Title
Corporate Sustainable Innovation and Employee Behavior

Journal
JOURNAL OF BUSINESS ETHICS, 150(4)

ISSN
0167-4544

Authors
Delmas, Magali A
Pekovic, Sanja

Publication Date
2018

DOI
10.1007/s10551-016-3163-1

Peer reviewed

CORPORATE SUSTAINABLE INNOVATION AND EMPLOYEE BEHAVIOR

Magali A. Delmas
University of California, Los Angeles
Anderson School of Management & Institute of the Environment and Sustainability
Los Angeles, CA, 90095-1496 USA
Phone 310-825-9310
Email delmas@ucla.edu

Sanja Pekovic
University Paris-Dauphine,
Place du Maréchal de Lattre de Tassigny, 75775 Paris Cedex 16, France
Email sanja.pekovic@dauphine.fr

Delmas, Magali A., and Sanja Pekovic. "Corporate sustainable innovation and employee behavior." *Journal of Business Ethics* 150, no. 4 (2018): 1071-1088.

Abstract

Corporate sustainable innovation is a major driver of institutional change, and its success can be largely attributed to employees. While some scholars have described the importance of intrinsic motivations and flexibility to facilitate innovation, others have argued that constraints and extrinsic motivations stimulate innovation. In the context of sustainable innovation, we explore which employee work practices are more conducive to firm-level innovation in corporate sustainability. Our results, based on a sample of 4,640 French employees from 1,764 firms, confirm the positive impact of intrinsic motivations (through employee social interactions), and the negative impact of job strain (through high imposed-work pace), on corporate sustainable innovation. We also find that extrinsic rewards, through pay satisfaction, counteract the negative effect of job strain to promote sustainable innovation. We therefore find that intrinsic and extrinsic rewards can work in tandem to facilitate sustainable innovation.

Keywords

Corporate Sustainability, innovation, job satisfaction, job strain, social interaction, work-related stress, natural environment, human resources, intrinsic motivations.

Introduction

Sustainable innovation, or environmental innovation, consists of new products and processes to avoid or reduce environmental burden for the benefit of the community (Hellström, 2007; Rennings, 2000; Rennings and Zwick, 2002; Rennings et al., 2006). Corporate sustainable innovation has been shown to drive institutional change by changing the dynamics of organizational fields or creating entirely novel fields (Hoffman, 1999; Delmas and Toffel, 2004). Sustainable innovation poses specific challenges to the firm, as compared to other types of innovation, as it seeks to achieve both profits and social missions (DiDomenico et al., 2009). Because sustainable innovation provides a public good by decreasing negative environmental externalities, its relationship with competitive advantage is even more uncertain than with other types of innovations (Delmas et al., 2011). This feature, according to some, has led to a significant and sustained pattern of underinvestment in sustainable innovation (Margolis and Kammen, 1999).

Conversely, the public good nature of sustainable innovation can also generate some positive attitudes among employees, who might appreciate that sustainable innovation is benefiting society beyond profit maximization (Ramus and Steger, 2000). While employees have been shown to be central to the creativity and innovation process, previous literature has generally neglected employee behavior when examining firm innovativeness as it relates to sustainability. Indeed the literature so far has focused mainly on identifying the external drivers of sustainable innovation, including regulation and stakeholder pressure (Delmas and Toffel, 2004; Delmas and Pekovic, 2015; Heyes and Kapur, 2011; Horbach, 2008; Horbach et al., 2012; Rennings, 2000; Yalabik and Fairchild, 2011; Rothenberg and Zyglidopoulos, 2007), as well as the barriers to

sustainable innovation (Bocquet et al., 2015; Foxon and Pearson, 2008). A better understanding of the individual and organizational challenges related to sustainable innovation is warranted (Asif et al., 2013; Delmas and Toffel, 2008; Delmas et al., 2011; Rocha et al., 2007).

It has been argued that theorizing about sustainable innovation may benefit from theorizing about innovation in general. However, theorizing about innovation in general may not cover the whole complexity of the nature of sustainable innovation, and its driving forces (De Marchi, 2012). We build on research about creativity and innovation in organizations that reveals a variety of important tensions that seem fundamental to the nature of creativity itself (Khazanchi et al., 2007). The first one is the tension between intrinsic and extrinsic motivations for innovation. We contend that extrinsic motivations through pay satisfaction, for example, might be less effective to drive sustainable innovation than more intrinsic motivations linked to active social interactions. This is because sustainable innovation provides social benefits that might be more salient to an individual involved in social interactions within the firm. The second one is the tension between flexibility and constraints to promote innovation. We hypothesize that both active social interactions and pay satisfaction can buffer the negative effect of job strain and create an environment that fosters sustainable innovation. That is to say, extrinsic motivation through pay satisfaction might be effective when social interactions are present but is otherwise insufficient to drive sustainable innovation. This indicates that bundling intrinsic and extrinsic motivations can be beneficial to drive sustainable innovation when job strain is present.

We use data obtained from surveys that detail employee and firm characteristics of 4,640 respondents from 1,764 French firms. This data allows us to measure employee-level social interactions, pay satisfaction, work overload, work-pace control and firm-level sustainable

innovation, as well as a host of employee- and firm-level control variables. We study both the net effect of these practices as well their combined effect on sustainable innovation. Regression analysis is best at answering theoretically framed questions about the net effects of competing independent variables on a dependent variable rather than the effect of combined variables. We therefore complement our regression analysis with a cluster analysis to explore how bundles of organizational practices affect sustainable innovation. Cluster analysis refers to a set of analytic procedures that reduces complex multivariate data into smaller subsets or groups and has been a popular method used to include multiple variables as sources of configuration definition (Ketchen and Shook, 1996).

This paper contributes to a surprisingly small empirical literature that examines how the employee's workplace shapes the way that employees think and feel, and plays a role in sustainable innovation. While scholars have recognized potential benefits that employees may obtain from firms' sustainable activities (Delmas and Pekovic, 2013; Hess et al., 2002; Lanfranchi and Pekovic, 2014; Peterson, 2004), few have identified what drives employees to develop sustainable innovation (Boiral and Paillé, 2012; Manohar and Pandit, 2014; Spanjol et al., 2014). This paper addresses two major gaps in the literature. First, based on the literature on creativity, we develop hypotheses on the drivers of sustainable innovation focused on the employee perception of work practices. Second, we use a large dataset with 4,640 employees, whereas previous studies are based predominantly on case-study evidence or surveys with limited samples.

Literature review

Sustainable innovation is defined as product, process, marketing, and organizational innovations that lead to a noticeable reduction of environmental burdens (Horbach et al., 2012: 26). Sustainable innovation is closely linked to a variety of related concepts and is often used interchangeably with "environmental innovation," or "eco-innovation" (Schiederig et al., 2012).[1] Scholars have argued that while there may be similarities between "environmental" and "non-environmental" innovation processes, research and theorizing about innovation, in general, does not cover the whole complexity of environmental innovations (De Marchi, 2012; Rennings, 2000). However, empirical analysis of this issue is scarce as environmental innovation is a relatively new field of research (Schiederig et al., 2012).

Sustainable innovation results in significant progress towards the goal of sustainable development, by reducing the impacts of production modes on the environment, enhancing nature's resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources (European Commission, 2012). Sustainable innovation is therefore often undertaken in response to regulation to address the negative external effects of production, rather than in response to market demand (Horbach, 2008), and there may be a higher uncertainty about the market potential of sustainable innovation than with other forms of innovation (van Hemel and Cramer, 2002). Some employees might perceive this uncertainty as problematic and might feel that sustainable innovation lacks extrinsic motivations, which involves engaging in a behavior in order to earn external rewards or avoid punishments. Extrinsic motivations drive

[1] A recent review study by Schiederig et al. (2012) has concluded that these terms share the same content and can "be used largely interchangeably" (p. 182).

people to do things for tangible rewards rather that are external to the task itself and can possibly can change a pleasurable task into work. For these employees, it might be necessary to boost their motivation through additional rewards.

Conversely, because sustainable innovation seeks to addresses negative externalities rather than market demand, it might generate more satisfaction to employees who care about the environment. Such employees might therefore, be intrinsically motivated to innovate in the area of sustainability. Intrinsic motivation occurs when people act without any obvious external rewards. They simply enjoy an activity or see it as an opportunity to for example explore or learn (Coon and Mitterer, 2010). In addition, work practices associated with the innovation process might provide inherent satisfaction to the employee therefore reinforcing the motivations to innovate. There is abundant evidence in the literature that people will be most creative when they are primarily intrinsically motivated, rather than extrinsically motivated by expected rewards and competition with peers (Amabile, 1997).

In theory, there is a possible antagonism between intrinsic and extrinsic motivations (Frey, 1997; Gneezy et al., 2011). An intrinsically motivated employee might respond negatively to extrinsic financial incentives provided by the firm since they might perceive these as unnecessary rewards. In other words, intrinsic motivation should decrease when extrinsic motivation increases. However, there is also evidence that not all types of extrinsic motivations are borne equal, that different types of extrinsic motivations have different effects on creativity and innovation, and that there are possible effective interaction of intrinsic and extrinsic motivations for innovation (Amabile, 1997). Furthermore, there is little empirical evidence on whether intrinsic motivations for sustainable innovation are enhanced or reduced through extrinsic motivations provided via

organizational practices, or whether employees need additional extrinsic motivations because their level of intrinsic motivation is weak in this area. This what we investigate in this paper.

The literature has identified several work practices that affect employee motivation and creativity, although the authors do not always agree on the direction of the relationship. For example Amabile et al. (1996) argue that creativity requires empowerment and is, therefore, more likely to emerge in contexts that allow employees the flexibility to seek collaborations and develop new knowledge at their own pace (Amabile et al., 1996). Social interactions within diverse working groups, and organizational encouragement playing an important role in this regard. They maintain that work strain is detrimental to creativity by reducing intrinsic motivations (Amabile et al., 1990; Amabile et al., 2002; Baer and Oldham, 2006; Talbot et al., 1992). Others argue to the contrary that focus and control may stimulate creativity and that employee work strain is a necessary sacrifice for innovation (Anderson et al., 2004; Bunce and West, 1994; Nicol and Long, 1996; Zhou and George, 2001). The literature provides therefore opposite predictions regarding the role of constraints and flexibility on innovation.

In this paper, we investigate the role of social interactions, job strain or extrinsic incentives through financial rewards on sustainable innovation. We propose hypotheses on how these types of work practices, which are linked to intrinsic or extrinsic motivations, impact sustainable innovation. We also investigate potential interactions between these practices.

Hypotheses

Social interactions

Although intrinsic motivations depend on the individual personality and preferences, the work environment can have a significant impact on an employee level of intrinsic motivation (Amabile, 1997). For example, social interactions, defined as an exchange between two or more individuals, can promote employee job satisfaction and motivation, which in turn lead to increased creativity (Cohen and Prusak, 2001). Indeed, work is a social activity that engages the same social needs and responses as any other part of life, such as the need for connection, cooperation, support and trust (Cohen and Prusak, 2001). Organizations that facilitate interpersonal contacts among their employees provide an enhanced working environment that might lead employees to give more to the firm and increase their creativity (Batt, 2004; Banker et al., 1996; Huselid, 1995).

Employees working in firms that support social interactions are also more likely to propose new ideas (West, 1990). This is consistent with the literature suggesting that creativity is, in part, a social process since social interactions are important antecedents to creativity (Perry-Smith and Shalley, 2003; Woodman et al., 1993). In other words, the development of creative ideas is a collaborative process rather than an intrapersonal one (Fliaster and Schloderer, 2010). This implies that employee interactions have a positive effect on employees' ability to leverage new knowledge in order to generate innovations. This is consistent with Ramus and Steger (2000), who demonstrate that employees who perceived strong signals of organizational and supervisory encouragement were more likely to develop and implement creative ideas that positively influence sustainable innovation.

Furthermore, social interactions can improve access to knowledge, help employees engage in knowledge transfer and lead to innovative ideas (Greve et al., 2010; Grolleau et al., 2013; Hamilton et al., 2003; Mohrman and Novelli, 1985; Obstfeld, 2005; Perry-Smith and Shalley, 2003). Interpersonal contacts and communication among workers with heterogeneous abilities can help employees engage in knowledge transfer that can lead to innovative ideas (Hamilton et al., 2003; Mohrman and Novelli, 1985; Obstfeld, 2005). This is particularly important for sustainable innovation that spans multiple fields. Indeed, sustainable innovations tend to rely more on external knowledge sources and cooperation compared to other innovations (Horbach et al., 2012; De Marchi, 2012) and more often require access knowledge from external actors and/or develop such knowledge together with other firms and partners. Hence, facilitating social interactions is important to access such external knowledge.

In addition, because sustainable innovation is often undertaken in response to regulation, it can be associated with high uncertainty regarding its market potential (Van Hemel and Cramer, 2002). In the absence of market rewards, supervisory behaviors in the form of competence building, communication, and information dissemination, can, therefore, plays an important role to support employee's sustainable innovation (Ramus, 2001). Cantor et al. (2012) suggest that supervisors' level of support influences positively employee's sustainability behaviors. Paillé and Raineri (2015) also argue that the relationship between perceived corporate sustainability policies and employees' eco-initiatives is mediated by perceived organizational support. Paillé et al. (2015) also find that when employees feel supported by their co-workers, they are more prone to express their loyalty by supporting their green initiatives. Thus, we hypothesize the following:

H1 *Increased social interactions are associated with increased sustainable innovation.*

Pay level satisfaction

Employee compensation is one of the most traditional extrinsic rewards that organizations can use in hope to influence employee behavior. Pay satisfaction, defined as the amount of overall positive or negative affect (or feelings) that individuals have toward their pay, has been described as one of the most important factors in human resource management (Williams et al., 2006). Pay satisfaction reduces employee turnover, absenteeism and increases job performance (Williams et al., 2006). Some research has also supported a positive relationship between pay satisfaction and innovation by arguing that pay satisfaction improves proactive creativity by stimulating initiative and unprompted proposals for improvements (Lau and Ngo, 2004). Beugelsdijk (2008) found that performance-based pay is positively and significantly associated with incremental innovation. While research indicates that extrinsic motivations have the potential to undermine people's intrinsic motivation to innovate (Amabile, 1996), several scholars have argued the contrary in the area of sustainability. That is to say that employee awards, i.e., profit-sharing programs, increase in pay, etc., contribute to employee's motivation to support firm's initiatives to implement sustainable activities (Paillé et al., 2014; Renwick et al., 2013; Daily and Huang, 2001). This might be explained by the uncertainty regarding the market demand related to sustainable innovation. Based on this discussion, we would expect a positive effect of pay level satisfaction on sustainable innovation. Thus, the hypothesis about pay level satisfaction and sustainable innovation is:

H2 *Increased pay level satisfaction is associated with increased sustainable innovation.*

Job strain

Employee might be intrinsically motivated by the challenge of sustainable innovation. However, some work practices might reduce this intrinsic motivation. For example, lack of control over the innovation process and overpressure might decrease intrinsic motivation (Fisher, 1978). Job strain, the perception of little control over one's work while facing high job demands, has been shown to generate anxiety and reduce employee creativity in some contexts (Amabile, 2000; Amabile et al., 2002). This is explained by the fact that job strain could distract employees from creative actions (Ford, 1996), lead them to make impulsive judgments that destroy their creativity and in turn hinder innovation performance (Hallowell, 2005) or drive them to routinized, well-rehearsed behavior patterns that reduce novel or creative responses and stick to the dominant practices within their organizational field (Baucus et al., 2008; Byron et al., 2010; Farr and Ford, 1990). Moreover, although some scholars argue that creativity requires a positive level of stress (Sutton, 2001), Baucus et al. (2008) argue that stress may have unintended negative consequences that more closely approximate ‘‘hazing’’ rather than ‘‘growth experiences.”

This might be even worse for those who are not intrinsically motivated by solving sustainability challenges through innovation. Because sustainable innovation aims for non-financial objectives, and because sustainability objectives are often not to the core of the company, some employees might perceive sustainable innovation as particularly problematic. This attitude combined to job strain might reduce employee motivations to innovate in the area of sustainability.

In addition, sustainable innovation requires knowledge transformation—the ability to derive new insights and consequences from the combination of existing and newly acquired knowledge (Delmas et al., 2011). The innovation process is, therefore, particularly challenging since sustainability spans multiple fields of expertise that are typically found outside of the firm's boundaries (Theyel, 2000). Furthermore, this knowledge is often complex, new to the firm, and implies profound changes in business processes (Wagner, 2007). As such, employees not only need to acquire knowledge on innovative sustainable technologies, but also they need to learn how to build up processes that enable them to absorb relevant sustainability related knowledge. In this context, job strain should limit the ability of employees to devote time to acquire and transform knowledge related to sustainability. Thus, we propose the following hypothesis:

H3 *Job strain is associated with decreased sustainable innovation.*

Buffering effects

Our *buffering hypothesis* suggests that both extrinsic and extrinsic motivations can counteract the negative impact of other work practices on sustainable innovation. In our case, job satisfaction provided through both social interactions and pay level satisfaction may attenuate the negative effect of stress generated by job strain. We hypothesize that job satisfaction accompanied by job strain might produce different results than if they existed independently. In other words, job satisfaction absorbs stress through a *buffering* mechanism (Cowan et al., 2011). The idea of buffering is that job strain is less capable of causing strain for employees who are satisfied at work. Furthermore, satisfied employees may better respond to job strain (Nahum-Shani and

Bamberger, 2011; Sonnentag and Fritz, 2007). Indeed, the positive feeling derived from social interactions and pay satisfaction can help employees to cope with work-demanding situations (Nahum-Shani and Bamberger, 2011). Moreover, scholars argue that moral stress can be controlled to a certain degree by creating a more ethical and supportive work environment (Ambrose et al., 2008; Mulki et al., 2008; DeTienne et al., 2012). Additionally, Caza et al. (2004) argue that virtuousness, which is associated with positive organizational outcomes, serves a buffering function by contributing to the speed and effectiveness of recovery from negative organizational outcomes.

Thus, social interactions as well as pay-level satisfaction are likely to eliminate job strain and, in turn facilitate, innovation. We therefore hypothesize the following:

H4 *Social interaction and pay level satisfaction buffer the negative effect of job strain on sustainable innovation.*

Method

Data

In order to test our hypotheses, we used employee- and firm-level survey data and focused on sustainable innovation from four different survey datasets.

The Organizational Changes and Computerization's (COI) 2006 survey is a matched employer-employee dataset on organizational change and computerization from the National Institute for Statistics and Economic Studies, the Ministry of Labor and the Center for Labor Studies.[4] The survey covered 7,700 firms from a representative population of French firms from all private

sector industries except agriculture, forestry and fishing. Each firm completed a self-administered questionnaire regarding their use of information technologies and work-organization strategies in 2006 and changes that had occurred since 2003. The firm representatives were also interviewed about their economic goals and the economic contexts in which they made organizational decisions. Within each surveyed firm, employees were randomly selected and asked about their personal socio-economic characteristics as well as their jobs and positions within the organization. The original dataset included 14,369 employees.

The community innovation survey (CIS, 2006–2008) is based on the Organization of Economic Cooperation and Development Oslo Manual and administered by the French Institute for Statistics and Economic Studies.[5] Firm representatives answered questions regarding innovations they had introduced within the past three years. The questionnaire was sent to 25,000 legal units. The response rate was very high: 81%. The CIS survey is mandatory for firms with more with 250 employees, so it tends to have a more important representation from firms with more than 250 employees.

We also used the annual enterprise survey (EAE, 2006), which is an annual survey conducted by the French Ministry of Industry to collect basic data on the structure of surveyed firms such as business activities, size and location.[6] The EAE is a mandatory survey and the sample we used comprised 80,000 enterprises that are surveyed each year. The elaboration of enterprise annual statistics (2008) was used to obtain information on financial participation and production.

Finally, the annual statement of social data (Déclarations Annuelles de Données Sociales) was used to obtain information about wages and working hours.

The three datasets are linked by a firm identification code named SIREN. As a result of merging the data based on the firm as a common denominator, our sample included 4,640 observations. Therefore, our data provide responses on employee level perception of work practices for multiple individuals within each firm, as well as employee characteristics (e.g. Age, gender, education level, seniority). This data is matched with firm level information regarding firm level sustainable innovation and other firm level control variables. In our sample, the average number of employee per firm is 2.63 with a minimum of one employee and a maximum of 12 employees. About 39% of the respondents in our sample belong to general and upper management, 8% of respondents belongs to Human Resources department, 2% are from the production department, 14% are from IT department, 30% from the finance and accounting department and 7% from other departments. Table 1 provides the descriptive statistics and the source of the data for each variable.

***

Insert Table 1 about here

***

Dependent Variable

Sustainable innovative practices. We constructed a variable based on whether firms introduced a product, process, organization, or marketing innovation between 2006 and 2008 that provided the following environmental benefits: (a) reduced resource and material per unit of production; (b) reduced energy use; (c) reduced CO2 (carbon dioxide) production; (d) replaced materials with less polluting or hazardous substitutes; (e) reduced soil, water, noise or air pollution; and (f)

recycled waste, water or materials. In creating the dependent variable, we followed previous scholars that had used CIS or similar databases (Antonioli et al., 2013; Delmas and Pekovic, 2015; Horbach et al., 2012).

Independent variables

We used two measures that can lead to job satisfaction: social interactions and pay level satisfaction. Following Nahum-Shani and Bamberger (2011), our *social interaction* construct reflects instrumental support given to colleagues. We integrated two measures of social interactions: *Employee participates in work task distribution*, and *Employee helps colleagues with work tasks* with the following possible responses: 1 *never or almost never*; 2 *sometimes*; or 3 *often*.

We measured *pay-level satisfaction* with a five-point scale. The question asked respondents: *How do you feel about your pay, taking into account the work you perform* with possible responses scaled from 1 *not paid well at all* to 5 *very well paid*. This approach is consistent with Hofmans et al. (2013), McFarlin and Sweeney (1992), and Spector (1994).

Job strain, which includes both the notion of lack of control over one's work and high demand, was measured through two different variables: work overload and work pace control. We assessed *work overload* using a question asking employees how often they felt unable to cope with their work or were overloaded. The response was on a five-point scale from 1 *never or almost never* to 5 *every day*. Several previous studies used a similar measure (Godard, 2001; Kalmi and Kauhanen, 2008; Ramsay et al., 2000). *Work pace control* reflects employees' perception of their ability to control their work pace (Ganster and Fusilier, 1989; Ivancevich and

Donnelly, 1975; Van Yperen and Hagedoorn, 2003). We constructed a measure that included three dimensions regarding who is imposing the work pace to the employee: a) internal requests from colleagues or other services that require immediate response (Yes/No); b) External requests (from clients for example) that require immediate response (Yes/No); c) production delays or production standards that have to be respected within an hour (Yes/No).

Controls

Our model included a set of firm control variables, such as: *size* (number of employees within the firm); *production* (total value of production sold in Euros); *wage* (average wage paid by the firm); *financial participation* (share of firm profit paid to employees); *export* (firm's exports volume divided by firm's sales); *environmental standards* (firm's adoption of environmental standards); *ISO 9000 standard* (firm's adoption of ISO 9000); *JIT* (adoption of just-in-time practices); *problem-solving groups* (firm's adoption of problem-solving practices); *teams* (firm's adoption of team practices); *R&D* (research & development activities); and *sector of activity* (sector variables based on the N36 sector classification, from the French National Institute for Statistics and Economic Studies: agri-food, consumption goods, cars and equipment, intermediate goods, energy, construction, commercial transport, financial and real-estate activities, and business and individual services).

Additionally, we included employee-level control variables: *gender* (a binary variable that takes a value of 1 if the employee is a woman); *age* (employee's age); *education* (10 categories of education numbered from 1 to 10, primary school to grande ecole, PhD); *seniority* (number of years the employee worked for the firm); *occupation* (employee's occupational position) and *working hours* (employee's working hours).

Table 1 presents the variables used in the estimation, their definitions and sample statistics. Appendix 1 presents the correlation matrix. We conducted a variance inflated factor (VIF) analysis to test for potential multicollinearity. The results of this analysis produced a VIF of 2.23, which is well below the commonly accepted threshold of five. The highest correlation was between the variables export and production. We removed the variable production from the analysis (see Table 2 column 4) and the results were robust to the exclusion of this variable.

Estimation strategy

In order to test the direct influence of job satisfaction and job strain dimensions on a firm's decision to invest in sustainable innovation (Hypotheses 1-3), we used a Tobit regression model since our dependent variable is left censored.

In order to test our buffering hypothesis (Hypothesis 4), which is about the combined effect of several variables, we need to assess the effect of a bundle of variables rather than individual variables. This is consistent with ideas advanced in the human resources literature, which emphasize the role of complementary related resource policies (Becker and Gerhart, 1996; Perry-Smith and Blum, 2000). Regression analysis is limited to study bundle of variables since it estimates the effect of a variable, controlling for the other variables. We therefore used cluster analysis, a commonly used technique for empirically identifying patterns in complex sets of organizational variables. The cluster analysis has been a popular method to include multiple variables as sources of configuration definition (Ketchen and Shook, 1996). Cluster analysis allowed us to investigate whether observations in our sample can be grouped around the variables we identified.

We performed a nonhierarchical (*K-means*) cluster analysis that divides observations into a predetermined number of clusters. It assigns a number of objects to a limited number of homogeneous classes. This K-clustering procedure splits a set of objects into a selected number of groups by maximizing between-cluster variation and minimizing within-cluster variation. Several issues should be considered when performing a nonhierarchical cluster analysis. First, since the main independent variables have different scales, we followed previous scholars (Ketchen and Shook, 1996; Steinley and Brusco, 2008) and standardized the variables. Second, as proposed by Smith et al. (1989), in order to determine the number of clusters and seed points, we performed extensive analyses with different numbers of clusters.

The analysis with five clusters was the most significant, given the objectives of the research and based on previous literature. In comparing the Caliński -Harabasz pseudo- F index for five, six and seven clusters, we found that the five-group solution with a Caliński -Harabasz pseudo- F value of 1050.68 was the largest, indicating that the five-group solution was the most distinct compared with the six- and seven-group solutions.[7] Moreover, multiple sets of random starting values were used to test the stability of the cluster solution. Actually, Aldenderfer and Blashfield (1984) argued that using random starting points in K-means clustering is more robust than the hierarchical method. Subsequently, we used Tobit regression to examine the effect of different firm cluster profiles on sustainable innovation.

Results

Table 2 presents the regression models (Hypotheses 1, 2 and 3) with the direct effects of the independent variables on sustainable innovation. Social interactions are positively, but weakly

associated with sustainable innovation ($p < .10$). This indicates that an increase in social interactions by one standard deviation is associated with an increase of innovation by 2%. This confirms Hypothesis 1. The relationship is not significant for pay-level satisfaction. Therefore, our results do not support Hypothesis 2. This might indicate that intrinsic motivations are more important than extrinsic motivations for sustainable innovation.

The variable work overload is insignificant to predict firm-level innovation. However, we found a negative and significant coefficient estimate ($p < .01$) of work-pace control on sustainable innovation. An increase in a standard deviation of work pace control is associated with a 5% decrease in innovation. This partially supports Hypothesis 3 about the negative effect of job strain on innovation. It indicates that a fast pace working environment might have more of a negative impact on sustainable innovation than what acknowledged by some of the previous literature.

We conducted a number of robustness tests. We ran the analysis with a simple OLS regression as well as with a Poisson regression. In addition, we built a structural equation model. All the models yield similar results and are available upon request from the authors.

***

Insert Table 2 about here

***

In order to test potential buffering effects, we employed a nonhierarchical (*K- means*) cluster analysis. The firms in our sample fall into five clusters that represented different levels of job satisfaction and job strain. Table 3 presents the descriptive statistics for each of the variables used in the final clustering process, based on standardized values.

***

Insert Table 3 about here

***

In Cluster 1 (775 observations) is characterized by weak social interactions and pay- level satisfaction, and an environment marked by a low-level of work overload and slow work pace. Cluster 2 includes 991 observations with low-level job satisfaction and high job strain. We therefore consider Cluster 2 as the worst-case work environment with low social interactions and pay-level satisfaction, and high job overload and job pace. Cluster 3 includes 791 observations. It exemplifies an environment with low social interactions but high pay-level satisfaction and a relatively low-stress environment. Cluster 4, with 1,247 observations, has similar characteristics as Cluster 3, except that work overload is high. Finally, Cluster 5, with 886 observations, indicates high-level social interactions and pay satisfaction, but also high-level work overload and a high-pace work environment.

Table 4 presents the regression analyses to test buffering effects (Hypothesis 4). The reference group is Cluster 2, representing the worst working conditions: low social interactions and pay-level satisfaction, and high work overload and work pace. We find that Cluster 1, which is characterized by low social interactions, pay satisfaction and work-related stress, does not differ significantly from Cluster 2 to explain sustainable innovation. Cluster 3, with low social interactions, high pay-level satisfaction and low work overload and work pace, is positive and significantly different from Cluster 2 ($p < .05$). We obtain similar results with Cluster 4, which represents low social interactions, high pay satisfaction, high overload and low work pace. This indicates that satisfactory pay moderates the negative effect of work overload on sustainable

innovation, even with low social interactions. Therefore, the results of our study provide some evidence that pay satisfaction neutralizes perceived job strain created by work overload and high work pace, and is associated with sustainable innovation.

The results regarding Cluster 5 indicate that social interactions and pay satisfaction with high levels of job strain are not significantly related to sustainable innovation. Therefore, one could argue that there is no buffering effect of pay satisfaction with high social interactions. However, our results can be further interpreted by analyzing the coefficients of the clusters. As shown in Table 3, the coefficient of pay-level satisfaction for Clusters 3 and 4 is 0.71, but it is only 0.56 in Cluster 5. Therefore, the level of pay satisfaction is 0.15 points lower in Cluster 5 as compared to Clusters 3 and 4. Moreover, although the mean for job overload is similar in Clusters 3, 4 and 5 (0.22, 0.21 and 0.21 respectively), it is not the case for the job pace. Indeed, Table 2 shows that the pace of work varies among three clusters: 0.40 for Cluster 3, negative for Cluster 4 and very high for Cluster 5 at 1.13. This suggests that social interactions and pay satisfaction might do little to attenuate the negative effect of job strain when it is very high. In order to cope with this situation, the firm might need to increase social interactions and pay. In other words, in order to foster an innovative environment, job satisfaction levels (1.31) should be higher than job strain levels (1.34).[8] Overall, our findings support the buffering effect of job satisfaction. Job satisfaction absorbs the negative effect of job strain and is associated with sustainable innovation. These results yield support for our Hypothesis 4. Our results also suggest that the buffering effect occurs only when job satisfaction intensity exceeds job strain intensity.

***

Insert Table 4 about here

***

Turning to the firm-level control variables, our analysis reveals that financial participation, export and organizational changes such as environmental standards, ISO 9000 standards, JIT, problem-solving groups and teamwork, as well as R&D activities positively influence sustainable innovation performance, which is in line with previous studies (Delmas and Pekovic, 2015; Horbach, 2008; Horbach et al., 2012). Turning to employee-level control variables, seniority, which can represent human capital (Becker, 1964), is found to be an important driver of sustainable innovation.

In addition, as a robustness test, we conducted a path analysis using the AMOS software. The results confirm the moderating effect of social interactions on work pace control to explain sustainable innovation. While the direct negative effect of work pace control on sustainable innovation is negative, the indirect effect of work pace control on sustainable innovation via social interactions as well as via pay satisfaction is positive (results available upon request from the authors). However, in this analysis, the total effect of work pace control on sustainable innovation is still negative, indicating that average social interactions and pay satisfaction are not enough to counter the negative effect of work pace control. We note that this analysis does not control for sectoral differences.

Discussion

Sustainable innovation is a complex process of institutional change that includes both employee and organizational involvement. Despite growing interest in sustainable activities, the literature has failed to examine employee behavior toward investment in sustainable innovation. Our key

question in the present study was whether intrinsic and extrinsic incentives work in tandem or in opposition to facilitate sustainable innovation.

First, we examined whether types of motivations provided by the organization and measured as social interactions and pay satisfaction were positively associated with sustainable innovation. We also tested whether job strain, measured as work overload and lack of control of the work pace, would be negatively associated with sustainable innovation. Second, we explored whether job satisfaction and job strain could be combined to create a supporting working environment for sustainable innovation.

Our results indicate that social interactions improve sustainable innovation performance, when controlling for job strain and pay satisfaction. These findings are consistent with most research on job satisfaction and performance (Obstfeld, 2005; Perry-Smith and Shalley, 2003). Hence, improving relationships at work can produce important payoffs in terms of sustainable innovation. Interestingly, pay-level satisfaction is not associated directly with improved sustainable innovation. This can be explained by the fact that employees might be ready to donate uncompensated, supplementary efforts for sustainability related activities (Lanfranch and Pekovic, 2014). In other words, intrinsic motivations drive sustainable innovation.

Surprisingly, work overload is not significantly related to sustainable innovation, but work-pace control is negatively associated with sustainable innovation. Hence, we suggest that not all sources of job strain detract sustainable innovation.

Generally, our findings provide evidence that the direct relationship of job satisfaction and job strain on sustainable innovation depend on the dimensions of job satisfaction and job strain

considered. In other words, not all dimensions of job satisfaction foster sustainable innovation, and not all types of job strain decrease a firm's decision to invest in green innovations.

In addition to direct effects, job satisfaction appears to neutralize the effects of job strain on sustainable innovation. Our results based on a cluster analysis indicate several interesting findings. First, firms with low employee job satisfaction (even those who have low job strain) are not as innovative as those with high levels of job satisfaction (Clusters 3 and 4). Our findings are in line with those of the previous literature highlighting the important role of social interactions and pay satisfaction for innovation improvement (Beugelsdijk, 2008; Perry-Smith, 2006). Our results, however, do not show that that extrinsic incentives such as pay-level satisfaction conflict with more intrinsic motivations, such as those related to sustainability, as suggested by Gneezy et al. (2011).

Our findings also confirm previous studies indicating that job satisfaction reduces stress by acting as a buffer that neutralizes the negative effect of stress on performance outcomes (Carlson and Perrewé, 1999; Cohen and Wills, 1985; Cowan et al., 2011; George et al., 1993; Nahum-Shani and Bamberger, 2011; Stamper and Johlke, 2003). Therefore, improved job satisfaction reduces stress and creates employee emotional balance positively associated with sustainable innovation. However, these previous studies examined the buffering effect mainly through social support. In our case, job satisfaction includes both social interactions and pay-level satisfaction, both of which attune the negative effect of job strain. We show that pay satisfaction was the most effective way to neutralize the negative effect of job strain in order to improve sustainable innovation performance. However, we did not have a situation with low pay-level satisfaction

and high social interactions, so it was difficult to evaluate the case of social interactions independently from pay-level satisfaction.

We conclude that pay satisfaction acts as an important source of sustainable innovation through its buffering effect on job strain. Employees who are satisfied with their pay may endure more work-related strain to facilitate the development of innovation improvement (as noted in Clusters 3 and 4). Our findings suggested that the relationship between job satisfaction and work-related strain and creativity is complex. Because job strain has both negative and positive effects on sustainable innovation, we confirm the importance of the concept of paradox as an analytical tool for analyzing innovation. Moreover, we add to Khazanchi et al.'s (2007) work that identified paradoxical sources such as flexibility and control of innovative supportive culture.

Finally, the insignificant effect of Cluster 5 on sustainable innovation performance did not support the argument that social support attenuates the level of overload regardless of the intensity of the work stressors experienced (Beehr, 1985; Cohen and Wills, 1985; Sullivan and Bhagat, 1992). In order to neutralize the job strain effect, job satisfaction intensity should be superior to job strain intensity. Our results provided further explanation of the lack of support concerning buffering effects (Dooley et al., 1987; Ganster et al., 1986; Kaufman and Beehr, 1989). We suggest that we can improve our understanding of the work-related, stress-buffering effect of job satisfaction by taking into account the intensity of both job satisfaction and job strain. Our findings complement those from Nahum-Shani and Bamberger (2011), who argued that the buffering effect of job satisfaction over stress was contingent on the general pattern characterizing employees' supportive exchanges across their close relationships. Noteworthy, the

results of our analysis emphasize the balance between job satisfaction and job strain resulting in improved sustainable innovation.

Overall, there is reasonable support for the buffering effect of job satisfaction over job strain. Our results suggest that firms interested in developing sustainable innovation might benefit from focusing on job satisfaction when creating the work environment. We show that employees are a significant source of generating innovations (Collins and Smith, 2006). Furthermore, our analysis supports pay-level satisfaction as a component that help firms improve innovation performance by eliminating the negative effect of job strain.

It is also possible that job satisfaction plays a dual role in firms' investment in sustainable innovation, since it produces both direct and buffering effects. We therefore suggest that job satisfaction is not only a direct resource for innovation but also provides a buffering effect to reduce the negative influence a stressful environment has on innovation performance. Alternatively, we may also conclude that an increase in the level of job satisfaction not only attenuates the generally negative effect of job strain, but also actually reverses this effect such that firms experience improved sustainability performance. In addition, we confirm that job strain exhibits paradoxical effects on sustainable innovation depending on whether it works in isolation or in combination with other factors. This shows the importance of studying bundle of practices rather than practices in isolation.

Conclusion

In this paper, we studied the impact of employee work practices on sustainable innovation. Sustainable innovation is particularly interesting to study because it is unclear whether employee

are more intrinsically motivated by sustainable innovation because of its public good component, or less motivated because of the uncertainty about the market demand for sustainable innovation. We investigated the role of three main work practices that have been shown to matter in the context of innovation. This included job satisfaction through social interactions and pay satisfaction, and job strain. Job strain being shown to decrease firm innovation in general, while job satisfaction being considered to improve it. Our paper tried to uncover not only the direct effect but also the trade-off between job satisfaction and job strain in the context of sustainable innovation.

First, we find that social interactions increase a firm sustainable innovation, but that job strain decreases it. The concept of social capital has been used increasingly to represent the "goodwill that is engendered by the fabric of social relations and that can be mobilized to facilitate action" (Adler and Kwon, 2002: 17). We describe how social interactions contribute to the organizational context for human capital and are associated with organizational performance such as innovation (Gabbay and Zuckerman, 1998; Kraatz, 1998).

Second, we find that pay satisfaction can counter job strain to facilitate sustainable innovation. This shows the effectiveness of extrinsic motivations in the context of sustainable innovation. Our results also indicate that improved job satisfaction not only attenuates the negative effect of job strain, but it also reverses this effect and improves sustainable innovation. Extending this research direction, we explained that firms' sustainable innovation could depend on trade-offs between the intensity of job satisfaction and job strain. Therefore, we argue that under favorable contextual conditions characterized by improved job satisfaction, job strain can be associated with sustainable innovation. Our results show the existence of two inconsistent effects regarding

the influence of job strain on sustainable innovation that confirm its paradoxical effect. Noteworthy, we suggest that the stress-buffering effect of job satisfaction may be effective only when the job-satisfaction level exceeds the job strain level.

Our study contributes to the research on sustainable innovation, as it is one of the first examining employee behavior towards sustainable innovation. Examining direct and buffering effects of job satisfaction and job strain is an important step in understanding how employee behaviors promote or hinder a firm's engagement in sustainable activities. By examining different dimensions of job satisfaction and job strain, we identified factors related to sustainable innovation. In addition, we provided an employee behavioral framework that would help firms convert job strain from a "bad thing" to a sustainable innovation generator.

Managerial Implications

The present study improves knowledge about the individual role of job satisfaction on sustainable innovation, and on the combined role of job satisfaction and job strain. Our results indicate that sustainable innovation can be promoted with a work environment that enhances job satisfaction through both intrinsic and extrinsic rewards. This is particularly important for employees who are less intrinsically motivated by the public good aspect of sustainable innovation. This can be accomplished by improving employee social interactions and by awarding employees (in term of pay) for their work. A managerial implication of the findings is that the negative effect of job strain can be avoided when employees are satisfied with their social interactions and pay. Therefore, our main contribution is that dimensions of job satisfaction have a dual effect on sustainable innovation: both direct and buffering. Hence, to

build sustainable competitive advantages by improving sustainable innovation, managers need to foster employee interactions, thereby decreasing job strain. A main concern of managers should be to teach employees how to improve their social interactions, since fostering good relations at work can pay off in term of improved sustainable innovation. Managers could implement different mechanisms to improve employee interactions and signal employees that their work is recognized. Both would reduce stress and any negative effect that the stress could have on organizational performance. Our study proposes that job strain is not always bad and by improving job satisfaction, employees may be able to channel the stress into creativity and enhance sustainable innovation. In this vein, this study also furthers the linkages between innovation and employee work conditions by underlying the potential for job satisfaction to function as an innovation resource. Importantly, managers should understand that neutralizing the negative effect of job strain is only manageable when the intensity of job satisfaction exceeds the intensity of job strain. Therefore, the challenge for managers is to find the right balance that would positively reflect on performance outcomes.

Limitations and further research

This research had several limitations that should be addressed in future research. First, this study relied on cross-sectional data. Accordingly, assertions about causality cannot be derived from this study. We tried to mitigate this issue by using lagged year for sustainable innovation investment, but future research should pursue longitudinal designs to shed further light on the underlying causation mechanisms. Second, while we were able to access a large number of characteristics for a high number individual employee, our dependent variable measures

innovation at the firm level. Further research should better assess innovative behavior at the individual level through more qualitative analyses. Third, while we were able to utilize responses from several employees per firm, we did not obtain responses from the majority of the employees in each firm. Further research could undertake firm case studies to trigger higher response rates from employees. Fourth, Nahum-Shani and Bamberger (2011) stated that different types of job satisfaction and job strain might have different effects on performance outcomes. Therefore, future work could use different dimensions of job satisfaction as well as assess the appraisal of the various types of work-related stressors to understand whether unique types of job satisfaction and job strain can produce both direct and buffering effects. Lastly, additional research attention should be given to exploring whether our findings could be generalized to countries apart from France. In summary, although some limitations apply, we believe this study contributes to the organizational literature by providing a comprehensive analysis of employee behavior towards sustainable innovation.

Notes

1. Harper's Monthly (September 1932)

2. http://blogs.wsj.com/digits/2011/08/24/steve-jobss-best-quotes/

3.http://singularityhub.com/2012/05/27/larry-page-with-a-healthy-disregard-for-the-impossible-people-can-do-almost-anything/

4. More details about the design and scope of this survey are available on www.enquetecoi.net: Survey COI-TIC 2006-INSEE-CEE/Treatments CEE.

5. More details about the design and scope of this survey are available on http://www.insee.fr/fr/methodes/default.asp?page¼sources/sou-enqcommunaut-innovation-cis.htm.

6. More details about the design and scope of this survey are available on http://www.insee.fr/fr/methodes/default.asp?page¼definitions/enqueteannuelle-entreprises.htm

7. The Caliński –Harabasz index could be applied to both nonhierarchical and hierarchical cluster analyses (Caliński and Harabasz, 1974).

8. The sum of means from Table 3, representing job satisfaction and stressful environment, respectively.

References

Adler, P.S., & Kwon, S.W. (2002). Social capital: Prospects for a new concept. *Academy of Management Review*, 27*(*1), 17-40.

Aldenderfer, M.S., & Blashfield, R.K. (1984). *Cluster analysis*. Beverly Hills, CA: Sage Publications.

Amabile, T.M., Goldfarb, P., & Brackfield, S.C. (1990). Social influences on creativity: evaluation, coaction, and surveillance. *Creativity Research Journal*, *3*(1), 6–21.

Amabile, T. M. (1996). Creativity in context. Boulder, CO: Westview Press

Amabile, T.M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, *39*(5), 1154-1184.

Amabile, T.M. (2000). Stimulate creativity by fueling passion. In Locke E. (ed) *Handbook of principle of organizational behavior*. Malden, MA: Blackwell, 331–341

Amabile, T.M., Hadley, C.N., & Kramer, S.J. (2002). Creativity under the gun. *Harvard Business Review*, 80(8), 52–61.

Ambrose, M. L., Arnaud, A., & Schminke, M. (2008). Individual moral development and ethical climate: The influence of person organization fit on job attitudes. *Journal of Business Ethics*, *77*, 323–333.

Anderson, N., De Dreu, C.K.W., & Nijstad, B.A. (2004). The routinization of innovation research: a constructively critical review of the state-of-the-science. *Journal of Organizational Behavior*, *25*(2), 147–173.

Antonioli, D., Mancinelli, S., & Mazzanti, M. (2013). Is environmental innovation embedded within high-performance organisational changes? The role of human resource management and complementarity in green business strategies. *Research Policy*, 42(4), 975-988.

Asif, M., Searcy, C., Zutshi, A., & Fisscher, O. A. (2013). An integrated management systems approach to corporate social responsibility. *Journal of Cleaner Production*, *56*, 7-17.

Baer, M., & Oldham, G. (2006). The curvilinear relation between experienced creative time pressure and creativity: moderating effects of openness to experience and support for creativity. *Journal of Applied Psychology, 91*(4), 963–970.

Banker, R. D., Field, J. M., Schroeder, R. G., & Sinha, K. K. (1996). Impact of work teams on manufacturing performance: A longitudinal study. *Academy of Management Journal, 39*(4), 867-890.

Batt, R. (2004). Who benefits from teams? Comparing workers, supervisors and managers. *Industrial Relations*, *43*(1), 183–212.

Baucus, M., S., Norton, W., I., Baucus, D., A., & Human, S., E. (2008). Fostering Creativity and Innovation without Encouraging Unethical Behavior. *Journal of Business Ethics, 81*, 97-115

Becker, B., & Gerhart, B. (1996). The impact of human resource management on organizational performance: Progress and prospects. *Academy of management journal*, *39*(4), 779-801.

Becker, G.S. (1964). *Human capital*. New York: Columbia University Press.

Beugelsdijk, S. (2008). Strategic human resource practices and product innovation. *Organization Studies, 29*(6), 821-847.

Beehr, T.A. (1985). The role of social support in coping with organizational stress. In Beehr, T.A., & Bhagat, R.S. (eds) *Human stress and cognitions in organization*. New York, NY: John Wiley & Sons, 375-398.

Blyer, M., & Coff, R. (2003). Dynamic capabilities, social capital, and rend appropriation: ties that split ties. *Strategic Management Journal,* 24(7), 677-686.

Boiral, O., & Paillé, P. (2012). Organizational Citizenship Behaviour for the Environment: Measurement and Validation. *Journal of Business Ethics*, *109*(4), 431-445.

Bunce, D., & West, M. (1994). Changing work environments, Innovative coping responses to occupational stress. *Work and Stress, 8*(4), 319–331.

Byron, K., Khazanchi, S., & Nazarian, D. (2010). The relationship between stressors and creativity: A meta-analysis examining competing theoretical models. *Journal of Applied Psychology, 95*(1), 201-212.

Caliński, T.J., & Harabasz, J. (1974). A dendrite method for cluster analysis. *Communication in Statistics, 3*(1), 1-27.

Cantor, D. E., Morrow, P. C., & Montabon, F. (2012). Engagement in environmental behaviors among supply chain management employees: An organizational support theoretical perspective. *Journal of Supply Chain Management, 48*, 33–51.

Carlson, D.S., & Perrewé, P.L. (1999). The role of social support in the stressor-strain relationship: An examination of work-family conflict. *Journal of Management, 25*(4), 513.

Caza, A., Barker, B. A., & Cameron, K. S. (2004). Ethics and ethos: The buffering and amplifying effects of ethical behavior and virtuousness. *Journal of Business Ethics, 52,* 169–178.

Cohen, S., & Wills, T.A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98*(2), 310-357.

Cohen, D, & Prusak, L. (2001). In Good Company: How Social Capital Makes Organizations Work. Harvard Business Press.

Collins, C.J., & Smith, K. (2006). Knowledge exchange and combination: the role of human resource practices in the performance of high-technology firms. *Academy of Management Journal*, *49*(3), 544–560.

Coon, D., & Mitterer, J. O. (2010). *Introduction to psychology: Gateways to mind and behavior with concept maps*. Belmont, CA: Wadsworth.

Cowan, R., Sanditov, B., & Weehuizen, R. (2011). Productivity effects of innovation, stress and social relations. *Journal of Economic Behavior & Organization*, *79*(3), 165-182.

Daily, B. F., & Huang, S. (2001). Achieving sustainability through attention to human resource factors in environmental management. *International Journal of Operations & Production Management, 21*(12), 1539–1552.

Delmas, M., & Toffel, M.W. (2004). Stakeholders and environmental management practices: an institutional framework. *Business Strategy and the Environment*, *13*(4), 209-222.

Delmas, M., & Toffel, M.W. (2008). Organizational Responses to Environmental Demands: Opening the Black Box. *Strategic Management Journal*, 29(10), 1027-1055.

Delmas, M., Hoffmann, V. H., & Kuss, M. (2011). Under the tip of the iceberg: Absorptive capacity, environmental strategy, and competitive advantage. *Business & Society*, *50*(1), 116-154.

Delmas, M., & Pekovic, S. (2013). Environmental standards and labor productivity: understanding the mechanisms that sustain sustainability. *Journal of Organizational Behavior*, *34*(2), 230–252.

Delmas, M., & Pekovic, S. (2015). Resource efficiency strategies and market conditions. *Long Range Planning*, *48*(2), 80-94.

De Marchi, V. (2012). Environmental innovation and R&D cooperation: Empirical evidence from Spanish manufacturing firms. *Research Policy, 41*, 614-623.

DeTienne, K., Agle, B., Phillips, J., & Ingerson, M. (2012). The impact of moral stress compared to other stressors on employee fatigue, job satisfaction, and turnover: An empirical investigation. *Journal of Business Ethics*, *110*, 377–391.

DiDomenico, M., Tracey, P., & Haugh, H. (2009). The dialectic of social exchange: Theorizing corporate-social enterprise collaboration. *Organization Studies*, *30*, 887-907.

Dooley, D., Rook, K., & Catalano, R. (1987). Job and non-job stressors and their moderators. *Journal of Occupational Psychology*, *60*, 115-132

European Commission (2012). Eco-innovation: The Key to Europe's Future Competitiveness. Publication Office of the European Union. doi: 10.2779/68837.

Farr, J.L., & Ford, C.M. (1990). Individual innovation. In West, M.A., & Farr, J.L. (eds) *Innovation and creativity at work*. New York: Wiley, 63–80.

Fisher, C. D. (1978). The effects of personal control, competence, and extrinsic reward systems on intrinsic motivation. *Organizational Behavior and Human Performance*, *21*(3), 273-288.

Fliaster, A., & Schloderer, F. (2010). Dyadic ties among employees: Empirical analysis of creative performance and efficiency. *Human Relations*, *63*(10), 1513–1540

Ford, C.M. (1996). A theory of individual creative action in multiple social domains. *Academy of Management Review, 21,* 1112-1142.

Foxon, T., & Pearson, P. (2008). Overcoming barriers to innovation and diffusion of cleaner technologies: some features of a sustainable innovation policy regime. *Journal of Cleaner Production*, *16*(1), S148-S161.

Frey, B., & Oberholzer-Gee, F. (1997). The Cost of Price Incentives: An Empirical Analysis of

Motivation Crowding-Out. *American Economic Review, 87* (4), 746-755.

Fusilier, M.R., Ganster, D.C., & Mayes, B.T. (1987). Effects of social support, locus of control and role stress on health. *Journal of Management*, *13*(3), 517- 528.

Gabbay, S.M., & Zuckerman, E.W. (1998). Social capital and opportunity in corporate R&D: The contingent effect of contact density on mobility expectations. *Social Science Research*, *27*(2), 189-217.

Ganster, D.C., Fusilier, M.R., & Mayes, B.T. (1986). Role of social support in the experience of stress at work. *Journal of Applied Psychology*, *71*(1), 102-110.

Ganster, D.C., & Fusilier, M.R. (1989). Control in the workplace. In Cooper, C.L., & Robertson, I. (eds) *International review of industrial and organizational psychology*. Chichester, England: Wiley, 235-280

George, J.M., Reed, T.F., Ballard, K.A., Colin, J., & Fielding, J. (1993). Contact with AIDS patients as a source of work-related distress: effects of organizational and social support. *Academy of Management Journal*, *36*(1), 157–171.

Gneezy, U., Meier, S., & Rey-Biel, P. (2011). When and why incentives (don't) work to modify behavior. *The Journal of Economic Perspectives*, *25*(4), 191-209.

Godard, J. (2001). High Performance and the Transformation of Work? The Implications of alternative work practices for the experience and outcomes of work. *Industrial and Labor Relations Review, 54*, 776-805.

Greve, A., Benassi, M., & Sti, A.D. (2010). Exploring the contributions of human and social capital to performance. *International Review of Sociology*, *20*(1), 35-5.

Grolleau, G., Mzoughi, N., & Pekovic, S. (2013). Is there a relationship between workplace atmosphere and innovation activities? An empirical analysis among French firms. *Economics of Innovation and New Technology, 22*(6), 566-580.

Hallowell, E.M. (2005). Overloaded circuits. Why smart people underperform. *Harvard Business Review, 83*(1), 54–62.

Hamilton, B.H., Nickerson, J.A., & Hideo, O. (2003). Team incentives and worker heterogeneity: An empirical analysis of the impact of teams on productivity and participation. *Journal of Political Economy, 111*(3), 465-497.

Hellström, T. (2007). Dimensions of environmentally sustainable innovation: the structure of eco-innovation concepts. *Sustainable Development, 15*(3), 148-159.

Hess, D., Rogovsky, N., & Dunfee, T. (2002). The next wave of corporate community involvement: Corporate social initiatives. *California Management Review, 44*(2), 110–125.

Heyes, A., & Kapur, S. (2011). Regulatory attitudes and environmental innovation in a model combining internal and external R&D. *Journal of Environmental Economics and Management, 61*(3), 327-340.

Hoffman, A. J. (1999). Institutional evolution and change: Environmentalism and the US chemical industry. *Academy of Management Journal, 42*(4), 351-371.

Hofmans, J., De Gieter, S., & Pepermans, R. (2013). Individual differences in the relationship between satisfaction with job rewards and job satisfaction. *Journal of Vocational Behavior, 82*(1), 1-9.

Horbach, J. (2008). Determinants of environmental innovation – New evidence from German panel data sources. *Research Policy, 37*(1), 163-173.

Horbach, J., Rammer, C., & Rennings, K. (2012). Determinants of eco-innovations by type of environmental impact -The role of regulatory push/pull, technology push and market pull. *Ecological Economics, 78,* 112-122.

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

Ivancevich, M.J., & Donnelly, H.J. (1975). Relation of organizational structure to job satisfaction, anxiety-stress, and performance. *Administrative Science Quarterly, 20*(2), 272-280.

Kalmi, P., & Kauhanen, A. (2008). Workplace innovations and employee outcomes: evidence from Finland. *Industrial Relations, 47,* 430e459

Kaufman, G.H., & Beehr, T.A. (1989). Occupational stressors, individual strains and social supports among police officers. *Human Relations, 42*(2), 185-197.

Ketchen, D.J., & Shook, C.L. (1996). The application of cluster analysis in strategic management research: an analysis and critique. *Strategic Management Journal, 17*(6), 441–458.

Khazanchi, S., Lewis, M.W., & Boyer, K.K. (2007). Innovation-supportive culture: The impact of organizational values on process innovation. *Journal of Operations Management, 25*(4), 871–884.

Kraatz, M.S. (1998). Learning by association? Inter organizational networks and adaptation to environmental change. *Academy of Management Journal, 41*(6), 621-643.

Lanfranchi, J., & Pekovic, S. (2014). How green is my firm? Worker well-being and job involvement in environmentally related certified firms. *Ecological Economics, 100,* 16–29.

Lau, C.-M., & Ngo, H.-Y. (2004). The HR system, organizational culture and product innovation. *International Business Review, 13*(6), 685–703.

Manohar, S. S., & Pandit, S. R. (2014). Core Values and Beliefs: A Study of Leading Innovative Organizations. *Journal of Business Ethics, 125*(4), 667-680.

Margolis, R.M., & Kammen, D.M. (1999). Evidence of under-investment in energy R&D in the United States and the impact of federal policy. *Energy Policy*, *27*(10), 575-584.

McFarlin, D., & Sweeney, P. (1992). Distributive and procedural justice as predictors of satisfaction with personal and organizational outcomes. *Academy of Management Journal*, *35*(3), 626 – 637.

Mohrman, S.A., & Novelli, LJr. (1985). Beyond testimonials: learning from a quality circles program. *Journal of Occupational Behavior*, *6*(2), 93-110.

Bocquet, R., Mothe, C., & Pinget, A. (2015). Barriers to environmental innovation in SMEs: Empirical evidence from French firms. *M@n@gement*, *18*(2), 132-155.

Mulki, J.P., Jaramillo, J.F., & Locander, W.B. (2008). Effect of ethical climate on turnover intention: Linking attitudinal- and stress theory. *Journal of Business Ethics*, *78*, 559–574.

Nahum-Shani, I., & Bamberger, P.A. (2011). The buffering effect of social support on stressor-strain relations: The conditioning effects of perceived reciprocity patterns. *Organizational Behavior and Human Decision Processes*, 114, 49-63.

Nicol, J.J., & Long, B.C. (1996). Creativity and perceived stress of female music therapists and hobbyists. *Creativity Research Journal,* 9(1), 1–10.

Obstfeld, D. (2005). Social networks, the tertius iungens orientation and involvement in innovation. *Administrative Science Quarterly, 50*(1), 100–130.

Paillé, P., Chen, Y., Boiral, O., & Jin, J. (2014). The Impact of Human Resource Management on Environmental Performance: an Employee-Level Study. *Journal of Business Ethics*, *121*(3), 451-466.

Paillé, P., & Raineri, N. (2015). Linking perceived corporate environmental policies and employees eco-initiatives: The Influence of perceived organizational support and psychological contract breach. *Journal of Business Research*, 68, 2404–2411 .

Paillé, P., Meija-Morelos, J., Marché-Paillé, A., Chen, Y. & Chen, H.-H. (2015). Corporate greening, exchange process among co-workers, and ethics of care: An empirical study on the

determinants of pro-environmental behaviors at coworkers-level. *Journal of Business Ethics*, forthcoming.

Perry-Smith, J. E., & Blum, T. C. (2000). Work-family human resource bundles and perceived organizational performance. *Academy of management Journal*, *43*(6), 1107-1117.

Perry-Smith, J.E., & Shalley, C.E. (2003). The social side of creativity: A static and dynamic social network perspective. *Academy of Management Review*, *28*(1), 89–106.

Perry-Smith, J.E. (2006). Social yet creative: The role of social relationships in facilitating individual creativity. *Academy of Management Journal*, *49*(1), 85–101.

Peterson, D.K. (2004). The relationship between perceptions of corporate citizenship and organizational commitment. *Business & Society*, *43*(3), 296–319.

Ramsay, H., Scholarios, D., & Harley, B. (2000). Employees and high-performance work systems: testing inside the black box. *British Journal of Industrial Relations*, *38*(4), 501–531.

Ramus, C. A., & Steger, U. (2000). The roles of supervisory support behaviors and environmental policy in employee "ecoinitiatives" at leading -edge European companies. *The Academy of Management Journal*, *43* (4), 605-626.

Ramus, C.A. (2001). Organizational support for employees: Encouraging creative ideas for environmental sustainability. *California Management Review*, *43*(3), 85-105.

Rennings, K. (2000). Redefining innovation – Eco-innovation research and the contribution from ecological economics. *Ecological Economics*, *32*(2), 319-332.

Rennings, K., & Zwick, T. (2002). The employment impact of cleaner production on the firm level-empirical evidence from a survey in five European countries. *International Journal of Innovation Management*, *6*(3), 319 – 342

Rennings, K., Ziegler, A., Ankele, K., & Hoffmann, E. (2006). The influence of different characteristics of the EU environmental management and auditing scheme on technical environmental innovations and economic performance. *Ecological Economics*, *57*(1), 45-59.

Renwick, D. W. S., Redman, T., & Maguire, S. (2013). Green human resource management: A review and research agenda. *International Journal of Management Reviews, 15(*1), 1–14.

Rocha, M., Searcy, C., & Karapetrovic, S. (2007). Integrating sustainable development into existing management systems. *Total Quality Management & Business Excellence*, *18*(1-2), 83-92.

Rothenberg, S., & Zyglidopoulos, S.C. (2007). Determinants of environmental innovation adoption in the printing industry: the importance of task environment. *Business Strategy and the Environment, 16*(1), 39–49

Schiederig, T., Tietze, F., & Herstatt, C. (2012). Green innovation in technology and innovation management - an exploratory literature review. *R & D Management*, *42*, 180-192.

Shalley, C.E., Zhou, J., & Oldham, G.R. (2004). The effects of personal and contextual characteristics on creativity: Where should we go from here? *Journal of Management, 30*(6), 933–958.

Sonnentag, S., & Fritz, C. (2007). The recovery experience questionnaire: Development and validation of a measure assessing recuperation and unwinding from work. *Journal of Occupational Health Psychology, 12*(3), 204–221.

Spanjol, J., Tam, L. & Tam, V. (2014). Employer-employee congruence in environmental values: an exploration of effects on job satisfaction and creativity. *Journal of Business Ethics*, DOI 10.1007/s10551-014-2208-6.

Spector, P.E. (1994). Job satisfaction survey, JSS
http://chuma.cas.usf.edu/~spector/scales/jsovr.html

Smith, K., Guthrie, J., & Chen, M. (1989). Strategy, size and performance. *Organization Studies, 10*(1), 63-81.

Stamper, C.L., & Johlke, M.C. (2003). The impact of perceived organizational support on the relationship between boundary spanner role stress and work outcomes. *Journal of Management, 29*(4), 569–588.

Steinley, D., & Brusco, M.J. (2008). Selection of variables in cluster analysis: An empirical comparison of eight procedures. *Psychometrika, 73*(1), 125-144.

Sullivan, S.E., & Bhagat, R.S. (1992). Organizational stress, job satisfaction, and job performance: Where do we go from here? *Journal of Management, 18*(2), 353–374.

Sutton, R. I. (2001). The Weird Rules of Creativity. *Harvard Business Review, 79(*8), 94–103.

Talbot, R., Cooper, C., & Barrow, S. (1992). Creativity and stress. *Creativity and Innovation Management, 1*(4), 183–193.

Theyel, G. (2000). Management practices for environmental innovation and performance. *International Journal of Operations & Production Management, 20*(2), 249-266.

Van Hemel, C., & Cramer, J. (2002). Barriers and stimuli for eco design in SMEs. *Journal of Cleaner Production, 10*(5), 439–453.

Van Yperen, N.W., & Hagedoorn, M. (2003). Do high job demands increase intrinsic motivation or fatigue or both? The role of job control and job social support. *Academy of Management Journal, 46*, 339-348.

Viswesvaran, C., Sanchez, J.I., & Fisher, J. (1999). The role of social support in the process of work stress: a meta-analysis. *Journal of Vocational Behavior, 54*(3), 314–334.

Wagner, M. (2007). On the relationship between environmental management, environmental innovation and patenting: Evidence from German manufacturing firms. *Research Policy, 36*(10), 1587-1602.

West, M.A. (1990). The social psychology of innovation in groups. In West M.A., & Farr, J.L. (eds) *Innovation and creativity at work*. New York: Wiley, 309-335

Williams, M. L., McDaniel, M. A., & Nguyen, N. T. (2006). A meta-analysis of the antecedents and consequences of pay level satisfaction. *Journal of Applied Psychology, 91*(2), 392.

Wills, T., & Isasi, C. (2007). Buffering effect. In Baumeister, R., & Vohs, K. (eds) *Encyclopedia of social psychology*. Thousand Oaks, CA. Sage Publications, 128-129.

Woodman, R., Sawyer, J., & Griffin, R. (1993). Toward a theory of organizational creativity. *Academy of Management Review, 18*(2), 293-321.

Yalabik, B., & Fairchild, R. J. (2011). Customer, regulatory, and competitive pressure as drivers of environmental innovation. *International Journal of Production Economics, 131* (2), 519-527.

Zhou, J., & George, J.M. (2001). When job dissatisfaction leads to creativity: encouraging the expression of voice. *Academy of Management Journal, 44*(4), 682-696.

Table 1: Descriptive Statistics

Variable	Description	Mean	SD	Min	Max
Dependent & Independent variables					
Sustainable Innovation**	The firm has adopted innovative practices to reduce resource and/or material per unit of production; reduce energy use; reduce firm's CO2 'footprint' (total CO2 production); replace materials with less polluting or hazardous substitutes; reduce soil, water, noise, or air pollution; recycle waste, water, or materials.	2.66	2.36	0.00	6.00
Social interactions*	The employee participates in work task distribution (3) often (2) sometimes (1) never or almost never; and employee helps colleagues with work tasks (3) often (2) sometimes (1) never or almost never.	2.08	1.28	0.00	4.00
Pay level satisfaction*	The employee think that taking account work that he/she realizes, he/she is: 5=very well paid, 4=well paid, 3=normally paid, 2=under paid, 1=very under paid	2.77	0.79	1.00	5.00
Job overload*	The employee feels unable to cope with his or her work or is overloaded: 5= every day, 4=at least once a week 3= at least once a month, 2=less frequently, 1=never or almost never	2.58	1.26	1.00	5.00
Work Pace Control*	The employee's work environment is imposed by (a) internal requests that require immediate response; (b) external requests that require immediate response; (c) production delays or production standards that have to be respected.	1.26	0.95	0.00	3.00
Control Variables					
Size*	Number of employees	2554.719	8719.197	20.00	111956
Production***	Total Production Sold (€) in 2006	560525.4	2954942	0.00	3.93e+07
Wage*****	Average wage within a firm in 2006	15.40	151.51	1.00	10318

Variable	Description	Mean	SD	Min	Max
Financial Participation****	Employee profit-sharing scheme (€) in 2008	2622.166	12471.38	-513.00	267038
Export***	Share of exports of total sales (€)	242359.6	1725085	0.00	2.63e+07
Green*	Registered for ISO 14001, organic labeling or fair trade (=1 if registered in 2006)	0.42	0.49	0.00	1.00
ISO 9000 *	Certified with ISO 9000 Dummy variable (=1 if certified in 2006)	0.73	0.44	0.00	1.00
JIT*	Adopted JIT Dummy variable (=1 if certified in 2006)	0.46	0.50	0.00	1.00
Problem solving groups*	Adopted problem solving group practices Dummy variable (=1 if certified in 2006)	0.52	0.50	0.00	1.00
Teams*	Adopted teams practices Dummy variable (=1 if certified in 2006)	0.61	0.49	0.00	1.00
R&D	R&D activities (external) Dummy variable (=1 if yes)	0.32	0.47	0.00	1.00
Sector*	Agrifood, consumption goods, cars and equipments, intermediate goods, energy, construction, commercial, transport, financial and real-estate activities, business services and individual services				
Gender*	The employee is a women (=1 if yes)	0.35	0.48	0.00	1.00
Age*	Age	41.09	10.03	18.00	65.00
Education*	Employee highest academic diploma is from: (1) primary school; (2) middle school; (3) short technical course: CAP (vocational certificate), BEP (technical school certificate), in apprenticeship; (4) short technical course: CAP, BEP, etc. without apprenticeship; (5) general secondary school (full 3 years); (6) technological or professional secondary school (full course); (7) 3-year university degree; (8) 4-year university degree; (9) 5-year university degree; (10) grande école, engineering school, business school	5.09	2.33	1.00	10.00
Seniority*	Seniority	13.63	10.27	0.00	43.00
Occupation*	Employee works as:				
	Management (included)	0.15	0.35	0.00	1.00
	Middle management (not included	0.25	0.43	0.00	1.00
	White-collar worker (not included)	0.16	0.37	0.00	1.00

Variable	Description	Mean	SD	Min	Max
	Blue-collar worker (included)	0.44	0.50	0.00	1.00
Working hours*****	Number of working hours per week	37.78	6.75	1.00	84.00

* variables were retrieved from the COI; ** variables retrieved from the CIS database; *** variables retrieved from the EAE database; **** variables retrieved from the ESANE database; ***** variables retrieved from the DADS databases.

Table 2. Results of the Tobit model (without clusters)

	Sustainable Innovation		
Social interactions	0.06*		0.06*
	(1.73)		(1.74)
Pay level satisfaction	0.05		0.05
	(0.86)		(0.83)
Job overload	0.01		0.00
	(0.14)		(0.12)
Work Pace Control	-0.13***		-0.13***
	(2.69)		(2.64)
Size	0.00	0.00	0.00
	(0.61)	0.50	(0.69)
Production	-0.00	-0.00	
	(1.41)	1.30	
Wage	-0.00	-0.00	-0.00
	(0.70)	(0.70)	(0.71)
Financial participation	0.00***	0.00***	0.00***
	(5.05)	(5.15)	(5.25)
Export	0.00***	0.00***	0.00***
	(3.01)	(2.96)	(3.44)
Green	0.57***	0.56***	0.58***
	(5.46)	(5.37)	(5.52)
ISO 9000	0.86***	0.87***	0.87***
	(7.00)	(7.06)	(7.02)
JIT	0.33***	0.33***	0.33***
	(3.38)	(3.43)	(3.36)
Problem solving group	0.44***	0.44***	0.44***
	(3.97)	(3.92)	(4.00)
Team	0.35***	0.35***	0.35***
	(3.47)	(3.44)	(3.45)
R&D	1.84***	1.85***	1.84***
	(17.90)	(17.98)	(17.86)
Gender	0.08	0.06	0.08
	(0.81)	(0.56)	(0.80)
Age	-0.01	-0.01	-0.01
	(0.89)	(0.94)	(0.92)
Education	0.04	0.04	0.04
	(1.40)	(1.34)	(1.37)
Seniority	0.02***	0.02***	0.02***
	(2.71)	(2.87)	(2.71)
Management position	-0.09	-0.06	-0.10
	(0.56)	(0.34)	(0.58)
Blue-collar worker	-0.04	-0.04	-0.05
	(0.36)	(0.35)	(0.41)
Working hours	0.00	0.00	0.00
	(0.00)	(0.01)	(0.06)
Constant	-0.03	0.11	0.01
	(0.05)	(0.24)	(0.03)
Pseudo R2	0.07	0.06	0.06
Observations	4,640	4,640	4,640

*p< 0.1, ***p< 0.05, *** p< 0.01. Sector dummies included: Agri-food, Consumption goods, Cars and equipments, Energy, Construction, Commercial, Transport, Financial and real estate, Services for firms, Services for individuals

Table 3. Descriptive statistics of the Nonhierarchical cluster analyses (min, mean, max)

Cluster		Social interactions	Pay level satisfaction	Job overload	Work Pace Control	Number of observations
1. Low Social Interactions and Pay level and low overload and work pace	min	-1.62	-2.23	-1.25	-1.32	775
	mean	-0.56	-1.24	-0.61	-0.32	
	max	1.50	-0.97	1.13	1.82	
2. Low Social Interactions and Pay level and high overload and work pace	min	-1.62	-2.23	-0.46	-1.32	991
	mean	-0.56	-0.21	1.07	0.23	
	max	0.72	2.81	1.92	1.82	
3. Low Social Interactions, High pay satisfaction, Low overload and low pace	min	-1.62	0.29	-1.25	-1.32	791
	mean	-0.54	0.71	0.22	0.40	
	max	1.50	2.81	1.92	1.82	
4. Low Social Interactions, High Pay Satisfaction, high overload and Low Pace	min	-1.62	0.29	-1.25	-1.32	1,247
	mean	-0.54	0.71	0.21	-0.56	
	max	1.50	2.81	1.92	1.82	
5. High Social Interactions, High Pay Satisfaction, high overload and High Pace	min	-1.62	-0.97	-1.25	-0.27	886
	mean	0.75	0.56	0.21	1.13	
	max	1.50	2.81	1.92	1.82	
Total	min	-1.62	-2.23	-1.25	-1.32	4,640
	mean	2.75e-07	1.78e-07	1.47e-07	-2.81e-08	
	max	1.50	2.821	1.92	1.82	

Table 4. Results of the Tobit model (with clusters)

Variables	Sustainable innovation
Cluster 1	**0.14**
Low Social Interactions and Pay level, Low overload and Work pace	(0.92)
Cluster 3	0.34***
Low Social Interactions, High pay satisfaction, Low overload and Work pace	(2.36)
Cluster 4	0.26**
Low Social Interactions, High Pay Satisfaction, High overload and Low Pace	(2.06)
Cluster 5	0.08
High Social Interactions and Pay Satisfaction, High overload and Work pace	(0.59)
Size	0.00
	(0.53)
Production	-0.00
	(1.32)
Wage	-0.00
	(0.68)
Financial participation	0.00***
	(5.11)
Export	0.00***
	(2.95)
Green	0.57***
	(5.40)
ISO 9000	0.87***
	(7.09)
JIT	0.33***
	(3.41)
Problem solving group	0.44***
	(3.93)
Team	0.35***
	(3.45)
R&D	1.85***
	(18.00)
Gender	0.07
	(0.72)
Age	-0.01
	(0.92)
Education	0.04
	(1.34)
Seniority	0.02***
	(2.78)
Management position	-0.08
	(0.49)
Blue-collar worker	-0.05
	(0.43)
Working hours	0.00
	(0.14)
Constant	-0.10
	(0.22)
Pseudo R2	0.06
Observations	4,640

*p< 0.1, ***p< 0.05, *** p< 0.01. *p< 0.1, ***p< 0.05, *** p< 0.01. Sector dummies included: Agri-food, Consumption goods, Cars and equipments, Energy, Construction, Commercial, Transport, Financial and real estate, Services for firms, Services for individuals

Appendix 1

Pearson correlation coefficients

		1	2	3	5	5	6	7	8	9	10	11	12	13	14	15	16
1	Sustain Innovation	1.00	-	-	_	-	-	-	-	-	-	-	-	-	-	-	-
2	Social Interactions	0.05*	1.00	-	_	-	-	-	-	-	-	-	-	-	-	-	-
3	Pay Satisfaction	0.06*	0.02	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Job overload	0.00	0.13*	-0.10*	1.00	-	-	-	-	-	-	-	-	-	-	-	-
5	Work pace control	-0.04*	0.14*	-0.04*	0.19*	1.00	-	-	-	-	-	-	-	-	-	-	-
6	Size	0.16*	-0.00	0.02	-0.00	-0.01	1.00	-	-	-	-	-	-	-	-	-	-
7	Production	0.16*	0.00	0.06*	-0.00	-0.02	0.84*	1.00	-	-	-	-	-	-	-	-	-
8	Wage	-0.01	0.02	0.04*	-0.02	0.01	-0.00	0.00	1.00	-	-	-	-	-	-	-	-
9	Financial participation	0.14*	0.01	0.03*	-0.01	-0.01	0.46*	0.20*	0.00	1.00	-	-	-	-	-	-	-
10	Export	0.15*	0.00	0.07*	0.00	-0.01	0.63*	0.90*	0.00	0.04*	1.00	-	-	-	-	-	-
11	Green	0.29*	0.02	0.05*	-0.02	0.01	0.17*	0.16*	-0.01	0.12*	0.13*	1.00	-	-	-	-	-
12	ISO 9000	0.27*	0.05*	0.03*	0.01	-0.02	0.08*	0.09*	-0.02	0.05*	0.07*	0.41*	1.00	-	-	-	-
13	JIT	0.14*	-0.00	0.00	0.02	0.00	0.12*	0.11*	-0.02	0.03	0.10*	0.23*	0.13*	1.00		-	-
14	Problem solving	0.26*	0.03*	0.04*	0.01	0.01	0.12*	0.11*	0.02	0.09*	0.11*	0.36*	0.36*	0.28*	1.00	-	-
15	Team	0.20*	0.02	0.03*	-0.01	0.02	0.10*	0.10*	0.02	0.09*	0.07*	0.21*	0.22*	0.17*	0.43*	1.00	-
16	R&D	0.38*	0.04*	0.09*	0.02	-0.01	0.14*	0.18*	-0.00	0.11*	0.17*	0.25*	0.24*	0.12*	0.29*	0.18*	1.00
17	Gender	-0.07*	-0.12	-0.07*	0.05*	0.04*	0.02	-0.01	-0.02	-0.01	-0.01	-0.09*	-0.18*	0.01	-0.07*	-0.07*	-0.07*
18	Age	0.06*	0.02	-0.02	-0.04*	-0.05*	0.02	0.04*	0.02	0.03	0.04*	0.08*	0.09*	-0.02	0.04*	0.05*	0.07*
19	Education	0.03*	0.14	0.13*	0.07*	0.13*	0.04*	0.04*	0.03*	0.06*	0.01	-0.01	-0.01	-0.03	0.07*	0.03*	0.09*
20	Seniority	0.13*	0.05*	0.01	-0.03	-0.06*	0.02	0.06*	0.00	0.03*	0.07*	0.16*	0.13*	0.03*	0.12*	0.09*	0.13*
21	Occupation1	0.02	0.18*	0.13*	0.03*	0.06*	0.04*	0.04*	0.07*	0.08*	0.02	-0.01	0.01	-0.06*	0.04*	0.02	0.07*
22	Occupation2	0.07*	0.07*	0.06*	0.05*	0.07*	-0.02	0.00	-0.01	0.01	0.01	0.03*	0.05*	-0.00	0.06*	0.05*	0.06*
23	Occupation3	-0.14*	-0.09*	-0.08*	0.05*	0.04*	0.05*	0.03*	0.02	0.02	-0.04*	-0.13*	-0.27*	-0.02	-0.13*	-0.09*	-0.15*
24	Occupation4	0.02	-0.12*	-0.09*	-0.10*	-0.13*	-0.05*	-0.01	-0.03*	-0.08*	0.01	0.07*	0.15*	0.06	0.02	0.02	0.01
25	Working hours	0.05	0.19*	0.08*	0.10*	0.07*	0.01	0.03*	0.03*	0.04*	0.03*	0.03	0.08*	-0.01	0.07*	0.04*	0.07*

[Appendix 1 continued]

		17	18	19	20	21	22	23	24	25
17	Gender	1.00	-	-	-	-	-	-	-	-
18	Age	-0.05*	1.00	-	-	-	-	-	-	-
19	Education	0.02	-0.29*	1.00	-	-	-	-	-	-
20	Seniority	-0.08*	0.70*	-0.27*	1.00	-	-	-	-	-
21	Occupation1	-0.11	0.08*	0.51*	0.00	1.00	-	-	-	-
22	Occupation2	0.02*	0.05*	0.14*	0.08*	-0.24*	1.00	-	-	-
23	Occupation3	0.37*	-0.11*	-0.00	-0.12*	-0.18*	-0.25*	1.00	-	-
24	Occupation4	-0.22*	0.02	-0.49*	0.02	-0.37*	-0.51*	-0.39*	1.00	-
25	Working hours	-0.25*	0.08*	0.29*	0.02	0.46*	0.05*	-0.24*	-0.19*	1.00

*$p < 0.01$.