The Job Demands-Resources Model: State of the Art

Article *in* Journal of Managerial Psychology · April 2007

DOI: 10.1108/02683940710733115 · Source: OAI

2 authors:

Arnold Bakker
Erasmus University Rotterdam
450 PUBLICATIONS **40,360** CITATIONS

SEE PROFILE

Evangelia Demerouti
Technische Universiteit Eindhoven
206 PUBLICATIONS **18,794** CITATIONS

SEE PROFILE

The Job Demands-Resources model: state of the art

Arnold B. Bakker
Erasmus University Rotterdam, Institute of Psychology, Department of Work and Organizational Psychology, Rotterdam, The Netherlands, and
Evangelia Demerouti
Utrecht University, Department of Social and Organizational Psychology, Utrecht, The Netherlands

Received June 2006
Revised October 2006
Accepted October 2006

Abstract

Purpose – The purpose of this paper is to give a state-of-the art overview of the Job Demands-Resources (JD-R) model

Design/methodology/approach – The strengths and weaknesses of the demand-control model and the effort-reward imbalance model regarding their predictive value for employee well being are discussed. The paper then introduces the more flexible JD-R model and discusses its basic premises.

Findings – The paper provides an overview of the studies that have been conducted with the JD-R model. It discusses evidence for each of the model's main propositions. The JD-R model can be used as a tool for human resource management. A two-stage approach can highlight the strengths and weaknesses of individuals, work groups, departments, and organizations at large.

Originality/value – This paper challenges existing stress models, and focuses on both negative and positive indicators of employee well being. In addition, it outlines how the JD-R model can be applied to a wide range of occupations, and be used to improve employee well being and performance.

Keywords Employees, Employee behaviour, Human resource management

Paper type Research paper

During the past three decades, many studies have shown that job characteristics can have a profound impact on employee well being (e.g. job strain, burnout, work engagement). For example, research has revealed that job demands such as a high work pressure, emotional demands, and role ambiguity may lead to sleeping problems, exhaustion, and impaired health (e.g. Doi, 2005; Halbesleben and Buckley, 2004), whereas job resources such as social support, performance feedback, and autonomy may instigate a motivational process leading to job-related learning, work engagement, and organizational commitment (e.g. Demerouti *et al.*, 2001; Salanova *et al.*, 2005; Taris and Feij, 2004). Although these previous studies have produced a long list of possible antecedents of employee well being, theoretical progress has been limited. Many studies have either used a laundry-list approach to predict employee well being, or they have relied on one of two influential job stress models, namely the demand-control model (Karasek, 1979) and the effort-reward imbalance model (Siegrist, 1996).

The present article outlines the strengths and weaknesses of both models regarding their predictive value for employee well being. We will argue that most research on the demand-control model and the effort-reward imbalance model has been restricted to a given and limited set of predictor variables that may not be relevant for all job

Journal of Managerial Psychology
Vol. 22 No. 3, 2007
pp. 309-328

0268-3946
DOI 10.1108/02683940710733115

positions. In addition, the vast majority of previous studies have focused on negative outcome variables, including burnout, ill health, and repetitive strain. The central aim of this article is to give an overview of the Job Demands-Resources (JD-R) model (Demerouti *et al.*, 2001a), which incorporates many possible working conditions, and focuses on both negative and positive indicators of employee well being. The JD-R model can be applied to a wide range of occupations, and can be used to improve employee well being and performance.

Balance models of employee well being

Point of departure of several models in the occupational health literature is that job strain is the result of a disturbance of the equilibrium between the demands employees are exposed to and the resources they have at their disposal. For example, according to the well-known demand-control model (DCM; Karasek, 1979, 1998), job strain is particularly caused by the combination of high job demands (particularly work overload and time pressure) and low job control – "the working individual's potential control over his tasks and his conduct during the working day" (Karasek, 1979, pp. 289-290). Thus, one basic premise in the DCM is that employees who can decide themselves how to meet their job demands do not experience job strain (e.g. job-related anxiety, health complaints, exhaustion, and dissatisfaction). According to Karasek (1979), p. 287):

> The individual's decision latitude is the constraint which modulates the release or transformation of "stress" (potential energy) into the energy of action.

There is indeed empirical evidence showing that particularly the combination of high job demands and low job control is an important predictor of psychological strain and illness (Karasek, 1979; Schnall *et al.*, 1994). Although the literature provides considerable support for the strain hypothesis, support for the buffer hypothesis – stating that control can moderate the negative effects of high demands on well being – is less consistent (De Jonge and Kompier, 1997; Van der Doef and Maes, 1999). This may suggest that job control is only partly able to buffer the impact of job demands on employee well being. Nevertheless, the DCM has dominated the empirical research on job stress and health over the past 20 years (see also Cordery, 1997).

An alternative model, the effort-reward imbalance (ERI) model (Siegrist, 1996) emphasizes the reward, rather than the control structure of work. The ERI-model assumes that job strain is the result of an imbalance between effort (extrinsic job demands and intrinsic motivation to meet these demands) and reward (in terms of salary, esteem reward, and security/career opportunities – i.e. promotion prospects, job security and status consistency). The basic assumption is that a lack of reciprocity between effort and reward (i.e. high effort/low reward conditions) will lead to arousal and stress (cf. equity theory; Walster *et al.*, 1978), which, in turn, may lead to cardiovascular risks and other strain reactions. Thus, having a demanding, but unstable job, achieving at a high level without being offered any promotion prospects, are examples of a stressful imbalance (De Jonge *et al.*, 2000). The combination of high effort and low reward at work was indeed found to be a risk factor for cardiovascular health, subjective health, mild psychiatric disorders and burnout (for a review, see Van Vegchel *et al.*, 2005). Unlike the DCM, the ERI-model introduces a personal component in the model as well. Over commitment is defined as a set of attitudes, behaviors and emotions reflecting excessive striving in combination with a strong desire of being approved and esteemed. According to the model, over commitment may moderate the association between effort-reward

imbalance and employee well being. Thus, personality is expected to be able to further qualify the interaction between effort and reward. Some evidence for this pattern has indeed been reported (e.g. De Jonge *et al.*, 2000).

Strengths and weaknesses of both models

The basic assumption of both the DCM and the ERI-model is that job demands particularly lead to job strain (and in extreme cases to burnout), when certain job resources are lacking (autonomy in the DCM; salary, esteem reward and security/career opportunities in the ERI-model). In general, one may argue that the strength of these models lies in their simplicity. This can also be seen as a weakness, since the complex reality of working organizations is reduced to only a handful of variables. This simplicity does no justice to reality. Indeed, research on employee well being has produced a laundry list of job demands and (lack of) job resources as potential predictors, not only including high psychological and physical job demands (lack of) rewards, and (lack of) autonomy, but also emotional demands, social support from colleagues, supervisory support, and performance feedback, to name only a few (see Halbesleben and Buckley, 2004; Kahn and Byosserie, 1992; Lee and Ashforth, 1996). This raises the question whether the DCM and ERI-model are applicable to the universe of job positions, and whether in certain occupations other combinations of demands and (lack of) resources than the ones incorporated in the models may be responsible for employee well being. Some scholars have acknowledged this in their research and included physical and emotional demands in the DCM or ERI-model (De Jonge *et al.*, 1999; Van Vegchel *et al.*, 2002).

A related point of critique is the static character of the two models. Thus, it is unclear why autonomy is the most important resource for employees in the DCM (and additionally social support in the extended demand-control-support model; Johnson and Hall, 1988). Would it not be possible that in certain work situations totally different resources prevail (for example inspirational leadership in an internet company, or open communication among reporters of a local TV station)? In a similar vein, the ERI-model (Siegrist, 1996) postulates salary, esteem reward, and status control as the most important job resources that may compensate for the impact of job demands on strain. Why is autonomy not incorporated in this model? Are salary and status control more important job resources than task identity and a high quality relationship with one's supervisor? Thus, the models do not leave room for the integration of other work-related factors that can (and have been found to) be related to well being.

Moreover, it is unclear why work pressure or (intrinsic and extrinsic) effort should always be the most important job demands. It seems evident that the choice of researchers for a certain model implies one-sided attention for specific aspects of the work environment, whereas other aspects are neglected. This is a serious draw back, since we know that certain job demands – like emotional demands – are highly prevalent in some specific occupations (e.g. teachers, nurses, doctors, and waitresses; Bakker *et al.*, 2000c; Hochschild, 1983; Morris and Feldman, 1996), whereas they are virtually absent in other occupations. For example, the work of control room operators and air-traffic controllers is more about the processing of information than about working with people (Demerouti *et al.*, 2001a, b), and therefore mental job demands are more important in these occupations.

Although empirical tests of Karasek (1979) DCM have primarily focused on work overload and time pressure as indicators of job demands, and on skill discretion and decision latitude as indicators of job control, Karasek included role conflict in his original job demands measure, and stated that:

> The goal in constructing the scale of job demands is to measure the psychological stressors involved in accomplishing the work load, stressors related to unexpected tasks, and stressors of job-related personal conflict (Karasek, 1979, p. 291).

He added that:

> Stressors such as fear of unemployment or occupational career problems might also contribute to these measures (p. 291).

In a similar vein, Karasek stated:

> In future research it would be desirable to discriminate between the effects of several different aspects of decision latitude (i.e. with respect to skill, task organization, time pacing, organizational policy influence, control over potential uncertainties, decision resources) (p. 290).

This all implies that Karasek acknowledged the relevance of a wider range of job demands and resources. Nevertheless, most studies on the DCM and the ERI-model have been restricted to a given and limited set of independent variables that may not be relevant for all job positions.

The job demands-resources model

At the heart of the Job Demands-Resources (JD-R) model (Bakker *et al.*, 2003b; c; Demerouti *et al.*, 2001a, b) lies the assumption that whereas every occupation may have its own specific risk factors associated with job stress, these factors can be classified in two general categories (i.e. job demands and job resources), thus constituting an overarching model that may be applied to various occupational settings, irrespective of the particular demands and resources involved. Job demands refer to those physical, psychological, social, or organizational aspects of the job that require sustained physical and/or psychological (cognitive and emotional) effort or skills and are therefore associated with certain physiological and/or psychological costs. Examples are a high work pressure, an unfavorable physical environment, and emotionally demanding interactions with clients. Although job demands are not necessarily negative, they may turn into job stressors when meeting those demands requires high effort from which the employee has not adequately recovered (Meijman and Mulder, 1998).

Job resources refer to those physical, psychological, social, or organizational aspects of the job that are either/or:

- Functional in achieving work goals.
- Reduce job demands and the associated physiological and psychological costs.
- Stimulate personal growth, learning, and development.

Hence, resources are not only necessary to deal with job demands, but they also are important in their own right. This agrees with Hackman and Oldham (1980) job characteristics theory that emphasizes the motivational potential of job resources at the task level, including autonomy, feedback, and task significance. In addition, this agrees on a more general level with conservation of resources (COR) theory (Hobfoll, 2001) that states that the prime human motivation is directed towards the maintenance and accumulation of resources. Accordingly, resources are valued in their own right or because they are means to the achievement or protection of other valued resources. Job resources may be located at the level of the organization at large (e.g. pay, career opportunities, job security), the interpersonal and social relations (e.g. supervisor and co-worker support, team climate), the organization of work (e.g. role clarity,

participation in decision making), and at the level of the task (e.g. skill variety, task identity, task significance, autonomy, performance feedback).

Dual processes

A second premise of the JD-R model is that two different underlying psychological processes play a role in the development of job strain and motivation (see Figure 1). In the first, health impairment process, poorly designed jobs or chronic job demands (e.g. work overload, emotional demands) exhaust employees' mental and physical resources and may therefore lead to the depletion of energy (i.e. a state of exhaustion) and to health problems (e.g. Demerouti *et al.*, 2000, 2001a, b; Leiter, 1993). According to Hockey (1993), individuals use performance-protection strategies under the influence of environmental demands. Performance protection is achieved through the mobilization of sympathetic activation (autonomic and endocrine) and/or increased subjective effort (use of active control in information processing). Hence, the greater the activation and/or effort, the greater the physiological costs for the individual. Even though the use of this strategy makes it difficult to demonstrate overt decrements in primary task performance, according to Hockey's theory, several different patterns of indirect degradation may be identified. These are referred to as compensatory costs (increased activation and/or subjective effort), strategy adjustments (narrowing of attention, increased selectivity, redefinition of task requirements), and fatigue after-effects (risky choices, high levels of subjective fatigue). The long-term effect of such a compensatory strategy may be a draining of an individual's energy, eventually resulting in a breakdown.

The second process proposed by the JD-R model is motivational in nature, whereby it is assumed that job resources have motivational potential and lead to high work engagement, low cynicism, and excellent performance. As follows from our definition, job resources may play either an intrinsic motivational role because they foster employees' growth, learning and development, or they may play an extrinsic motivational role because they are instrumental in achieving work goals. In the former case, job resources fulfill basic human needs (Deci and Ryan, 1985), such as the needs

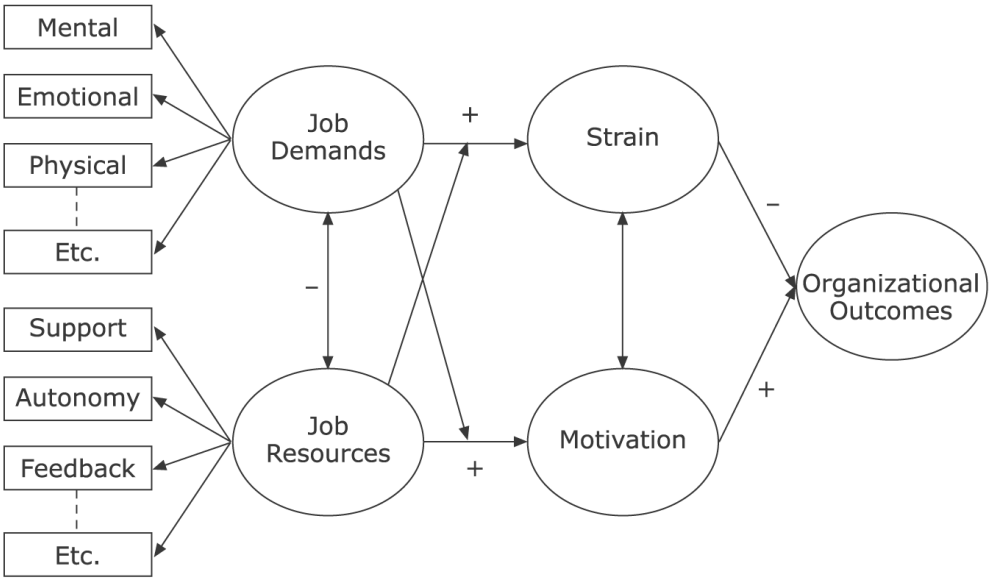

Figure 1.
The Job Demands-Resources model

for autonomy (DeCharms, 1968), competence (White, 1959), and relatedness (Baumeister and Leary, 1995). For instance, proper feedback fosters learning, thereby increasing job competence, whereas decision latitude and social support satisfy the need for autonomy and the need to belong, respectively. Job resources may also play an extrinsic motivational role, because, according to the effort-recovery model (Meijman and Mulder, 1998), work environments that offer many resources foster the willingness to dedicate one's efforts and abilities to the work task. In that case it is likely that the task will be completed successfully and that the work goal will be attained. For instance, supportive colleagues and proper feedback from one's superior increase the likelihood of being successful in achieving one's work goals. In either case, be it through the satisfaction of basic needs or through the achievement of work goals, the presence of job resources leads to engagement, whereas their absence evokes a cynical attitude towards work (see Figure 1).

Interactions between job demands and resources

In addition to the main effects of job demands and resources, the JD-R model proposes that the interaction between job demands and job resources is important for the development of job strain and motivation as well. More specifically, it is proposed that job resources may buffer the impact of job demands on job strain, including burnout (Bakker *et al.*, 2003c). This assumption is consistent with the demand-control model (DCM; Karasek, 1979, 1998), but expands this model by claiming that several different job resources can play the role of buffer for several different job demands. Which job demands and resources play a role in a certain organization depends upon the specific job characteristics that prevail. Thus, whereas the DCM states that control over the execution of tasks (autonomy) may buffer the impact of work overload on job stress, the JD-R model expands this view and states that different types of job demands and job resources may interact in predicting job strain.

This proposition agrees with Diener and Fujita (1995) findings that there are many potential resources, which can facilitate the achievement of a specific goal/demand, implying that different goals/demands are likely to be influenced by several resources. The buffer hypothesis is also consistent with Kahn and Byosserie (1992), who argue that the buffering or interaction effect can occur between any pair of variables in the stress-strain sequence. They claim that properties of the work situation, as well as characteristics of the individual, can buffer the effects of a stressor. The buffering variable can reduce the tendency of organizational properties to generate specific stressors, alter the perceptions and cognitions evoked by such stressors, moderate responses that follow the appraisal process, or reduce the health-damaging consequences of such responses (Kahn and Byosserie, 1992, p. 622).

Social support is probably the most well known situational variable that has been proposed as a potential buffer against job strain (e.g. Haines *et al.* 1991; Johnson and Hall, 1988). Other characteristics of the work situation that may act as moderators are:

- The extent to which the onset of a stressor is predictable (e.g. role clarity and performance feedback).
- The extent to which the reasons for the presence of a stressor are understandable (e.g. through information provided by supervisors).
- The extent to which aspects of the stressor are controllable by the person who must experience it (e.g. job autonomy) (Kahn and Byosserie, 1992).

The reason why job resources can act as buffers is different for different resources. For example, a high quality relationship with one's supervisor may alleviate the influence of job demands (e.g. work overload, emotional and physical demands) on job strain, since leaders' appreciation and support puts demands in another perspective. Leaders' appreciation and support may also aid the worker in coping with the job demands, facilitate performance, and act as a protector against ill health (Väänänen *et al.*, 2003). In contrast, job autonomy may be crucial for employee health and well being because greater autonomy is associated with more opportunities to cope with stressful situations (see Jenkins, 1991; Karasek, 1998). Social support is a straightforward resource, in that it is functional in achieving work goals. Thus, instrumental support from colleagues can help to get the work done in time, and may therefore alleviate the impact of work overload on strain (Van der Doef and Maes, 1999). In addition, the stress-buffering hypothesis states that social support protects employees from the pathological consequences of stressful experiences (Cohen and Wills, 1985). As a final example, constructive feedback not only helps employees do their work more effectively, but also improves communication between supervisors and employees. When specific and accurate information is provided in a constructive way, both employees and supervisors can improve or change their performance. Appraising employees for good performance helps maintain their motivation and signals them to continue in this direction (Hackman and Oldham, 1980). In addition, communicating with employees in a positive manner when they need to improve their performance will help prevent work problems.

The final proposition of the JD-R model is that job resources particularly influence motivation or work engagement when job demands are high. According to conservation of resources (COR) theory (Hobfoll, 2001), people seek to obtain, retain, and protect that which they value, e.g. material, social, personal, or energetic resources. The theory proposes that stress experienced by individuals can be understood in relation to potential or actual loss of resources. More specifically, Hobfoll and Shirom (2000) have argued that:

- Individuals must bring in resources in order to prevent the loss of resources.
- Individuals with a greater pool of resources are less susceptible to resource loss.
- Those individuals who do not have access to strong resource pools are more likely to experience increased loss ("loss spiral").
- Strong resource pools lead to a greater likelihood that individuals will seek opportunities to risk resources for increased resource gains ("gain spiral").

Hobfoll (2002) has additionally argued that resource gain, in turn and in itself has only a modest effect, but instead acquires its saliency in the context of resource loss. This implies that job resources gain their motivational potential particularly when employees are confronted with high job demands. The full JD-R model is depicted graphically in Figure 1.

Evidence for the JD-R model

Evidence for the dual process

Several studies have provided evidence for the hypotheses put forward by the JD-R model. Specifically, a number of studies supported the dual pathways to employee well being proposed by the model, and showed that it can predict important organizational outcomes. Bakker *et al.* (2003a) applied the model to call centre employees of a Dutch telecom company, and investigated its predictive validity for self-reported absenteeism and turnover intentions. Results of a series of structural equation modeling (SEM)

analyses largely supported the dual processes. In the first energy-driven process, job demands (i.e. work pressure, computer problems, emotional demands, and changes in tasks) were the most important predictors of health problems, which, in turn, were related to sickness absence (duration and long-term absence). In the second motivation-driven process, job resources (i.e. social support, supervisory coaching, performance feedback, and time control) were the only predictors of dedication and organizational commitment, which, in turn, were related to turnover intentions.

Hakanen *et al.* (2006) found comparable results in their study among Finnish teachers. More specifically, they found that burnout mediated the effect of job demands on ill-health, and that work engagement mediated the effect of job resources on organizational commitment. Furthermore, Bakker *et al.* (2003b) applied the JD-R model to nutrition production employees, and used the model to predict future company registered absenteeism. Results of SEM-analyses showed that job demands were unique predictors of burnout and indirectly of absence duration, whereas job resources were unique predictors of organizational commitment, and indirectly of absence spell. Finally, Bakker *et al.* (2004b) used the JD-R model to examine the relationship between job characteristics, burnout, and other-ratings of performance. They hypothesized and found that job demands (e.g. work pressure and emotional demands) were the most important antecedents of the exhaustion component of burnout, which, in turn, predicted in-role performance. In contrast, job resources (e.g. autonomy and social support) were the most important predictors of extra-role performance, through their relationship with (dis)engagement. Taken together, these findings support the JD-R model's claim that job demands and job resources initiate two different psychological processes, which eventually affect important organizational outcomes (see also Bakker *et al.*, 2003c; Schaufeli and Bakker, 2004).

Most studies providing evidence for the dual processes suggested by the JD-R model have been based on subjective evaluations of job demands and resources increasing the risk of common method variance between working characteristics and employee well being. Two additional studies utilized an alternative methodology for the assessment of job demands and resources. The study of Demerouti *et al.* (2001a) among employees working with people, things or information included next to self-reports also observer ratings of job demands and resources. Results of a series of structural equation analyses, both with self-report data and with observer ratings of job characteristics, provide strong and consistent evidence for the validity of the JD-R model. Job demands were primarily and positively related to exhaustion, whereas job resources were primarily and negatively related to disengagement from work.

Bakker *et al.* (2005), Study 1 approached employees from seven different organizations, who were asked to fill in the Utrecht Work Engagement Scale (the UWES). In the next step, twenty employees high in engagement and twenty employees low in engagement were visited at their workplace, and exposed to short video clips of about 30 seconds. In these video clips, professional actors role-played two aspects of work engagement (vigor, dedication), three job demands, and four job resources. The participants were asked to indicate how often they experienced each of the situations shown on the video clips. Results showed that the engaged group reported to experience more often work engagement (vigor and dedication) as role-played by the actors. Importantly, the low and high engagement group also differed significantly regarding the prevalence of several of the working conditions shown on the video clips. As predicted, particularly job resources (not job demands) were higher among the high (vs low) engagement group. The high engagement group scored significantly higher on

three of the four job resources (autonomy, feedback, and supervisory coaching; the effect was nonsignificant for social support). There were no differences between both groups regarding the job demands.

Taken together, empirical evidence is supportive of the idea that job demands and resources are responsible for two different processes. Accordingly, job demands are related to strain (including lack of energy and development of health problems) and job resources are related to motivation (including engagement with or disengagement from work, and commitment). Combining these processes in an additive sense leads us to the following propositions (see Figure 2): when both job demands and resources are high, we expect employees to develop strain and motivation while when both are low we expect the absence of strain and motivation. Consequently, the high demands-low resources condition should result in high strain and low motivation while the low demands-high resources condition should have as a consequence low strain and high motivation.

Evidence for the buffer effect of job resources

Two recent studies explicitly focused on the buffer effect of job resources on the relationship between job demands and well being, and found clear evidence for the proposed interaction. Bakker *et al.* (2005), in their study among 1,000 employees of a large institute for higher education, found that the combination of high demands and low job resources significantly added to the prediction of burnout (exhaustion and cynicism). Specifically, they found that work overload, emotional demands, physical demands, and work-home interference did not result in high levels of burnout if employees experienced autonomy, received feedback, had social support, or had a high-quality relationship with their supervisor. Psychologically speaking, different processes may have been responsible for these interaction effects. Thus, autonomy may have helped in coping with job demands because employees could decide for themselves when and how to respond to their demands, whereas social support and a high-quality relationship with the supervisor may have buffered the impact of job demands on levels of burnout because employees received instrumental help and emotional support. In contrast, feedback may have helped because it provided employees with the information necessary to maintain their performance and to stay healthy (see Kahn and Byosserie, 1992, for a further discussion).

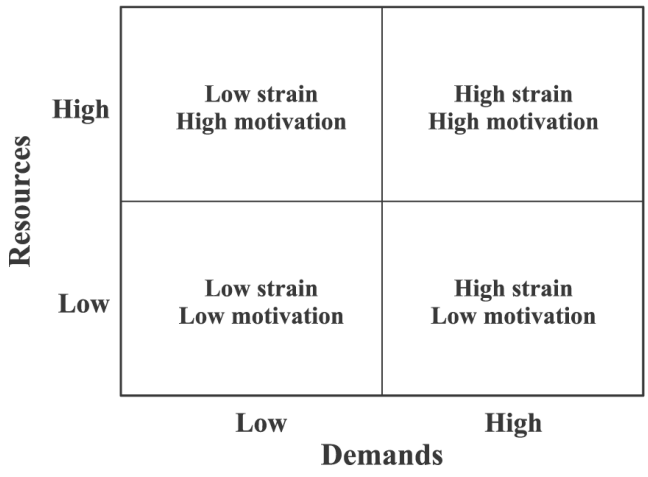

Figure 2.
Predictions of the Job Demands-Resources model based on additive effects

Similar findings were reported by Xanthopoulou *et al.* (2006), who tested the JD-R interaction hypothesis among employees from two home care organizations. The findings revealed, e.g. that patient harassment interacted with autonomy and support in predicting exhaustion; and with autonomy, support and professional development in predicting cynicism. Autonomy proved to be the most important buffer of job demands for both burnout dimensions, followed by support and opportunities for professional development. Results showed that all significant interactions were in the expected direction. Conditions where the four job demands were high and the five job resources were low resulted in the highest levels of exhaustion and cynicism. Put differently, in cases where the levels of job resources were high, the effect of job demands on the core dimensions of burnout was significantly reduced. To illustrate, Figures 3 and 4 display one interaction effect for each burnout dimension.

Evidence for the salience of job resources in the context of high job demands

One previous study outside the framework of the JD-R model has supported the hypothesis that resources gain their salience in the context of high demands/threats. Billings *et al.* (2000) found that men who were care giving for AIDS patients and used social support coping maintained their positive emotional states under conditions of stress, and consequently experienced less physical symptoms, thus supporting the importance of resource gain in the context of loss.

Two studies using the JD-R model have shown that job resources particularly have an impact on work engagement when job demands are high. Hakanen *et al.* (2005)

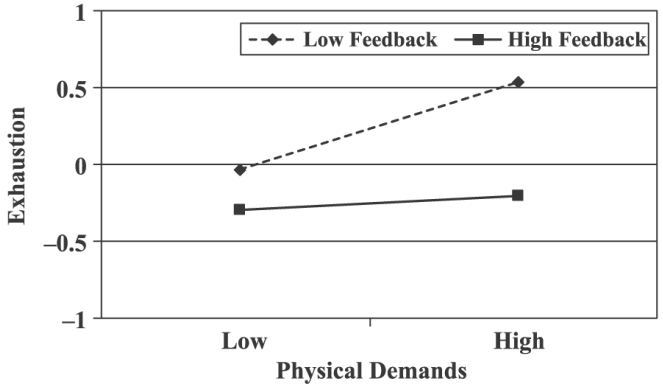

Figure 3.
Interaction effect of physical demands and feedback on exhaustion

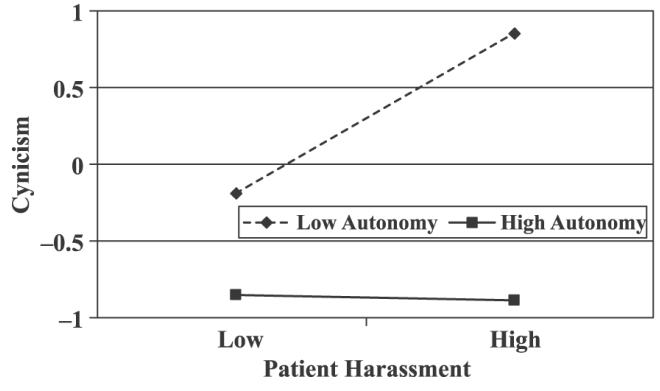

Figure 4.
Interaction effect of patient harassment and autonomy on cynicism

tested this interaction hypothesis in a sample of Finnish dentists employed in the public sector. It was hypothesized that job resources (e.g. variability in the required professional skills, peer contacts) are most beneficial in maintaining work engagement under conditions of high job demands (e.g. workload, unfavorable physical environment). The dentists were split in two random groups in order to cross-validate the findings. A set of hierarchical regression analyses resulted in seventeen out of 40 significant interactions (40 percent), showing, e.g. that variability in professional skills boosted work engagement when qualitative workload was high, and mitigated the negative effect of qualitative workload on work engagement.

Conceptually similar findings have been reported by Bakker *et al.* (2006). In their study among Finnish teachers working in elementary, secondary, and vocational schools, they found that job resources act as buffers and diminish the negative relationship between pupil misbehavior and work engagement. In addition, they found that job resources particularly influence work engagement when teachers are confronted with high levels of pupil misconduct. A series of moderated structural equation modeling analyses resulted in fourteen out of 18 possible two-way interaction effects (78 percent). Particularly supervisor support, innovativeness, appreciation, and organizational climate were important job resources for teachers that helped them cope with demanding interactions with students. Figures 5 and 6 display two interactions (one for the vigor dimension of work engagement, and one for the dedication dimension) that show the salience of job resources under conditions of high job demands.

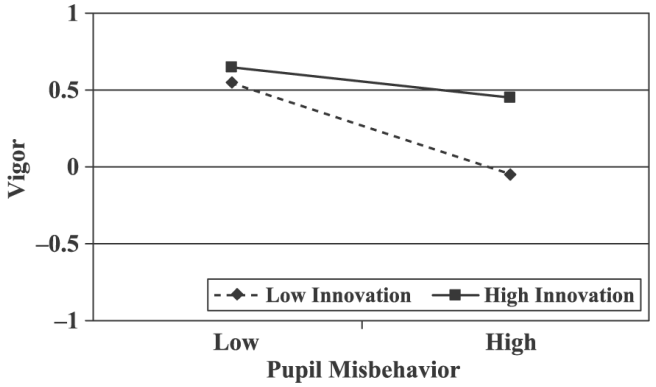

Figure 5.
Interaction effect of pupil misbehavior and innovation on vigor

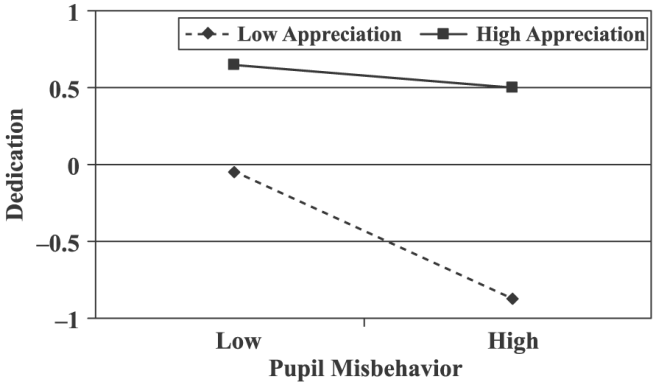

Figure 6.
Interaction effect of pupil misbehavior and appreciation on dedication

Conclusion

Whereas the JD-R model (Demerouti *et al.*, 2001a, b) fits the tradition of the general DCM and the ERI-model, it also satisfies the need for specificity by including various types of job demands and resources, depending on the occupational context under study. Thus, the JD-R model encompasses and extends both models and is considerably more flexible and rigorous. Indeed, Van Veldhoven *et al.* (2005), using data from 37,291 Dutch employees', compared the demand-control-support model with the JD-R model. They found that the latter model provided the best approximation of the relationships among work characteristics, health, and well being. In a similar vein, the study of Lewig and Dollard (2003) among Australian call centre workers showed that the JD-R model accounted for more variance in emotional exhaustion and job satisfaction than either the DCM or the ERI-model.

Taking into consideration the evidence about interaction effects leads to a revision of the predictions shown in Figure 2. This is because Figure 2 was made by considering only the main effects of job demands and job resources – i.e. the influence of job demands on strain, irrespective of the level of job resources, and the influence of job resources on motivation, irrespective of the level of job demands. The evidence about interaction effects requires the adjustment of two quadrants, namely the high-high and low-low constellation (see Figure 7). When job resources are high we saw that it makes no difference in exhaustion or vigor (thus in strain; cf. Figures 3 and 5) what the level of job demands is. Within this constellation strain was at a low or average level instead of a high level as was predicted by the additive model, i.e. when solely the effect of job demands was examined. Returning now to the low demands-low resources condition, the prediction regarding strain remains the same while the prediction regarding motivation should be altered. As we saw in Figures 4 and 6, when job resources are high the level of motivation is high as well, irrespective of the level of demands. However, when job resources are low the lowest level of motivation is found for the high demands-low resources condition leaving an average motivation for the low-low constellation.

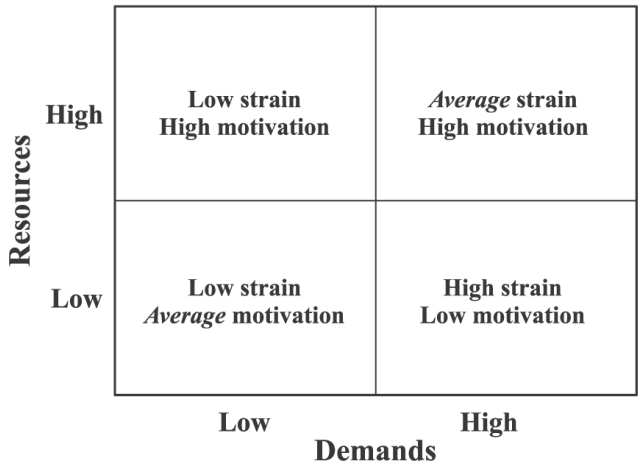

Figure 7.
Predictions of the Job Demands-Resources model based on interaction effects

Avenues for future research

Four main avenues for future research on the JD-R model may be distinguished. These pertain to reciprocal relationships, objective outcomes, the main and interaction effects, and the inclusion of personal resources in the JD-R model.

Reciprocal relationships

The classical hypotheses that job demands predict job strain and that job resources predict motivation represent conventional pathways, and they have been confirmed by several studies (e.g. De Jonge *et al.*, 2001; Dormann and Zapf, 2002; Wong *et al.*, 1998). But is it also conceivable that employee well being has an impact on job demands and job resources? In their review, Zapf *et al.* (1996) identified six out of 16 longitudinal studies, which evidenced reversed causal relationships between working conditions and job stress. More recent studies provide additional evidence for reversed causation, e.g. between financial prospects of self-employed individuals and their health (Gorgievski-Duijvesteijn *et al.*, 2005; Gorgievski-Duijvesteijn *et al.*, 2000), between the quality of the doctor-patient relationship and burnout (Bakker *et al.*, 2000), and between job characteristics (e.g. job control, job complexity, supervisor support, work pressure, and boundary spanning) and exhaustion or satisfaction (Demerouti *et al.*, 2004; De Lange *et al.*, 2004; Wong *et al.*, 1998). In two studies, evidence for reversed causal effects was found across time lags of five (Bakker *et al.*, 2000) and even ten years of time (Gorgievski-Duijvesteijn *et al.*, 2000)! Furthermore, Houkes (2002) included several job resources in her longitudinal research among bank employees and teachers, and found evidence for a reversed causal effect between the motivating potential score (an additive index, including skill variety, task identity, task significance, autonomy, and job feedback) and intrinsic work motivation. Finally, Salanova *et al.* (2006) found that organizational resources predicted work-related flow, which, in turn, predicted future organizational resources.

Taken together, these findings suggest that job stress and motivation can both be outcomes as well as predictors of job demands and resources, such that higher stress and impaired motivation result in less favorable working conditions over time. There are several possible explanations for such reversed causal effects. Two explanations will briefly be discussed here. First, employees who experience job stress or disengagement may, as a result of their own behavior, create additional demands and fewer resources. For example, employees who are exhausted by their work are likely staying behind their workflow, thus creating additional job demands such as time pressure and role conflicts (e.g. Demerouti *et al.*, 2004). In a similar vein, employees who depersonalize their clients by treating them as objects rather than as human beings are likely to evoke more demanding and stressful interactions (e.g. Bakker *et al.*, 2000). Such findings are consistent with the notion of a "loss spiral" (Hobfoll, 2001, 2002).

Second, job demands and resources may also be affected by employees' perceptions of the working environment (Zapf *et al.*, 1996). Just like the tendency of depressed people to assess their environment more negatively and thus contributing to a more negative climate (Beck, 1972), burned-out employees may perceive relatively high job demands and complain more often about their workload, thus creating a negative work climate (Bakker and Schaufeli, 2000). In a similar vein, engaged employees may perceive more resources and be better able to mobilize their resources, because they are more pleasant colleagues to interact with. Indeed, social information processing theory argues that overall job attitudes – like cynicism towards work or its opposite dedication – initiate a rationalizing

process through which individuals cognitively construct characteristics of their job that are consistent with the social context (James and Tetrick, 1986; Wong *et al.*, 1998).

Both explanations for reversed causal effects are also consistent with the phenomenon of job crafting . . . the actions employees take to shape, mold, and redefine their jobs (Wrzesniewski and Dutton, 2001, p. 180). Crafting a job involves shaping the task boundaries of the job (either physically or cognitively), the relationship boundaries of the job, or both. People are not passive receivers of information from their work environment, but rather active in interpreting their jobs, and consequently in shaping their jobs (Daniels, 2006). Future studies on the JD-R model should aim to incorporate reversed causal relationships, and provide more insights in the phenomenon of job crafting and thereby in the dynamics of employee well being.

Objective outcomes

Most studies on the JD-R model have relied exclusively on self-report measures. Some exceptions to this rule are Demerouti *et al.*, 2001a, b, who employed expert ratings to assess job demands and job resources, Bakker *et al.* (2004b) and Salanova *et al.* (2005), who used other-ratings of performance, and Bakker (2006), who used video clips of job demands and resources. It is crucial for the development of the field of organizational psychology to include in research models objective measures that play a role in business. For instance, Harter *et al.* (2002) showed that levels of employee engagement were positively related to business-unit performance (i.e. customer satisfaction and loyalty, profitability, productivity, turnover, and safety) across almost 8,000 business-units of 36 companies. The authors conclude that engagement is "... related to meaningful business outcomes at a magnitude that is important to many organizations" (p. 276). Future research should further illuminate to what extent objective business indicators (e.g. work performance, customer satisfaction, sickness absenteeism, sales) are predicted by the JD-R model. It would also be interesting to examine whether the proposed combinations of job demands and resources can predict objective health outcomes, e.g. cardiovascular risks.

Main and interaction effects

Studies on the JD-R model as well as on the DCM indicate that there is ample evidence for the main (additive) effects of job demands and of job resources on strain and motivation, and considerable evidence for the interaction effects. This is either because scientists have shown more the interest in investigating main effects or because interaction effects are difficult to detect (cf. the low confirmation rates, see Van der Doef and Maes, 1999), or both. However, it is important that future studies pay attention to both perspectives because each perspective has different theoretical and practical implications. At the theoretical level, it is important to uncover what happens in terms of strain when job demands and job resources are on an elevated level (a situation frequently met in several occupations). Does this condition lead to high strain (cf. the additive, main effects model), or to a low or average level of strain (cf. interaction effects)? The answer to this question has implications at the practical level, since if job resources indeed buffer the effect of job demands on strain the advice to organizations would be to enhance job resources without having to alter the level of job demands (Van Vegchel, 2005). In a statistical sense, it is important to know whether the interaction follows a multiplicative function (implying that job resources influence the strength of the relationship between job demands and strain) or whether a proportional or ratio function is applicable (cf. Edwards and Cooper, 1990). This latter function

implies that strain increases as the proportion of job demands that is fulfilled by job resources becomes lower (see also Van Vegchel, 2005). As Edwards and Cooper (1990) suggest, the preference for the one or the other kind of interaction should be based on theoretical grounds and is open for future research.

Personal resources

An important extension of the JD-R model is the inclusion of personal resources in the model. Recently, Xanthopoulou *et al.* (2006) examined the role of three personal resources (self-efficacy, organizational-based self-esteem and optimism) in predicting exhaustion and work engagement. Results of structural equation modeling analyses showed that personal resources did not manage to offset the relationship between job demands and exhaustion. However, as predicted, personal resources partly mediated the relationship between job resources and work engagement, suggesting that job resources foster the development of personal resources.

Practical implications

The JD-R model assumes that whereas every occupation may have its own specific working characteristics, these characteristics can be classified in two general categories (i.e. job demands and job resources), thus constituting an overarching model that may be applied to various occupational settings, irrespective of the particular demands and resources involved. The central assumption of the JD-R model is that job strain develops – irrespective of the type of job or occupation – when (certain) job demands are high and when (certain) job resources are limited. In contrast, work engagement is most likely when job resources are high (also in the face of high job demands).

This implies that the JD-R model can be used as a tool for human resource management. In close collaboration with human resource managers and consultants, the model has now been applied in over 130 different organizations in The Netherlands. Because every occupation may have its own unique risk factors of burnout (or antecedents of work engagement), we have started to use a two-stage procedure in our organizational research with the model. The first qualitative phase of the research includes explorative interviews with job incumbents from different layers of an organization (e.g. representatives from management, staff, and shop floor). The interviews, which last approximately 45 minutes, include open questions about the jobs of the interviewees, and refer to its positive and negative aspects. The incorporation of a qualitative phase in the research is valuable because it potentially generates knowledge about unexpected, organization-specific job demands and job resources that will be overlooked by highly standardized approaches. For example, it is conceivable that in one organization (e.g. a production company) employees are exposed to high physical job demands, whereas in another organization (e.g. an insurance company) employees are not exposed to such demands at all. In addition, in certain companies, employees are confronted with mergers, which may cause job insecurity and role ambiguity. Such organization-specific job demands can be traced in the exploratory qualitative phase.

In the second phase of the research, the job demands and job resources potentially associated with burnout or engagement are operationalized in items and scales and incorporated in a tailor-made questionnaire. All employees from an organization are then invited to fill out this questionnaire. This enables a quantitative analysis of the job demands and job resources that have been identified qualitatively and that potentially

play a role in the development of job strain and motivation. The analysis usually concentrates on differences between departments and job positions, in terms of job demands, resources, employee well being, and its consequences. In some projects, managers participate in JD-R workshops before the start of the study, so that they can learn how to use the information that will become available. The subgroup analyses can provide clear indications for interventions, since they highlight the strengths and the weaknesses of departments and job positions. Tailor-made interventions are then possible, aimed at reducing the identified job demands, and increasing the most important job resources, which, in turn, may decrease the risk for burnout, and increase the likelihood of work engagement and good performance.

In addition, we have recently developed an internet application of the JD-R model – called the JD-R monitor, in which employees who fill in an electronic questionnaire receive online and personalized feedback on their computer screen about their most important job demands and resources. The feedback includes histograms of the specific demands and resources included in the study, in which the participant's score is compared with that of a benchmark (comparison group). In addition, the feedback mode is interactive, such that participants can click on the histograms and receive written feedback about the meaning of their scores on the demands and resources. In a similar way, feedback about well being is included in this internet tool. The final PDF-report that can be generated at the end of the program is used as input for interviews with company doctors and personal coaches.

We hope that this review encourages researchers to investigate the validity of the Job Demands-Resources model in various occupational groups and in different countries. In addition, future research should test whether the JD-R monitor is effective in helping employees to cope with their demands, mobilize their resources, stay healthy, and perform well.

References

Bakker, A.B. (2006), "Job resources as predictors of work engagement and employee retention", manuscript submitted for publication.

Bakker, A.B. and Schaufeli, W.B. (2000), "Burnout contagion processes among teachers", *Journal of Applied Social Psychology*, Vol. 30, pp. 2289-308.

Bakker, A.B., Demerouti, E. and Schaufeli, W.B. (2003a), "Dual processes at work in a call centre: an application of the Job Demands-Resources model", *European Journal of Work and Organizational Psychology*, Vol. 12, pp. 393-417.

Bakker, A.B., Demerouti, E. and Verbeke, W. (2004), "Using the Job Demands-Resources model to predict burnout and performance", *Human Resource Management*, Vol. 43, pp. 83-104.

Bakker, A.B., Demerouti, E. and Euwema, M.C. (2005), "Job resources buffer the impact of job demands on burnout", *Journal of Occupational Health Psychology*, Vol. 10, pp. 170-80.

Bakker, A.B., Hakanen, J.J. and Demerouti, E. (2006), *Job Resources Boost Work Engagement, Particularly When Job Demands are High*, manuscript submitted for publication.

Bakker, A.B., Demerouti, E., De Boer, E. and Schaufeli, W.B. (2003b), "Job demands and job resources as predictors of absence duration and frequency", *Journal of Vocational Behavior*, Vol. 62, pp. 341-56.

Bakker, A.B., Demerouti, E., Taris, T., Schaufeli, W.B. and Schreurs, P. (2003c), "A multi-group analysis of the Job Demands-Resources model in four home care organizations", *International Journal of Stress Management*, Vol. 10, pp. 16-38.

Bakker, A.B., Schaufeli, W.B., Sixma, H., Bosveld, W. and Van Dierendonck, D. (2000), "Patient demands, lack of reciprocity, and burnout: a five-year longitudinal study among general practitioners", *Journal of Organizational Behavior*, Vol. 21, pp. 425-41.

Baumeister, R.F. and Leary, M.R. (1995), "The need to belong: desire for interpersonal attachments as a fundamental human motivation", *Psychological Bulletin*, Vol. 117, pp. 497-529.

Beck, A.T. (1972), *Depression: Causes and Treatment*, University of Pennsylvania Press, Philadelphia, PA.

Billings, D.W., Folkman, S., Acree, M. and Moskowitz, J.T. (2000), "Coping and physical health during care-giving: the roles of positive and negative affect", *Journal of Personality and Social Psychology*, Vol. 79, pp. 131-42.

Cohen, S. and Wills, T.A. (1985), "Stress, social support, and the buffering hypothesis", *Psychological Bulletin*, Vol. 98, pp. 310-50.

Cordery, J. (1997), "Reinventing work design theory and practice", *Australian Psychologist*, Vol. 32, pp. 185-90.

Daniels, K. (2006), "Rethinking job characteristics in work stress research", *Human Relations*, Vol. 59, pp. 267-90.

DeCharms, R. (1968), *Personal Causation*, Lawrence Erlbaum Associates, Hillsdale, NJ.

Deci, E.L. and Ryan, R.M. (1985), *Intrinsic Motivation and Self-determination in Human Behavior*, Plenum Press, New York, NY.

De Jonge, J. and Kompier, M.A.J. (1997), "A critical examination of the Demand-Control-Support Model from a work psychological perspective", *International Journal of Stress Management*, Vol. 4, pp. 235-58.

De Jonge, J., Mulder, M.J.G.P. and Nijhuis, F.J.N. (1999), "The incorporation of different demand concepts in the Job Demand-Control Model: effects on health care professionals", *Social Science and Medicine*, Vol. 48, pp. 1149-60.

De Jonge, J., Bosma, H., Peter, R. and Siegrist, J. (2000), "Job strain, effort-reward imbalance and employee well being: a large-scale cross-sectional study", *Social Science and Medicine*, Vol. 50, pp. 1317-27.

De Jonge, J., Dormann, C., Janssen, P.P.M., Dollard, M.F., Landeweerd, J.A. and Nijhuis, F.J.N. (2001), "Testing reciprocal relationships between job characteristics and psychological well being: a cross-lagged structural equation model", *Journal of Occupational and Organizational Psychology*, Vol. 74, pp. 29-46.

De Lange, A., Taris, T.W., Kompier, M., Houtman, I. and Bongers, P. (2004), "The relationships between work characteristics and mental health: examining normal, reversed and reciprocal relationships in a four-wave study", *Work and Stress*, Vol. 18, pp. 149-66.

Demerouti, E., Bakker, A.B. and Bulters, A.J. (2004), "The loss spiral of work pressure, work-home interference and exhaustion: reciprocal relations in a three-wave study", *Journal of Vocational Behavior*, Vol. 64, pp. 131-49.

Demerouti, E., Bakker, A.B., Nachreiner, F. and Schaufeli, W.B. (2001a), "The job demands-resources model of burnout", *Journal of Applied Psychology*, Vol. 86, pp. 499-512.

Demerouti, E., Bakker, A.B., Nachreiner, F. and Schaufeli, W.B. (2000), "A model of burnout and life satisfaction among nurses", *Journal of Advanced Nursing*, Vol. 32, pp. 454-64.

Demerouti, E., Bakker, A.B., De Jonge, J., Janssen, P.P.M. and Schaufeli, W.B. (2001b), "Burnout and engagement at work as a function of demands and control", *Scandinavian Journal of Work, Environment and Health*, Vol. 27, pp. 279-86.

Diener, E. and Fujita, F. (1995), "Resources, personal strivings, and subjective well being: a nomothetic and idiographic approach", *Journal of Personality and Social Psychology*, Vol. 68, pp. 926-35.

Doi, Y. (2005), "An epidemiologic review on occupational sleep research among Japanese workers", *Industrial Health*, Vol. 43, pp. 3-10.

Dormann, C. and Zapf, D. (2002), "Social stressors at work, irritation, and depressive symptoms: accounting for unmeasured third variables in a multi-wave study", *Journal of Occupational and Organizational Psychology*, Vol. 75, pp. 33-58.

Edwards, J.R. and Cooper, C.L. (1990), "The person-environment fit approach to stress: recurring problems and some suggested solutions", *Journal of Organizational Behavior*, Vol. 11, pp. 293-307.

Gorgievski-Duijvesteijn, M.J., Giessen, C. and Bakker, A.B. (2000), "Financial problems and health complaints among farm couples: results of a ten-year follow-up study", *Journal of Occupational Health Psychology*, Vol. 5, pp. 359-73.

Gorgievski-Duijvesteijn, M.J., Bakker, A.B., Schaufeli, W.B. and Van der Heijden, P.G.M. (2005), "Finances and health: a dynamic equilibrium model of resources", *Journal of Occupational Health Psychology*, Vol. 10, pp. 210-24.

Hackman, J.R. and Oldham, G.R. (1980), *Work Redesign*, Addison-Wesley, Reading, MA.

Haines, V.A., Hurlbert, J.S. and Zimmer, C. (1991), "Occupational stress, social support, and the buffer hypothesis", *Work and Occupations*, Vol. 18, pp. 212-35.

Hakanen, J.J., Bakker, A.B. and Demerouti, E. (2005), "How dentists cope with their job demands and stay engaged: the moderating role of job resources", *European Journal of Oral Sciences*, Vol. 113, pp. 479-87.

Hakanen, J.J., Bakker, A.B. and Schaufeli, W.B. (2006), "Burnout and work engagement among teachers", *Journal of School Psychology*, Vol. 43, pp. 495-513.

Halbesleben, J.R.B. and Buckley, M.R. (2004), "Burnout in organizational life", *Journal of Management*, Vol. 30, pp. 859-79.

Harter, J.K., Schmidt, F.L. and Hayes, T.L. (2002), "Business-unit-level relationship between employee satisfaction, employee engagement, and business outcomes: a meta-analysis", *Journal of Applied Psychology*, Vol. 87, pp. 268-79.

Hobfoll, S.E. (2001), "The influence of culture, community, and the nested-self in the stress process: advancing conservation of resources theory", *Applied Psychology: An International Review*, Vol. 50, pp. 337-70.

Hobfoll, S.E. (2002), "Social and psychological resources and adaptation", *Review of General Psychology*, Vol. 6, pp. 307-24.

Hobfoll, S.E. and Shirom, A. (2000), "Conservation of resources theory: Applications to stress and management in the workplace", in Golembiewski, R.T. (Ed.), *Handbook of Organization Behavior*, 2nd ed., Dekker, New York, NY, pp. 57-81.

Hochschild, A.R. (1983), *The Managed Heart. Commercialization of Human Feeling*, University of California Press, Berkeley, CA.

Hockey, G.R.J. (1993), "Cognitive-energetical control mechanisms in the management of work demands and psychological health", in Baddely, A. and Weiskrantz, L. (Eds), *Attention: Selection, Awareness, and Control*, Clarendon Press, Oxford, pp. 328-45.

Houkes, I. (2002), "Work and individual determinants of intrinsic work motivation, emotional exhaustion and turnover intention", doctoral dissertation, Maastricht University, Maastricht.

James, L.R. and Tetrick, L.E. (1986), "Confirmatory analytic tests of three causal models relating job perceptions to job satisfaction", *Journal of Applied Psychology*, Vol. 71, pp. 77-83.

Jenkins, R. (1991), "Demographic aspects of stress", in Cooper, C.L. and Payne, R. (Eds), *Personality and Stress: Individual Differences in the Stress Process*, Wiley, New York, NY, pp. 107-32.

Johnson, J.V. and Hall, E.M. (1988), "Job strain, work place social support and cardiovascular disease: a cross-sectional study of a random sample of the Swedish working population", *American Journal of Public Health*, Vol. 78, pp. 1336-42.

Kahn, R.L. and Byosserie, P. (1992), "Stress in organizations", in Dunette, M.D. and Hough, L.M. (Eds), *Handbook of Industrial and Organizational Psychology*, Vol. 3, Consulting Psychologists Press, Palo Alto, CA, pp. 571-650.

Karasek, R.A. (1979), "Job demands, job decision latitude, and mental strain: implications for job design", *Administrative Science Quarterly*, Vol. 24, pp. 285-308.

Karasek, R.A. (1998), "Demand/Control Model: a social, emotional, and physiological approach to stress risk and active behaviour development", in Stellman, J.M. (Ed.), *Encyclopaedia of Occupational Health And Safety*, ILO, Geneva, pp. 34.06-34.14.

Lee, R.T. and Ashforth, B.E. (1996), "A meta-analytic examination of the correlates of the three dimensions of job burnout", *Journal of Applied Psychology*, Vol. 81, pp. 123-33.

Leiter, M.P. (1993), "Burnout as a developmental process: consideration of models", in Schaufeli, W.B., Maslach, C. and Marek, T. (Eds), *Professional Burnout: Recent Developments in Theory and Research*, Taylor and Francis, Washington, DC, pp. 237-50.

Lewig, K.A. and Dollard, M.F. (2003), "Emotional dissonance, emotional exhaustion and job satisfaction in call centre workers", *European Journal of Work and Organizational Psychology*, Vol. 12, pp. 366-92.

Meijman, T.F. and Mulder, G. (1998), "Psychological aspects of workload", in Drenth, P.J., Thierry, H. and de Wolff, C.J. (Eds), *Handbook of Work and Organizational Psychology*, 2nd ed., Erlbaum, Hove, pp. 5-33.

Morris, J.A. and Feldman, D.C. (1996), "The dimensions, antecedents, and consequences of emotional labor", *Academy of Management Journal*, Vol. 21, pp. 989-1010.

Salanova, M., Agut, S. and Peiró, J.M. (2005), "Linking organizational resources and work engagement to employee performance and customer loyalty: the mediation of service climate", *Journal of Applied Psychology*, Vol. 90, pp. 1217-27.

Salanova, M., Bakker, A.B. and Llorens, S. (2006), "Flow at work: evidence for an upward spiral of personal and organizational resources", *Journal of Happiness Studies*, Vol. 7, pp. 1-22.

Schaufeli, W.B. and Bakker, A.B. (2004), "Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study", *Journal of Organizational Behavior*, Vol. 25, pp. 293-315.

Schnall, P.L., Landsbergis, P.A. and Baker, D. (1994), "Job strain and cardiovascular disease", *Annual Review of Public Health*, Vol. 15, pp. 381-411.

Siegrist, J. (1996), "Adverse health effects of high effort-low reward conditions", *Journal of Occupational Health Psychology*, Vol. 1, pp. 27-41.

Taris, T.W. and Feij, J.A. (2004), "Learning and strain among newcomers: a three-wave study on the effects of job demands and job control", *Journal of Psychology*, Vol. 138, pp. 543-63.

Van Vegchel, N. (2005), "Two models at work: a study of interactions and specificity in relation to the demand-control model and the effort-reward imbalance model", dissertation thesis, Utrecht University, Utrecht.

Van Vegchel, N., De Jonge, J., Bakker, A.B. and Schaufeli, W.B. (2002), "Testing global and specific indicators of rewards in the Effort-Reward Imbalance model: does it make any difference?", *European Journal of Work and Organizational Psychology*, Vol. 11, pp. 403-21.

Van Vegchel, N., de Jonge, J., Bosma, H. and Schaufeli, W.B. (2005), "Reviewing the effort-reward imbalance model: drawing up the balance of 45 empirical studies", *Social Science and Medicine*, Vol. 60, pp. 1117-31.

Van Veldhoven, M.J.P.M., Taris, T.W., De Jonge, J. and Broersen, S. (2005), "The relationship between work characteristics and employee health and well being: how much complexity do we really need?", *International Journal of Stress Management*, Vol. 12, pp. 3-28.

Van der Doef, M. and Maes, S. (1999), "The Job Demand-Control(-Support) Model and psychological well being: a review of 20 years of empirical research", *Work and Stress*, Vol. 13, pp. 87-114.

Väänänen, A., Toppinen-Tanner, S., Kalimo, R., Mutanen, P., Vahtera, J. and Peiró, J.M. (2003), "Job characteristics, physical and psychological symptoms, and social support as antecedents of sickness absence among men and women in the private industrial sector", *Social Science and Medicine*, Vol. 57, pp. 807-24.

Walster, E., Walster, G.W. and Berscheid, E. (1978), *Equity: Theory and Research*, Allyn and Bacon, Boston, MA.

White, R. (1959), "Motivation reconsidered: the concept of competence", *Psychological Review*, Vol. 66, pp. 297-333.

Wong, C.S., Hui, C. and Law, K.S. (1998), "A longitudinal study of the job perception-job satisfaction relationship: a test of the three alternative specifications", *Journal of Occupational and Organizational Psychology*, Vol. 71, pp. 127-46.

Wrzesniewski, A. and Dutton, J.E. (2001), "Crafting a job: revisioning employees as active crafters of their work", *Academy of Management Review*, Vol. 26, pp. 179-201.

Xanthopoulou, D., Bakker, A.B., Demerouti, E. and Schaufeli, W.B. (2006), "The role of personal resources in the job demands-resources model", manuscript submitted for publication.

Zapf, D., Dormann, C. and Frese, M. (1996), "Longitudinal studies in organizational stress research: a review of the literature with reference to methodological issues", *Journal of Occupational Health Psychology*, Vol. 1, pp. 145-69.

Further reading

Riolli, L. and Savicki, V. (2003), "Optimism and coping as moderators of the relation between work resources and burnout in information service workers", *International Journal of Stress Management*, Vol. 10, pp. 235-52.

Xanthopoulou, D., Bakker, A.B., Demerouti, E., Schaufeli, W, Taris, T. and Schreurs, P. (2006), "Different combinations of job demands and resources predict burnout", manuscript submitted for publication.

Corresponding author

Arnold B. Bakker can be contacted at: bakker@fsw.eur.nl