Report no. L394). Retrieved from Official Journal of the European Union: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX: 32006H0962&from=EN

EC. (2007). Competitiveness of the European Food Industry: An economic and legal assessment. Luxembourg: European Commission: Enterprise and Industry.

Eraut, M. (2004). Informal learning in the workplace. Studies in Continuing Education, 26, 247-273.

Fenwick, T. (2003). Innovation: examining workplace learning in new enterprises. The Journal of Workplace Learning, 15, 123-132.

Fischer, A., Greiff, S., & Funke, J. (2012). The Process of Solving Complex Problems. The Journal of Problem Solving, 4(1), 19-42.

Gaglio, C. M. & Katz, J. A (2001). The psychological basis of opportunity identification: entrepreneurial alertness. Small Business Economics, 16, 95-111. doi:10.1023/A:1011132102464

Gielnik, M. M., Krämer, A. C., Kappel, B., & Frese, M. (2014). Antecedents of business opportunity identification and innovation: investigating the interplay of information processing and information acquisition: business opportunity identification. Applied Psychology, 63, 344–381.

Gilsing, V. A., & Duysters, G. (2008). Understanding novelty creation in exploration networks—structural and relational embeddedness jointly considered. Technovation, 28(10), 693-708.

Grégoire, D. A., Shepherd, D. A., & Schurer Lambert, L. (2010). Measuring opportunity-recognition beliefs: illustrating and validating an experimental approach. Organizational Research Methods, 13 (1), 114-145.

Guth, W. D., & Ginsberg, A. (1990). Guest Editors' Introduction: Corporate Entrepreneurship.Strategic Management Journal, 11, 5-15.Harryson, S. J., Dudkowski, R., & Stern, A. (2008). Transformation networks in innovation alliances–the development of Volvo C70. Journal of Management Studies, 45(4), 745-773.

Hitt, M. A., Ireland, R. D., Camp, S. M., & Sexton, D. L. (2001). Strategic entrepreneurship: entrepreneurial strategies for wealth creation. Strategic Management Journal, 22(6-7), 479-491. doi: 10.1002/smj.196

Holman, D., Totterdell, P., Axtell, C., Stride, C., Port, R., Svensson, R., & Zibarras, L. (2012). Job design and the employee innovation process: the mediating role of learning strategies. Journal of Business and Psychology, 27(2), 177.

Hornsby, J. S., Kuratko, D. F., Shepherd, D. A., & Bott, J. P. (2009). Managers' corporate entrepreneurial actions: Examining perception and position. Journal of Business Venturing, 24(3), 236-247.

Hornsby, J. S., Kuratko, D. F., & Zahra, S. A. (2002). Middle managers' perception of the internal environment for corporate entrepreneurship: assessing a measurement scale. Journal of Business Venturing, 17(3), 253-273.

Hsieh, C., Nickerson, J. A., & Zenger, T. R. (2007). Opportunity Discovery, Problem Solving and a Theory of the Entrepreneurial Firm. Journal of Management Studies, 44(7), 1255-1277.

Huber, G. P. (1991). Organizational Learning: The Contributing Processes and the Literatures. Organization Science, 2(1), 88-115.

Hurley, R. F., & Hult, G. T. M. (1998). Innovation, Market Orientation, and Organizational Learning: An Integration and Empirical Examination. Journal of Marketing, 62(3), 42-54. doi: 10.2307/1251742

Ireland, R. D., Hitt, M. A., Camp, M., & Sexton, D. L. (2001). Integrating entrepreneurship and strategic management actions to create firm wealth. Academic Management Perspective, 15, 49-63. doi: 10.5465/AME.2001.4251393

Jensen, M. B., Johnson, B., Lorenz, E., & Lundvall, B. Å. (2007). Forms of knowledge and modesof innovation. Research Policy, 36(5), 680-693.

Jones, B. and Grimshaw, D. (2012). The effects of policies for training and skills on improving innovation capabilities in firms. NESTA Working Papers.

Jones, O., & Macpherson, A. (2006). Inter-Organizational Learning and Strategic Renewal in SMEs: Extending the 4I Framework. Long Range Planning, 39(2), 155-175.

Lans, T., Biemans, H., Verstegen, J., & Mulder, M. (2008). The Influence of the Work Environment on Entrepreneurial Learning of Small-business Owners. Management Learning, 39(5), 597-613. doi: 10.1177/1350507608098117

Lans, T., Blok, V., & Wesselink, R. (2014). Learning Apart and Together: Towards an Integrated Competence Framework for Sustainable Entrepreneurship in Higher Education. Journal of Cleaner Production(0). doi: http://dx.doi.org/10.1016/j.jclepro.2013.03.036

Lans, T., Hulsink, W., Baert, H., & Mulder, M. (2008). Entrepreneurship education and training in a small business context: insights from the competence-based approach. Journal of Enterprising Culture, 16(4), 363-383.

Lans, T., van Galen, M. A., Verstegen, J. A. A. M., Biemans, H. J. A., & Mulder, M. (2014). Searching for entrepreneurs among small business ownermanagers in agriculture. NJAS - Wageningen Journal of Life Sciences, 68(0), 41-51. doi: http://dx.doi.org/10.1016/j.njas.2013.12.001

Lans, T., Blok, V., & Gulikers, J. (2015). Show me your Network and I'll tell you who you are: Social Competence and Social Capital of Early-stage Entrepreneurs. Entrepreneurship & Regional Development.

Lantz, A., & Brav, A. (2007). Job design for learning in work groups. Journal of Workplace Learning, 19(5), 269.

Lumpkin, G. T. (2005). The role of organizational learning in the opportunity-recognition process. Entrepreneurship Theory and Practice, 29(4), 451-472. doi: 10.1111/j.1540-6520.2005.00093.x

Lumpkin, G. T. & Lichtenstein, B.B. (2005). The role of organizational learning in the opportunity recognition process. Entrepreneurship Theory and Practice, 29 (4), 451-472.

Lundvall, B.-Å., & Lorenz, E. (2012). Innovation and competence building in the learning economy: implications for innovation policy. In B. T. Asheim & M. D. Parilli (Eds.), Interactive learning for innovation. A key driver for clusters and innovation systems (pp. 33-71). London: Palgrave Macmillan.

Lutfihak, A., Cagri, B., Gurhan, G., Gunduz, U., & Kemal, K. (2010). Organizational support for intrapreneurship and its interaction with human capital to enhance innovative performance. Management Decision, 48(5), 732.

Man, T. W. Y., Lau, T., & Chan, K. F. (2002). The competitiveness of small and medium enterprises: A conceptualization with focus on entrepreneurial competencies. Journal of Business Venturing, 17(2), 123-142.

March, J. G. (1991). Exploration and Exploitation in Organizational Learning. Organization Science, 2(1), 71-87.

McCauley, C. D., Ruderman, M. N., Ohlott, P. J., & Morrow, J. E. (1994). Assessing the developmental components of managerial jobs. Journal of Applied Psychology, 79(4), 544-560.

Mulder, M. (2001). Competence development - some background thoughts 1. [The Journal of Agricultural Education and Extension]. The Journal of Agricultural Education and Extension, 7(4), 147-158. doi: 10.1080/13892240108438822

Mulder, M., Lans, T., Verstegen, J., Biemans, H., & Meijer, Y. (2007). Competence development of entrepreneurs in innovative horticulture. The Journal of Workplace Learning, 19, 32-44.

Nickerson, J. A., & Zenger, T. R. (2004). A knowledge-based theory of the firm - the problem-solving perspective. Organization Science, 15, 617-632.

OECD. (2005). Oslo Manual: Guidelines for collecting and interpreting innovation data.

Ozgen, E. & Baron, R. A. (2007). Social sources of information in opportunity recognition: effects of mentors, industry networks, and professional forums. Journal of Business Venturing, 22, 174-192.

Pannekoek, L., Van Kooten, O., Kemp, R., & Omta, S. W. F. (2005). Entrepreneurial innovation in chains and networks in Dutch greenhouse horticulture. Journal on Chain and Network Science, 5, 39-50. doi: 10.3920/JCNS2005.x053

Raisch, S., & Birkinshaw, J. (2008). Organizational Ambidexterity: Antecedents, Outcomes, and Moderators. Journal of Management, 34(3), 375-409. doi: 10.1177/0149206308316058

Rauch, A., & Frese, M. (2007). Born to be an entrepreneur? Revisiting the personality approach to entrepreneurship. In J. R. Baum, M. Frese, & R. A. Baron (Eds.), The psychology of entrepreneurship (pp. 41-65). New Jersey: Lawrence Erlbaum.

Reid, S. E., & De Brentani, U. (2004). The Fuzzy Front End of New Product Development for Discontinuous Innovations: A Theoretical Model. Journal of Product Innovation Management, 21(3), 170-184. doi: 10.1111/j.0737-6782.2004.00068.x

Rhee, J., Park, T., & Lee, D. H. (2010). Drivers of innovativeness and performance for innovative SMEs in South Korea: Mediation of learning orientation. Technovation, 30(1), 65-75.

Rogers, E. M. (1983). Diffusion of Innovations. New York: Free Press.

Rothaermel, F. T., & Hess, A. M. (2007). Building Dynamic Capabilities: Innovation Driven by Individual-, Firm-, and Network-Level Effects. Organization Science, 18(6), 898-921. doi: 10.1287/orsc.1070.0291

Sanchez De Pablo Gonzalez Del Campo, J. D. & Skerlavaj, M. (2011). The organisational learning process as facilitator of innovativeness. International Journal of Innovation and Learning, 9(4), 401-421.

Sarasvathy, S. D., Drew, N., Velamuri, S. R., & Venkataraman, S. (2010). Three views of entrepreneurial opportunity. In Z. J. Acs & D. B. Audretsch (Eds.), Handbook of entrepreneurship research. Boston: Springer

Sharma, P. & Chrisman, S. J. J. (2007). Toward a reconciliation of the definitional issues in the field of corporate entrepreneurship. In A. Cuervo, D. Ribeiro, & S. Roig (Eds.), Entrepreneurship: concepts, theory and perspective (pp. 83-103). Berlin: Springer

Schumpeter, J. (1934). The Theory of Economic Development. Cambridge: Harvard University Press.

Shane, S. (2003). A General Theory of Entrepreneurship: The individual-Opportunity Nexus. Northampton: MA: Edward Elgar Publishing.

Shane, S., & Venkataraman, S. (2000). The Promise of Enterpreneurship as a Field of Research. The Academy of Management Review, 25(1), 217-226.

Shepherd, D. A. & DeTienne, D. R. (2005). Prior knowledge, potential financial reward, and opportunity identification. Entrepreneurship Theory and Practice, 29 (1), 91-112.

Shipton, H. (2006). Cohesion or confusion? Towards a typology for organizational learning research. International Journal of Management Reviews, 8, 233-252.

Short, J. C., Ketchen, D. J., Shook, C. L., & Ireland, R. D. (2010). The Concept of "Opportunity" in Entrepreneurship Research: Past Accomplishments and Future Challenges. Journal of Management, 36(1), 40-65. doi: 10.1177/0149206309342746

Stevenson, H. H., & Jarillo, C. (1990). A paradigm of entrepreneurship: entrepreneurial management. Strategic Management Journal, 11, 17-27.

Tohidi, H., Seyedaliakbar, S. M., & Mandegari, M. (2012). Organizational learning measurement and the effect on firm innovation. Journal of Enterprise Information Management, 25(3), 219-245. doi: 10.1108/17410391211224390

Toner, P. (2011). Workforce skills and innovation: an overview of major themes in the literature. Working Paper series of the OECD Directorate for Science, Technology and Industry.

Tynjälä, P. (2008). Perspectives into learning at the workplace. Educational Research Review, 3(2), 130-154.

United Nations Conference on Sustainable Development (2012). What is sustainable development? Available at: http://www.uncsd2012.org/about.html (accessed February 2014).

Wang, Y. L., Ellinger, A. D., & Wu, Y. C. J. (2013). Entrepreneurial opportunity recognition: an empirical study of R&D personnel. Management Decision, 51, 248-266. doi: 10.1108/00251741311301803

Wood, M. S. & McKinley, W. (2010). The production of entrepreneurial opportunity: a constructivist perspective. Strategic Entrepreneurship Journal, 4, 66-84. doi: 10.1002/sej.83

Yeh, Y. J. Y. & Chou, L. H. (2007). Transforming a semiconductor company into a learning organisation: A bottom-up approach of knowledge management implementation. International Journal of Technology Management, 39(1-2), 219-234.doi:10.1504/ijtm.2007.013447

Zhao, H., Seibert, S. E., & Hills, G. E. (2005). The Mediating Role of Self-Efficacy in the Development of Entrepreneurial Intentions. Journal of Applied Psychology, 90(6), 1265-1272.

Zietsma, C., Winn, M., Branzei, O., & Vertinsky, I. (2002). The War of the Woods: Facilitators and Impediments of Organizational Learning Processes. British Journal of Management, 13, S61-S74.

6. PROJECT IDENTITY

LLLight'in'Europe is an FP7 research project supported by the European Union, which has investigated the relevance and impact of lifelong learning and 21st century skills on innovation, productivity and employability. Against the background of increasingly complex tasks and jobs, understanding which skills impact individuals and organizations, and how such skills can be supported, has important policy implications. LLLight'in'Europe pioneered the use of an instrument to test complex problem solving skills of adults in their work environment. This allowed for the first time insights into the development of professional and learning paths of employed individuals and entrepreneurs and the role that problem solving skills play. Additionally, LLLight'in'Europe draws on a series of databases on adult competences from across the world to conduct rich analyses of skills and their impact.

These analyses were conducted in concert with different disciplines. Economists have been analyzing the impact of cognitive skills on wages and growth; sociologists have been investigating how public policies can support the development of such skills and lifelong learning; innovation researchers have been tracking the relationships between problem solving skills, lifelong learning and entrepreneurship at the organizational level;. educational scientists have investigated how successful enterprises support their workforce's competences; cognitive psychologists have researched on the development and implications of cognitive skills relevant for modern occupations and tasks; and an analysis from the perspective of business ethics has clarified the role and scope of employers' responsibility in fostering skills acquisition in their workforce. The team has carried out its research and analyses on the value of skills and lifelong learning in EU countries, USA, China, Latin America and Africa.

The result is a multi-disciplinary analysis of the process of adult learning and problem solving in its different nuances, and of the levers which can support the development of these skills for both those who are already in jobs, and for those who are (re)entering the labor market, as well as the development of effective HR strategies and public policy schemes to support them.

Coordinator	Zeppelin University
Project Director	Peer Ederer
EU Project Officer	Monica Menapace
EU Contribution	€ 2,695,000
EU Project #	290683
Project Duration	January 2012 – September 2015

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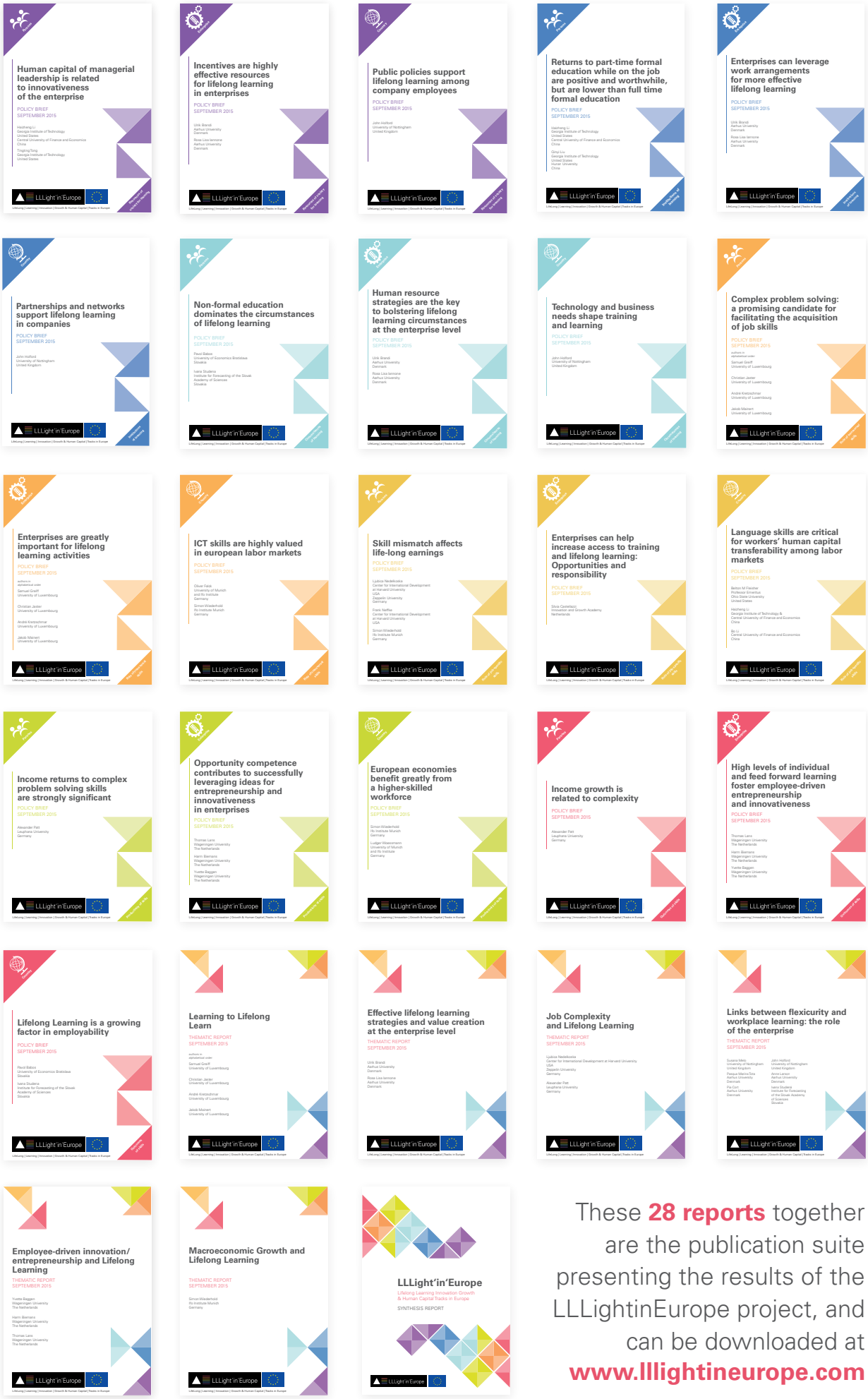

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