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Good employees through good jobs

A latent profile analysis of job types and employee outcomes in the Belgian electricity sector

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Abstract

Purpose – The purpose of this paper is to identify different job types in the Belgian electricity sector and their relations with employee outcomes such as work engagement and innovative work behaviour (IWB).
Design/methodology/approach – This paper uses a combination of latent profile analysis and relative operating characteristics (ROC) analysis.
Findings – Depending on the job resources and demands, five different job types are identified corresponding largely to the Karasek and Theorell (1990) job types. Their relation with the outcomes is not parallel with low-strain jobs performing best for work engagement, and active jobs for IWB.
Research limitations/implications – The combination of methods used in this study increases significantly the ease of communication of the findings, yet an external benchmark for the ROC analysis would be preferable.
Practical implications – To foster engagement and IWB with employees one should focus on the job content and only increase demands if they are combined with sufficient resources.
Originality/value – This research is the first in its kind that relates latent job types with different employee outcomes using a combination of latent profile and ROC analysis.

Keywords Employee behaviour, Work engagement, Innovative work behaviour, Latent profile analysis
Paper type Research paper

Introduction

According to much of the management literature, having motivated, engaged employees and a company strategy focused on innovation helps to generate competitive advantage (e.g. Kesting and Ulhøi, 2010; Pfeffer, 1995; Robinson and Schroeder, 2004). In this search for the determinants of employee engagement and innovation, job quality and characteristics are a key focus in the academic literature.

One of the main theoretical frameworks in this context is the job demand-control (JD-C) model of Karasek and Theorell (1990), which was later extended by Bakker and Demerouti (2007) into the job demand-resources (JD-R) model. Both models suggest that job characteristics can be divided into two broad categories: job demands (all aspects of a job that require attention and effort) and job resources (all characteristics of a job that are instrumental to performing the job). According to both models, the interplay between the respective levels of demands and resources is the key to determining employee outcomes in terms of strain and learning.

To date, studies that investigate the interplay between job demands and resources have primarily used regression models that focus on the interplay between specific job characteristics in relation to employees' engagement or innovative performance (e.g. Baer

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and Oldham, 2006; Chung-Yan, 2010; Hammond *et al.*, 2011). Such an approach faces two fundamental challenges. The first problem is that combinations of some job characteristics that, theoretically, are optimal might not actually occur in the data or in reality. Second, there is no definite understanding of what a "one-point difference in work engagement" means in practice. Faced with these two methodological problems, this study uses an observation-centred approach (latent profile analysis (LPA)) to identify different job types that are based on combinations of job characteristics. These job types are then related to employee outcomes. Using traditional methods from medical research (relative operating characteristic (ROC) analysis), threshold values are computed which differentiate between employees scoring "good", "moderate" and "very bad" on a certain outcome. As such, this research enables a better interpretation and communication of job characteristics, which can help to foster employee engagement and innovative behaviour.

This study contributes to the literature by using established job design theoretical frameworks and relating them to two topical employee outcomes: work engagement and innovative work behaviour (IWB). Studying these outcomes together provides insights into which job types are likely to foster work engagement and IWB simultaneously and which ones are focused on only the one or the other.

Literature

Job types: Karasek and beyond

The JD-C model developed by Karasek (1979) is a leading model for studying the relation between job characteristics and employee outcomes. According to this model, all jobs consist of two main characteristics which affect the behaviour and attitudes of employees. On the one hand, there are the job demands, which refer to the workload – the amount of tasks demanded of the employee in a given timeframe. On the other hand, there is the job control, the degree to which the employee has control over how he/she organises his/her own job tasks.

Karasek and Theorell (1990) state that job demands are potentially harmful. They can inflict stress which will reduce employee productivity, stymie learning and development and even result in resignation. Job control is positive as it gives employees the necessary instruments to perform the job, therefore contributing to high motivation and active learning. However, Karasek and Theorell (1990) recognise the importance of the combined effects of job demands and job control. Depending on the combination of high/low demands and high/low control, employees will be employed in distinct job types which have distinct effects on their behaviour and attitudes. Figure 1 provides an illustration of these different job types. Jobs which combine low demands and low control are called passive jobs: these are jobs in which employees are not expected to work hard, but also do not have the instruments needed to work autonomously. Jobs in which the demands are low, but the control is high, are low-strain jobs. In such jobs, there is low pressure and workload,

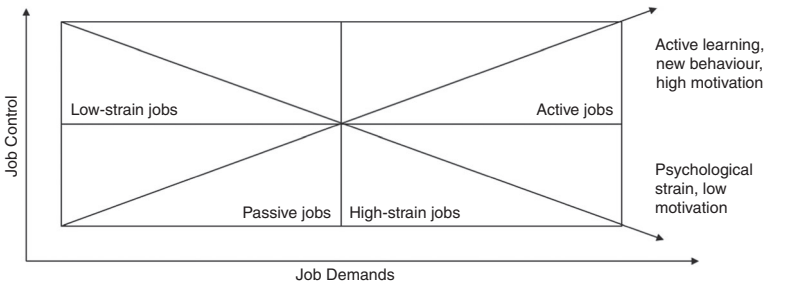

Figure 1.
Karasek model

Source: Karasek and Theorell (1990)

while the employees have all the resources to organise their own work. The third job type is a combination of high demands and low control: this is the high-strain job. Here employees have a lot of work, experience high levels of pressure and also lack control over organising their work. The last job type is the active job, which is a combination of high demands and high control; employees in such jobs are required to perform well and have the necessary control needed to meet these demands.

According to Karasek and Theorell (1990), these different job types will have distinct outcomes in terms of employee attitudes and behaviour. In general, positive outcomes are predicted for active jobs (high motivation, active learning) and negative effects for high-strain jobs (stress, low motivation).

Building on the Karasek model, Bakker and Demerouti (2007) subsequently developed the JD-R model. The major difference here is the idea that every job involves a certain amount of job-specific demands and resources which cannot all be related to the more general terms of "job demand" or "job control". In some jobs, autonomy might be a major resource, while in others it may be contact with co-workers. Bakker and Demerouti (2007), thus enlarged the scope of the model and began identifying a broader list of job resources. The authors retained the idea that employee outcomes depend on a combination of demands and resources, but departed from the job type terminology defined by Karasek. With this extension of the scope in terms of possible job demands and resources, the amount of potential contingencies (interaction effects) increases significantly.

Employee outcomes: IWB and work engagement

Work engagement has been defined as "a positive, fulfilling, work-related state of mind that is characterised by vigour, dedication, and absorption" (Schaufeli and Bakker, 2004). It is not a momentary mood that is directly related to one object, event, individual or behaviour in particular, but rather a more persistent state of mind (Bakker and Demerouti, 2008; Salanova *et al.*, 2005). Traditionally, three dimensions are identified. Vigour refers to a mental state of an employee that is characterised by high levels of energy, resilience, willingness to invest effort and persistence in the face of problems. Next, dedication is characterised by an employee's enthusiasm and pride about their work and the inspiration and overall sense of significance that they experience in relation to it. Finally, absorption refers to a state of mind in which the employee is highly concentrated and engrossed by his/her work; time flies and they are unable to detach themselves from the task at hand. Work engagement is an important employee outcome in itself, yet is also a strong antecedent for employee behavioural outcomes (e.g. Bakker and Demerouti, 2007, 2008). As such, research found positive relations between work engagement and work performance (Salanova *et al.*, 2005), pro-active behaviour and learning (Sonnentag, 2003).

West and Farr (1990) define IWB as: "all employee behavior directed at the generation, introduction and/or application (within a role, group or organisation) of ideas, processes, products or procedures, new to the relevant unit of adoption that significant benefitly the relevant unit of adoption". IWB includes the behaviour of employees that directly and indirectly stimulates innovation in the workplace. IWB is distinguishable from concepts such as employee creativity for two main reasons. First, creativity focuses exclusively on the "idea generation" phase, while IWB encompasses all employee behaviour related to different phases of the innovation process. Second, creativity traditionally refers to the creation of something "absolutely new". IWB, on the contrary, focuses on something new for the relevant unit of adoption. Employees who take the initiative to copy successful work habits from other departments, for example, are demonstrating important "innovative behaviour", while not at all engaging in workplace creativity (De Spiegelaere, Van Gyes and Van Hootegem, 2014). IWB has only recently been developed as a concept and is mostly used as the dependent variable in studies (as it is here). The literature on related concepts

like employee-driven innovation nevertheless shows that employee innovation activities can be a crucial asset for firms aiming to achieve sustainable competitiveness (Kesting and Ulhøi, 2010; Robinson and Schroeder, 2004).

By focusing on these two employee outcomes simultaneously, this research aims to give a more complete view of the qualities of certain job types. Work engagement and IWB are positive for both the employer and the employee; however, work engagement seems primarily relevant for the employee (to work with pleasure) and IWB for the employer (to optimise employee performance). Through the parallel analysis of both, possible win-win strategies for both parties can be identified. Although, it is an implicit assumption in all the innovation literature that employees engage in innovative activities because they are motivated (Shalley *et al.*, 2004; Shalley and Gilson, 2004), a growing body of studies found clear indications that IWB can also be a part of coping strategy. Employees facing high demands might try to innovate to lower these demands without being especially motivated or engaged (Martín *et al.*, 2007; De Spiegelaere *et al.*, 2015).

Job type variables and hypotheses

Job resources

For the identification of the different job types, this study uses five possible job resources and five possible job demands. For this, we built on the broader definitions of Bakker and Demerouti (2007, p. 312), who define job resources as "those physical, psychological, social, or organisational aspects of the job that (a) are functional in achieving work goals, (b) reduce job demands and the associated physiological and psychological costs, or (c) stimulate personal growth and development". We here focus on five different job characteristics that can also be defined as job resources: job autonomy, organising tasks, information provision, task completeness and contact opportunities.

Job autonomy is a traditional job content variable included in such traditional job design models as Hackman and Oldham's (1980) job characteristics model. It can be defined as "[T]he degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out" (Hackman and Oldham, 1976, p. 258). Job autonomy has long been linked to various positive work-related outcomes such as work engagement (Halbesleben, 2010) or employee innovativeness (Hammond *et al.*, 2011). Job autonomy gives employees (a sense of) control over how they do the work, enabling them to find and develop appropriate ways to perform tasks (De Spiegelaere, Van Gyes and Van Hootegem, 2014; De Spiegelaere, Van Gyes, De Witte, Niesen and Van Hootegem, 2014). As a consequence, the employee will not only do a better job, but will also be more engaged and involved in their work. Moreover, for employees to be able to be creative and innovative, they need the necessary space to do so. Innovative behaviour is all about experimenting with different alternatives in order to find a new, better-fitting approach. Autonomy in work processes is, therefore, crucial for employees to be able to demonstrate innovative behaviour.

Whereas job autonomy has received a lot of scholarly attention, the other job resources included in this study are more rarely studied. First of all, organising tasks refers to the control of the employee over the organisation of the work of his/her team or department, the degree to which he/she can influence how the work is shared with co-workers. Again, such organising tasks give control to the employees and offer a unique opportunity to propose alternative work strategies. It differs from job autonomy in the sense of being focused on the work in the team, not on the individual tasks of the employee (Schouteten and Benders, 2004). As such it is similar to what is sometimes called "collective" or "team autonomy" (von Bonsdorff *et al.*, 2015; Jønsson and Jeppesen, 2013; Rousseau and Aubé, 2013): the team members' capacity to make decisions together concerning the accomplishment of the work.

Information provision concerns the degree to which employees has complete, correct and timely information about what to do and how to do it. Research into the importance of such organisational communication (Stoter, 2009) shows that a lack of such information might lead to uncertainty (Vander Elst *et al.*, 2010) and reduced commitment (Allen, 1992) from the employees side, both significant obstacles to employee engagement (Hakanen *et al.*, 2006).

Task completeness refers to whether or not employees are supposed to perform relatively complete tasks, or only bits and parts. Are they responsible for a very specific part in the production process and thus do not have an overview of the start or end product, or are they responsible (together or alone) for the whole task? Of major importance here is whether they only do the executive part of the work or whether they are also involved in its preparation and evaluation (Schouteten and Benders, 2004). Task completeness is similar to what Hackman and Oldham (1976) call "task identity". Also, research into the similar concept of "task interdependence" showed that that a high interdependence (and thus low task completeness) causes role ambiguity (Wong *et al.*, 2007). Moreover, workers performing incomplete tasks can lack the necessary overview and knowledge to develop innovative approaches.

The last job resource included here is "contact opportunities". Contact opportunities refer to the possibilities that the employee has to talk to co-workers and supervisors about how to do the work. Is the employee isolated or is there always help available? Contact opportunities and social support in general have already long been seen as crucial job variables for job satisfaction, employee health and employee behaviour (Brough and Frame, 2004). It is through the possible help of co-workers that small problems can be solved swiftly and employees can gather support for their innovative ideas.

Job demands

Job demands are defined by Bakker and Demerouti (2007) as "those physical, social, or organisational aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs". In this study we include five job demand variables: job complexity, time pressure, emotional pressure, job insecurity and job content insecurity.

Job complexity relates to the number of different aspects of an employee's job that he/she has to take into account while performing his/her work. Is he/she supposed to be attentive at all times, or can the job to be performed according to a developed routine? Complex jobs are seen as challenging and stimulating for employees, yet if the complexity is not matched by sufficient instruments to respond to those challenges, it can be mentally demanding and result in fatigue or stress. Empirical studies found that job complexity can indeed lead to employee creativity (Shalley *et al.*, 2009) or work engagement (Marinova *et al.*, 2015), but multiple interaction effects have been identified in this relationship (Campbell and Gingrich, 1986; Chung-Yan, 2010; Shalley *et al.*, 2009).

Time pressure is another traditional job content variable included in a variety of studies (Andrews and Farris, 1972; Baer and Oldham, 2006; Karasek, 1979). Time pressure refers to the workload of the employee: the amount of tasks that they are expected to complete in a certain period of time. Again, the potential effect of time pressure is twofold. A continued exposure to high workload levels and sustained pressure can lead to stress and burnout. At the same time, time pressure can be a stimulating aspect of the job, contributing to the challenging and engaging nature of the work. Again, the literature finds curvilinear effects with regards to creativity (Baer and Oldham, 2006) and interaction effects with regards to work engagement (Kühnel *et al.*, 2012).

Emotional pressure refers to the intensity of the work and whether or not it causes personal stress. Such emotional demands are a core example of a job demand that requires effort from the employee him/herself to overcome (Bakker and Demerouti, 2007). If sustained

and not mitigated by sufficient resources, such emotional pressure is likely to cause decreased job satisfaction (Cortese *et al.*, 2010), work engagement, and therefore IWB.

Job insecurity concerns the employee's subjective evaluation of the stability of his or her work: will he/she be able to keep the same job in the future or is he/she likely to be fired? Being related to income, a lack of job security causes stress and therefore jeopardises the employee's level of engagement in his/her job, meaning that he/she will be less likely to think creatively and find new approaches to the work at hand. Empirical studies mostly found (small) negative relations between job insecurity and creativity (Probst, 2002), IWB (De Spiegelaere, Van Gyes and Van Hootegem, 2014; De Spiegelaere, Van Gyes, De Witte, Niesen and Van Hootegem, 2014) and work engagement (De Cuyper *et al.*, 2008; Mauno *et al.*, 2005). Nevertheless, some studies found that job insecurity has a differential relation with IWB depending on the occupational group that the employee belongs to (De Spiegelaere *et al.*, 2012).

Finally, job content insecurity (sometimes referred to as qualitative job insecurity (Witte *et al.*, 2010)) refers to the employee's uncertainty about whether he/she will still have the same job conditions in the future. More specifically, this can include concerns about possible future changes in the content or location of the job. This type of job insecurity has been studied less than quantitative job insecurity; the few studies to explore it have found negative relations with such variables as job satisfaction or alienation (Hellgren *et al.*, 1999; Witte *et al.*, 2010).

Analytical strategy

Most research into the effect of job characteristics and job design on employee outcomes uses multiple regression or structural equation methods. These methods are called variable-centred methods as they essentially aim to isolate the effect of a certain variable on an outcome, independent of the scores of the other variables. Most models on job design state, however, that the interaction between the different variables is of great importance. It is the combination of the different job resources and demands that make the difference, rather than the individual levels. One way of studying these combined effects is to add interaction terms to the regression models; another is to employ observation-centred methods.

Observation-centred methods focus on identifying frequently occurring combinations of characteristics in the data. They look, in other words, at different job types rather than individual scores on a certain variable. Traditional K-means cluster analysis is one example of an observation-centred approach; LPA, used in this study, is another. Although variable-centred approaches dominate in the job design studies, some recent studies have used observation-centred methods similar to this one. Lorenz and Valeyre (2005), for example, used hierarchical cluster analysis to differentiate between four types of work organisation using the European Working Conditions Survey of 2000. Their analysis enables easy cross-country and cross-sectoral comparisons of how the employee's work was organised. In a similar vein, Holman (2012) used two-step cluster analysis based on the 2005 wave of the European Working Conditions Survey to identify different job types. These job types were consequently related to such outcomes as job satisfaction and psychological and physical well-being. The advantages of such approaches are not only methodological (see Method section), but also conceptual as they are more in line with the theoretical frameworks used here. Moreover, differences between types of jobs is something that can be visualised and communicated in more concrete terms than the more abstract differences in the level of a certain variable keeping all the others constant.

In addition to taking this innovative approach to studying the determinants of employee outcomes, this paper also uses an alternative strategy with regards to outcome variables. Traditionally, survey-based employee outcomes are coded as scales on which the independent variables have an effect. It is, however, not always entirely clear what a one-point difference in work engagement means. Nor it is clear whether a one-point difference from, for example, 1-2 has the same signification as a one-point difference from 8-9. Furthermore, communicating such results is often a challenging exercise.

One way of handling this conceptual and communication challenge is by (empirically) identifying threshold values. Using such values, one can differentiate between simpler categories of, for example, "very innovative", "somewhat innovative" and "not innovative" employees. This paper uses an established method from the medical science (ROC analysis; see Method section for more details) to identify these thresholds. In this way we address the two problems that have been identified. First of all, this method identifies the value that best distinguishes between "good" and "bad" scores for employees, circumventing the problem of whether a one-point difference is always the same on a scale. Second, using these thresholds, the insights can be communicated in terms of probabilities of having a good, moderate or bad score. To our knowledge, this paper is the first to combine these two well-established methods in the field of work-related studies.

Data and method

Data

This study is based on an employee survey conducted among a sample of organisations active in the electricity sector of both the Flemish- and French-speaking parts of Belgium. The data were collected based on a company-level stratified sample. In every company, a sample of employees was selected to complete the standardised questionnaire and the management were interviewed by the researcher. In small companies (< 20 employees) all available employees were surveyed; in larger companies a selection of employees (up to 30) completed the survey. The surveys were distributed and recollected by the researcher from all available employees. Efforts were undertaken to visit the company premises during meetings to reach a maximum amount of employees.

The stratification was done with regards to the company size and region (Flemish-speaking and French-speaking). Given the predominance of very small companies employing less than 20 people in the sector (more than 90 per cent of all companies and 68 per cent of all employees), small companies were defined as having less than 20 employees, medium-sized companies as having 2150 employees and larger companies as having more than 50 employees. Ensuring a 50/50 distribution between Flemish- and French-speaking companies, 150 small, 45 middle-sized and 30 large companies were sampled. In total, 74 companies (33 per cent response rate) were visited and 461 employees were surveyed. The employee-level response rate is difficult to compute as the researchers did not have a full database of all employees in the companies which they could draw a sample from. Virtually all employees who were given a survey also completed it.

As the stratification at the company level was disproportional, this is reflected in an underrepresentation of employees of small companies in the data. Based on a comparison with the official sector data on the proportional distribution of employees of company sizes in both linguistic regions, six weight factors were computed which essentially gave more weight to employees from small companies in both regions.

This study focuses on a single sector (the electricity sector) to study the relationship between jobs types and employee outcomes. Employment in this sector is characterised by its relative homogeneity. Workers are predominantly men (> 95 per cent) and working full-time (> 90 per cent) (Vlaamse Overheid, 2012). They report having very similar occupations (installing electrical equipment), which largely involve the same tasks (preparing electrical circuits, grinding, drilling and crushing wall segments, filling in administrative papers, etc.) (Vormelek Formelec, 2008). The advantage of this approach is that if we can find clearly different job types while the population generally does similar tasks, we would be able to identify the difference as being in the job organisation rather than the work itself. In this case, it is how the company organises the work that will determine the level of job resources and demands. The obvious disadvantage of a study focused on only one sector is that it might be difficult to apply the results to employees and sectors with different work tasks.

Measures

All variables included in this survey are measured using a series of statements with which the respondents could indicate their agreement or disagreement using a five-point Likert scale going from "totally agree" to "totally disagree". All variables were rescaled on an 11-point scale running from 0 to 10 to ease interpretation.

For the resources, we look at job autonomy, organising tasks, information provision, task completeness and contact opportunities. For the job demands we focus on complexity, time pressure, emotional pressure, job insecurity and job content insecurity. All these job characteristic measures are based on the NOVA-WEBA survey which is a standard Dutch survey that assesses job content issues (Delarue, 2003; Van Hootegem *et al.*, 2014; Schouteten and Benders, 2004). Example items, reliability measures and the amount of items included in the scales are given in Table I. Note that job insecurity is here measured by a single reverse coded question on the perception on the stability of one's job. Reverse-coded or neutral questions are frequently used in measuring job insecurity (see Mauno *et al.*, 2005; Witte *et al.*, 2010).

IWB is measured using a four-item adaptation of the questions used by Scott and Bruce (1994) and De Jong and Den Hartog (2010). Although the scales of De Jong and Den Hartog (2010) had more items and were aimed at distinguishing different dimensions of IWB, this paper studies IWB as a unidimensional concept, already a confirmed practice in various other studies (e.g. Aryee *et al.*, 2012; Reuvers *et al.*, 2008). Respondents indicated how often something occurred in their job, ranging from "very rarely" to "very frequently". Sample items are "finding original solutions for work related problems" and "developing innovative ideas into practical applications".

Work engagement is measured using a nine-item scale developed by Salanova and Schaufeli (2008). Work engagement is typically conceived as a multidimensional concept characterised by vigour (e.g. "When I get up in the morning, I feel like going to work"), dedication (e.g. "I am enthusiastic about my job") and absorption (e.g. "I feel happy when I am working intensely"). In this study we computed a single scale from the nine items, which proved highly reliable (α: 0.90).

Methods

As developed in the Literature section, the relation between job characteristics and employee outcomes is subject to multiple interaction effects. For this reason, we opt for an

Variable	No. of items	Item example	Cronbach's α
Autonomy	10	I can decide for myself how I perform my work	0.80
Organising tasks	5	I have an influence on the decisions taken in my department	0.77
Information provision	11	The information I need for my job is usually provided on time	0.88
Task completeness	8	I have to correct the errors I make in my job myself	0.69
Contact opportunities	6	I talk to co-workers from my department about the tasks	0.70
Complexity	4	In my job, I have to keep an eye on lots of things simultaneously	0.75
Time pressure	5	I have to work under time pressure	0.72
Emotional pressure	4	In my job I am confronted with situations that affect me personally	0.76
Job insecurity	1	I expect that I can keep my current job	n/a
Job content insecurity	2	I feel insecure about the future content of my job	0.76
Work Engagement	9	If I'm working I'm feeling fit and strong	0.90
Innovative work behaviour	4	Finding original solutions for work-related problems	0.82

Table I.
Measures, items and reliability

observation-oriented rather than a variable-oriented approach. Using such a method, different job types (combinations of job variables) are identified. In a second step, these job types are related to the outcome variables: work engagement and IWB. In order to ease the interpretation of changes in the outcome variables, they are recoded as ordinal variables based on empirically estimated thresholds. As such, our previously described model will be analysed using three techniques, which are illustrated in Figure 2. For the identification of the job types, LPA is used. For the thresholds of the dependent variables, ROC analysis is used, and for the relation between the job types and the outcomes, cross-tab analysis techniques are used. In what follows, we discuss the LPA and ROC techniques and their applicability for this study.

Identifying job types: LPA

LPA is a statistical method that classifies respondents into groups, depending on their scores on several (continuous) independent variables (Notelaers *et al.*, 2006). LPA is similar to latent class analysis (LCA), which classifies respondents in groups based on several categorical independent variables. Both methods are very similar in terms of approach, yet the LPA literature is significantly less developed than the LCA literature. For this reason, many of the references used here are based on LCA articles rather than LPA articles (Marsh *et al.*, 2009; Vermunt and Magidson, 2002).

LPA is similar to more traditional K-means cluster analysis, yet has some considerable advantages. First, LPA provides rigorous statistical indicators that guide the decision on the amount of profiles (Nylund *et al.*, 2007). Second, in LPA, variables can have different scales or measurement levels (Magidson and Vermunt, 2002). Third, in contrast to K-means cluster analyses, in LPA cases are classified in clusters using estimated model-based posterior membership probabilities, taking into account a degree of uncertainty in the classification (Vermunt and Magidson, 2002; Wang and Hanges, 2011). At the same time, just as in a clustering approach, LPA identifies groups of observations based on various variables. It is thus a good method for identifying the presence (or absence) of specific combinations of job characteristics. Given the multiple contingencies identified in the relations between job characteristics and employee outcomes, LPA is shown to be an appropriate method for studying the relation between job quality and employee outcomes. Nylund *et al.* (2007) suggest that the decision regarding the amount of profiles should incorporate all of these different aspects. They state that the optimal solution should: show the lowest BIC, have a significant BLRT value, have profiles with a reasonable amount of observations and show clearly defined profiles reflected in a low classification error. The contribution of individual variables in distinguishing between latent profiles can be assessed using the Wald statistic. A non-significant *p*-value of the Wald statistic signals that the variable does not discriminate between the profiles in a statistically significant way (Vermunt and Magidson, 2004, p. 114).

Identifying threshold values: ROC analysis

In order to identify threshold values of the dependent variables IWB and work engagement, an ROC (relative operation characteristic) analysis is performed.

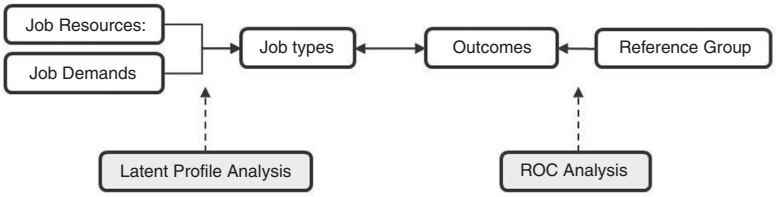

Figure 2.
Model and methods

Such an analysis starts with the identification of a group of employees who have a very problematic profile in terms of (external) variables. In a second step, the probability of a respondent belonging to the problematic group is computed, depending on their score on the dependent variable (IWB or work engagement), using a logistic regression analysis. This analysis provides us with three indicators: the sensitivity, the specificity and the area under curve. For each score of IWB or work engagement, the sensitivity and specificity is computed. The sensitivity is the "true positive rate", the rate of respondents that are correctly identified in the problem group using this specific score as a threshold. The specificity is the "true negative rate", the rate of respondents that are correctly identified in the non-problematic group using this specific score as a threshold.

A ROC curve is acquired by plotting sensitivity against 1-specificity (the "false positive rate"). A ROC curves visualises all combinations of sensitivity vs 1-specificity for all possible values in IWB or work engagement. The upper left corner of this curve indicates the optimal threshold in terms of specificity and sensitivity (Gönen, 2006). This point can be identified using Youden's *J*-statistic, which is the difference between the true positive rate (sensitivity) and the false positive rate (1-specificity). The maximum Youden's *J*-statistic refers to the optimal threshold value (and thus the upper left corner of the ROC curve) (Metz, 1978; Streiner and Cairney, 2007; Zhou *et al.*, 2011).

However, depending on the costs of a false negative, other thresholds can be chosen. In this study, we chose to work with two distinct thresholds. A first threshold (the orange threshold) refers to the previously described optimum: the score in which there is an optimal balance between the sensitivity and specificity levels. A second threshold (the red threshold) is identified as the score which corresponds to a sensitivity level of 0.90. After this score, there is a 90 per cent probability that the respondent will be correctly identified as being part of the problematic group.

This optimal threshold depends largely on the group that is identified in the first step. Some groups will be more or less suitable for the computation of thresholds for certain variables. An indicator to evaluate the suitability of the group is the area under curve. This area quantifies the ability of the variable (IWB, work engagement) to discriminate between people that are in or out of the problem group. In our case, this area under curve can be used in the evaluation of how good the problem group is for the identification of useful thresholds. If there is no relation between the group and IWB or work engagement, the area under curve will be equal to 0.5. The IWB or work engagement score does not identify respondents in the group better than a random identification. A perfect relation will be reflected in an area under curve of 1 (Fawcett, 2006). As a rule of thumb, an area under curve of between 0.5 and 0.7 is low, between 0.7 and 0.9 is moderate and above 0.90 is high (Streiner and Cairney, 2007).

Results

Job types

Using the Latent Gold software, we ran several latent profile models in order to compare their model fit indices (Table II). Inspection of the AIC and BIC values shows that a five-profile

	LL	BIC(LL)	AIC(LL)	AIC3(LL)	CAIC(LL)	Npar	Class. error	LL Diff. bootstrap	*p*-value
1 Profile	−7,320	14,808	14,696	14,724	14,836	28	0		
2 Profiles	−7,129	14,540	14,352	14,399	14,587	47	0.088	382	< 0.01
3 Profiles	−7,020	14,436	14,173	14,239	14,502	66	0.117	217	< 0.01
4 Profiles	−6,882	14,273	13,934	14,019	14,358	85	0.089	277	< 0.01
5 Profiles	−6,823	14,269	13,854	13,958	14,373	104	0.098	118	< 0.01
6 Profiles	−6,770	14,277	13,786	13,909	14,400	123	0.095	106	< 0.01

Table II.
LPA models

solution fits the data best. The associated classification error (0.098) is acceptable and the BLRT test shows that there is a significant improvement in terms of model fit between a four- and five-profile solution. All profiles represent a significant proportion of the data (> 15 per cent). The five-profile model, thus, answers the conditions for profile selection as proposed by Nylund *et al.* (2007): relatively low BIC, low classification error and sufficient observations in the profiles. Further inspection of the Wald statistics showed that all variables significantly distinguished between the different identified profiles (on a 0.05 level of certainty). The BLRT shows a significant improvement in model fit for a five-profile model in comparison with a four-profile model. The BLRT test also shows that a six-profile model is better; this nevertheless has a higher BIC value. Moreover, the sixth profile represents 3.5 per cent of the data, corresponding to about 14 observations. Therefore, we preferred the five- above the six-profile model. The five-profile solution results in well-populated profiles. We reran the five-profile solution several times with 150 random sets of starting values to control for local maxima.

Table III shows the mean values associated with the different profiles. In the table we reordered the classes, putting the fifth class before the first after inspection of the pattern discussed below. As can be seen from the table, all five profiles cover a considerable part of the population. As mentioned in the Literature section, we used Karasek's job types to inspect the patterns of the identified job types and give them names. The first profile is characterised by relatively high scores in terms of job resources and low scores on job demands. We, therefore, titled this profile as low-strain jobs. The second profile has high scores on almost all variables, regarding both job demands and resources. This second profile is, therefore, named as active jobs. The third profile has low scores on job resources and high scores on job demands and is, therefore, called high-strain jobs. The two last profiles are similar to some of the previous profiles but with more conspicuous patterns. Therefore, the fourth profile is named as very high-strain jobs and the fifth profile as very low-strain jobs. Interestingly, the jobs which combine both low demands and low resources (passive jobs) are not found in this population when using this methodology (see Figure 3).

The variation in the mean values of the job characteristic variables reflects the hypothesised pattern and previously observed correlations. In jobs with high demands, the other demands also tend to be high and vice versa; the same holds for job resources. The only job characteristic that diverges from this pattern is job complexity. Although, hypothetically, a job demand behaves more like a job resource as it is relatively high in the (very) low-strain jobs and somewhat lower in the (very) high-strain jobs.

	Profile 5 Very low-strain jobs	Profile 1 Low-strain jobs	Profile 2 Active jobs	Profile 3 High-strain jobs	Profile 4 Very high-strain jobs
Profile size (%)	15	26	23	20	16
Job resources					
Autonomy	6.17	6.00	6.15	4.59	3.90
Contact opportunities	6.38	6.74	5.60	5.67	4.21
Organising Tasks	5.03	6.23	6.53	4.61	2.58
Task completeness	6.19	6.27	6.95	4.87	4.50
Information provision	6.90	6.81	5.88	5.85	5.33
Job demands					
Complexity	6.52	6.59	7.93	6.14	6.24
Time pressure	4.72	4.67	6.30	5.04	6.41
Emotional pressure	0.00	2.42	3.83	3.45	3.54
Job insecurity	2.16	2.36	1.89	3.13	3.29
Job content insecurity	1.94	2.63	3.58	3.53	3.88

Table III. Latent profile structure

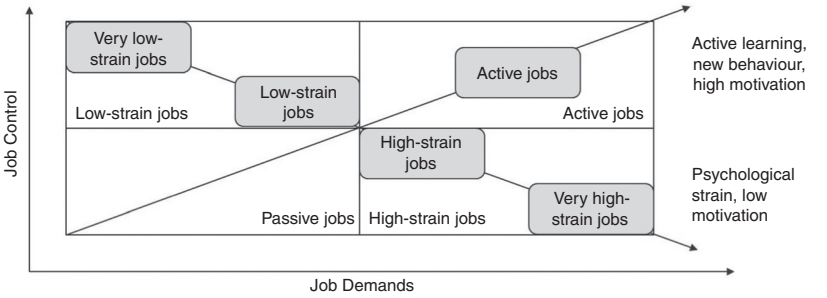

Figure 3.
Jobs types: results

ROC analysis

As mentioned in the Method section, a ROC analysis is performed in three steps. In the first step, a clearly problematic group is identified using other variables than the scores of IWB and work engagement. For work engagement, the clearly problematic group is identified by placing together the employees that express being "dissatisfied" or "very dissatisfied" with their job with the employees who remain neutral regarding job satisfaction but who would not recommend their employer to people they know. Given that employees almost always, regardless of their job characteristics, declare themselves to be relatively satisfied with their job, a negative or neutral answer on this question can be seen as a clear sign of a problematic job situation (Cabrita and Perista, 2007). A total of 41 respondents are to be found in this group.

For IWB, the problematic group is identified by using the employee's response to two statements: "if something goes wrong, I search for a solution" and "my work is as such that it challenges me to find improvements or innovations". Employees who responded "totally disagree" or "disagree" to these statements are placed together. In total, the problematic group includes 17 respondents.

In a second step, a ROC analysis is performed. In this ROC analysis, the attention first goes to the area under curve which indicates how well a test (the score on IWB or work engagement) identifies respondents as being members of the problematic or unproblematic group. For work engagement, the area under curve is 0.805 and for IWB it is 0.863, which are generally seen as moderate to good discrimination scores (Streiner and Cairney, 2007). By looking at the ROC curve and computing the Youden's *J*-statistic, the optimal threshold for both variables is computed. For work engagement, this threshold reflects a score of 5.08 and for IWB a score of 4.48. Next, a second threshold was computed by looking at the 90 per cent specificity level. This corresponds to a score of 3.14 and 4.48 for work engagement and IWB, respectively.

In a third step, these scores are applied to the data and the distribution in the data is inspected. Applying the thresholds of work engagement results in 25.85 per cent of the employees having a "problematic" work engagement score, and 8.16 per cent having a "very problematic" score. For IWB, we found that 15.42 per cent have a "problematic" score and "9.47 per cent" have a "very problematic" score.

Job types, work engagement and IWB

Table IV demonstrates the relation between latent class membership and employee outcomes and it shows some remarkable results. For work engagement, we see that employees in very high-strain jobs have a significantly higher probability of having a very problematic score than employees in all other job types. In comparison with an employee in a low-strain job, the employees in high-strain jobs are 12 times more likely to have a problematic work engagement score. Employees in very low-strain and low-strain jobs are the least likely to have a problematic engagement score. There is no significant difference

	Very low strain (%)	Low strain (%)	Active job (%)	High strain (%)	Very high strain (%)	χ^2 p-value
Work engagement						
No problem	79	81	69	56	36	< 0.01
Problem	15	17	24	37	40	
Big problem	7	2	7	7	24	
Innovative work behaviour						
No problem	78	88	92	66	45	< 0.01
Problem	11	10	7	22	29	
Big problem	11	2	1	11	26	

Table IV. Latent profiles and employee outcomes

between the two proportions (79 vs 81 per cent, p-value 0.607). The difference with regards to employees in active jobs or high-strain jobs is marginally statistically significant (69 vs 56 per cent, p-value 0.038), whereas the difference between active and high-strain jobs is clear (69 vs 36 per cent, p-value < 0.01). We can conclude that, in terms of work engagement, there is a clear hierarchy in the identified jobs. Employees in (very) low-strain jobs are most likely to have a non-problematic engagement score, followed by employees in active jobs and high-strain jobs. Finally, employees in very high-strain jobs are very likely to have a problematic engagement score.

With regards to IWB, we see a similar yet not identical pattern. Again, employees in high-strain jobs are most likely to have a (very) problematic IWB score, in comparison to employees in active jobs, they are about 26 times more likely to have a problematic IWB score. The employees with the lowest probability of having a (very) problematic IWB score are the employees in active jobs and low-strain jobs (92 vs 88 per cent, p-value 0.806); they are more likely to have a non-problematic score than employees in all other job types. Here we do find a significant difference between employees in low and very low-strain jobs, with those in the latter being less likely to have a non-problematic score than those in the former (88 vs 78 per cent, p-value 0.046). Again, a clear hierarchy can be deduced from the results: the active and low-strain jobs perform the best in terms of IWB, whereas the very low-strain jobs come off a little worse and the high-strain and very high-strain jobs are associated with high probabilities of having problematic IWB scores.

Discussion

The identified job types in this data set of employees from the electricity sector are generally in line with previously developed theoretical models and empirical research on job types. We here distinguished between five different job types, for which the patterns of job demands and job resources are much in line with the job types proposed by Karasek (1979). They are also to be found in job type studies by Holman (2012) and others, although these studies generally take a more comprehensive approach to job quality and include variables related to the work environment, social relations or employment conditions. Using LPA on our data, we could not, however, identify a job type which corresponds to what Karasek called a "passive job": a job combining low resources with low demands. A recent study by Vandenbrande *et al.* (2012) that looked into job quality in Belgium using a larger set of variables and data from all sectors was also unable to identify a cluster of jobs similar to Karasek's "passive jobs", and Holman's (2012) study also found that the proportion of passive jobs in Belgium is relatively low compared to other countries. Moreover, Lorenz and Valeyre found that technicians (a predominant occupation in the electricity sector) were mostly to be found in "lean jobs" and not "simple jobs". The lack of passive jobs in our study, in other words, does not seem to contradict other research findings.

Turning to the variables and the categorisation of job resources and job demands, most variables behave as predicted. Job complexity seems to vary according to its own logic and does not follow the "job resources vs job demands" logic. The mean values are slightly lower in (very) low-strain jobs than in the (very) high-strain jobs, and it reaches its peak in the active job. Furthermore, job insecurity does not follow the dominant pattern of having low values for (very) low-strain jobs and high for (very) high-strain jobs.

We here categorised job complexity as a job demand based on the hypothesis that it causes fatigue and stress when the complexity is not matched by sufficient instruments to handle it. In some studies, however, job complexity is categorised as a job resource, instead of a job demand (Salanova and Schaufeli, 2008). In these studies the measures for job complexity are often very similar to those for job autonomy (Baer *et al.*, 2003; Shalley *et al.*, 2009).

By relating the job types to the (categorised) job outcome variables, a clear hierarchy of job types is suggested. For work engagement, the best job types are the low-strain and very low-strain jobs, followed by the active jobs and the high and very high-strain jobs. For IWB the pattern is a bit different, with the active and low-strain jobs performing the best, followed by the very low-strain jobs and then the (very) high-strain jobs. Obviously, providing employees with few resources to meet high demands (high and very high-strain jobs) is negative both in terms of work engagement and IWB. When high demands are combined with a high degree of resources (active job) the outcomes are a lot better; the chance of having a very problematic work engagement score is relatively low while the probability of having a good IWB score is very high. This observation clearly confirms the statement of Karasek that active jobs will "predict motivation, new learning behaviours, and coping pattern development" (Karasek *et al.*, 1998). It also validates a lot of research that showed that while the combination of high demands and resources might not lead to very high levels of work engagement, at least the potentially negative effect of high job demands is buffered or neutralised (Bakker and Demerouti, 2007)

In terms of finding a win-win strategy for employers and employees, the results of our study suggest that the low-strain job offers the best outcomes: it combines high probabilities of good work engagement with high probabilities of good IWB. In this job, the resources are high and the demands are limited, yet not non-existent. In the job type with even lower demands (very low-strain jobs) we find a higher probability of having a (very) problematic score in terms of IWB. From a variable-oriented perspective, our findings suggest a quadratic effect of certain job demands on IWB in combination with an interaction effect with certain job resources. This variable-oriented interpretation immediately reveals the complexity of the "job variables-employee outcomes" relation and the difficulty one would have in finding a fitting, interpretable and correct model.

The observation of more problematic scores in very low-strain jobs in comparison with low-strain and active jobs also confirms the widely held view that some demands are good and stimulating for employees. While this belief is confirmed in this study, only limited demands are needed to stimulate employees; higher demands clearly result in higher, rather than lower, risks of having problems with engagement or innovative behaviour.

Implications

This study has some clear implications for the literature. First, our study showed that taking an observation-oriented rather than a variable-oriented approach to studying job types is a feasible method by which actually existing contingencies in the job types-employee outcomes relation can be identified and analysed. In doing so, this study confirmed the basic premises of the JD-C and JD-R models that not only the isolated levels of job resources and demands determine employee outcomes, but also their combination.

Second, this study confirms the statement that active jobs are likely to result in employees demonstrating innovative behaviour and being involved in a process of continuous learning. This confirms theoretical and empirical insights into the advantages of

pushing for innovation (Gutnick *et al.*, 2012). However, seeing that low-strain jobs score equally well on IWB (and even better on work engagement), this study supports the observation that innovation can also flourish in more relaxed, less demanding jobs. This relates to what Amabile *et al.* (2002) call the "time pressure-creativity matrix", which shows that innovation can occur (or not) in both low- and high-pressure environments.

Third, this study is one of the first to study work engagement and IWB together. Such an approach provides the opportunity to search for job types which are directly beneficial to both the employee (work engagement) and the employer (IWB). At the same time, this research challenges a widely shared assumption in the employee innovation literature that job design affects employee innovation through changed levels of employee motivation or engagement (Shalley *et al.*, 2004; Shalley and Gilson, 2004). This study demonstrated that innovation can occur in jobs that involve very high work engagement (low-strain jobs) and moderate engagement (active jobs), therefore showing that other paths need to be considered.

Fourth, by focusing on a single sector, this study shows that a very similar set of tasks (all done by electricians) can be organised in a very distinct way with very different effects on the employees' behaviour and attitudes. This might indicate that a job type is not solely determined by the tasks themselves, but rather by the way the tasks are organised.

In terms of HR and organisational practices, this study can provide some useful insights and ideas for action. Although this study has various limitations (see below) and we cannot make definite statements regarding causal relations, its findings are nevertheless relevant. First of all, the study shows clearly that a high degree of determination of the work by the employer (low job resources) is to be avoided. Certainly when in combination with high demands, employees in such jobs are very unlikely to be engaged or to take the initiative in finding solutions for problems. Putting people under pressure without giving them the instruments to respond to those pressures is not likely to result in optimal employee behaviour and attitudes. Combining pressure with resources and autonomy is good, but the real win-win situation is when the job demands are held at bay. Second, our study suggests that the most salient factor for employee outcomes is the job resources. Independent of the amount of job demands, all job types with high resources are associated with positive employee outcomes. Third, our study suggests that there is a win-win option with regards to work engagement and IWB, which can be achieved by giving employees low-strain jobs: many resources and not too many demands (but not too little either).

Limitations

This research nevertheless also faces some limitations related to both contextual factors and choices made in the conception and analysis stage. First of all, the analysis in this study is based on survey data gathered at a single point in time, using a single method and stemming from a single source: the employee. In such a case as this, one runs the risk of encountering "common method variance" (CMV): covariance between variables not coming from real covariance but caused by the use of the single method. In the literature, several *post-hoc* statistical tests were proposed to examine whether CMV is a problem in a certain data set and whether it significantly alters the results. According to a review article by Podsakoff *et al.* (2003), these *post-hoc* statistical tests are relevant, but the focus should be on preventing rather than diagnosing and treating CMV. One example of a preventive technique (also used in this study) is combining single- and multi-item scales. Nevertheless, in future studies the focus should be on developing more preventive strategies such as the mixing up of questions relating to different latent concepts, the introduction of different answer formats in the survey, the inclusion of temporal break, etc. (Lindell and Whitney, 2001). In this study, we built largely on the existing Nova-Weba (Schouteten and Benders, 2004) survey. Such an approach enables us to compare these results with the results of different sectors, yet reduces the methodological freedom for experiments and innovation.

A second, related limitation of this study concerns the ROC analysis. In most ROC analyses in the medical field, the reference groups (with a clearly problematic profile) are determined using an external variable. In the organisational field a similar external variable could be used for the identification of the thresholds, for example, peer ratings, supervisor ratings, company data regarding productivity, absenteeism, etc. Such a strategy was inconceivable for this sector, which includes a multitude of small companies that do not have such data.

A third limitation relates to the cross-sectional nature of the analysis. In this study, there is no longitudinal design with a specific intervention or change. The conclusions are based on the comparison of employees in different situations. It is, therefore, impossible to make definite causal statements about a variable *X* leading to a change in variable *Y*.

Conclusion

As employee attitudes and behaviour are equally important for employees, employers and policymakers, the investigation into what affects these employee outcomes is crucial. For a long time, researchers have focused on job content as one of the major predictors of employee behaviour and attitudes. Through these studies, a multitude of important job characteristics have been identified and, more importantly, a variety of contingencies have been uncovered in the relation between job content and employee outcomes.

Building on this research, this study focuses on the relation between job characteristics and employee outcomes using an observation- rather than variable-focused approach. By using LPA, five different job types are identified based on employee data from the Belgian electricity sector. These different job types correspond well to the job types proposed by Karasek and Theorell (1990). In low-strain jobs, the employees face a low level of job demands and a high level of job resources; in the high-strain jobs, by contrast, the resources are low and the demands are high. The active job combines high levels of demands and resources. Two further job types were identified, more pronounced versions of the low-strain and high-strain jobs: very low-strain and very high-strain jobs.

These job types result in significantly different outcomes in terms of employee behaviour and attitudes. As such, we focused on work engagement and IWB, the two important outcomes for both the employee and the employer. Using ROC analysis, threshold values were computed for these dependent variables, and the respondents were categorised into groups with non-problematic, problematic and highly problematic scores for work engagement and IWB.

By focusing on the relation between job types and these outcome variables, a clear hierarchy of job types was established. For work engagement, the low and very low-strain jobs performed the best, followed by the active jobs, while for the high and very high-strain jobs the probability of having a problematic score was found to be considerably higher. For IWB, employees in active or low-strain jobs had the lowest probability of having a problematic IWB score, followed by the very low-strain jobs and, again, employees in high and very high-strain jobs had a considerably higher probability of having a problematic IWB score than the others.

This study, thus, suggests that job types can generate both higher engagement and greater IWB given sufficient resources and a reasonable degree of job demands. Furthermore, this study shows that an observation-oriented approach is a promising methodology to analyse the complex nature of the job characteristics-employee outcomes relationship.

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