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A Longitudinal Test of the Job Demands-Resources Model among Australian University Academics

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A longitudinal test of the Job Demands-Resources (JD-R) model of work stress and engagement (Bakker & Demerouti, 2007; Demerouti et al., 2001) was conducted in a sample of Australian university academics ($N = 296$). The aim was to extend the JD-R model by (1) determining how well job demands (work pressure, academic workload) and job resources (procedural fairness, job autonomy) would predict psychological strain and organisational commitment over a three-year period, and (2) incorporating longitudinal tests of reversed causation. The results of SEM analyses showed that Time 1 resources directly predicted Time 2 strain and organisational commitment, but that Time 1 demands predicted Time 2 strain only indirectly via job resources. We did not

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find evidence for reversed causation. We discuss possible mediators of the relationships between working conditions and work stress outcomes, and the practical implications of the results.

INTRODUCTION

Since its formulation by Demerouti and her colleagues (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), the Job Demands-Resources (JD-R) model has demonstrated its usefulness as a parsimonious yet comprehensive model for conceptualising and investigating occupational well-being, burnout, and engagement (Schaufeli & Bakker, 2004). The JD-R model, in both its original and modified forms (Bakker & Demerouti, 2007; Bakker, Demerouti, & Euwema, 2005), has been successfully applied in numerous contexts. These include investigations of burnout in hospital nurses (Demerouti et al., 2001), home care professionals (Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003), and call-centre workers (Lewig & Dollard, 2003), as well as the study of repetitive strain injury and dedication in call-centre employees (Bakker, Demerouti, & Schaufeli, 2003), engagement among dentists (Hakanen, Schaufeli, & Ahola, 2008), and the performance of human service professionals in various occupations (Bakker, Demerouti, & Verbeke, 2004).

The present study sought to extend this body of research by applying the JD-R model to an investigation of the antecedents of psychological strain and organisational commitment among university academics. Importantly, while most previous studies of the JD-R model have used a cross-sectional approach, this study is among the first to use a longitudinal design, allowing both causal and reversed causal effects to be tested (e.g. de Lange, Taris, Kompier, Houtman, & Bongers, 2004).

The JD-R Model

As the tenets of the JD-R model have been described in detail elsewhere (Bakker & Demerouti, 2007), only a summary is presented here. The JD-R model originally represented an attempt to synthesise the theoretical insights and empirical findings of several prior models, including the Demand-Control-Support model (DCS; Karasek, 1979; Karasek & Theorell, 1990), the Effort–Reward Imbalance model (ERI; Siegrist, 1996), and the Conservation of Resources model (Hobfoll, 1989). Thus, in contrast to the DCS and ERI models which focus on specific work characteristics (e.g. control, support, or (un)fairness), the JD-R model offers a more flexible approach, embracing a wide variety of work-related factors that impact on well-being, thereby allowing the choice of factors to be tailored to particular work contexts (Bakker & Demerouti, 2007).

Job demands are the physical, psychological, social, or organisational aspects of the job that require sustained physical and/or psychological effort or skills, and are associated with physiological or psychological costs (Demerouti et al., 2001; see also Bakker, Demerouti, Taris et al., 2003). Job resources, on the other hand, are the physical, psychological, social, or organisational aspects of the job that function to reduce job demands, enable achievement of work goals, and/or stimulate personal growth, learning, and development (Bakker, Demerouti, Taris et al., 2003; Demerouti et al., 2001). Resources are therefore assumed to promote work-related motivation and engagement (the motivational hypothesis; Bakker, Demerouti, & Schaufeli, 2003), while excessive job demands lead to impaired health and exhaustion via energy depletion (the health impairment hypothesis; Bakker, Demerouti, & Schaufeli, 2003; see also Lee & Ashforth, 1996).

The contrasting relationships between demands and health impairment/exhaustion, and between resources and engagement—the so-called "dual process"—form the centerpiece of the JD-R model, and are well supported by empirical evidence across a range of occupations (Bakker, Demerouti, de Boer, & Schaufeli, 2003; Bakker, Demerouti, & Schaufeli, 2003; Bakker et al., 2004; Bakker & Geurts, 2004; Lewig, Xanthopoulou, Bakker, Dollard, & Metzer, 2007). For example, in a study of absenteeism among nutrition company employees, Bakker, Demerouti, de Boer et al. (2003) found that job demands (workload, job reorganisation) and resources (control, participation in decision-making) predicted burnout and organisational commitment, respectively, while burnout and commitment in turn mediated the relationships between working conditions and absenteeism. Similarly, based on a more heterogeneous sample of workers, Bakker and colleagues (2004) reported a strong positive relationship between job demands (workload, emotional demands, work–home conflict) and exhaustion, together with a strong negative relationship between resources (autonomy, possibilities for development, social support) and disengagement (the opposite of motivation and commitment). In addition, exhaustion partially mediated the relationship between demands and in-role job performance, while disengagement fully mediated the relationship between resources and extra-role citizenship behaviors. Finally, in a multi-sample study, Schaufeli and Bakker (2004) found that burnout mediated the relationship between job demands and health problems, while both burnout and engagement mediated the relationships between job resources and turnover intentions.

In sum, considerable support exists for the dual processes posited by the JD-R model. However, there is evidence that job resources are implicated, not only in the motivational process, but also in the energy depletion/health impairment process. For example, cross-sectional studies have shown that burnout is predicted by an absence of such job resources as social support, feedback, and supervisory coaching (Schaufeli & Bakker, 2004), and a lack of

job control, supervisor support, information, social climate, and innovative climate (Hakanen, Bakker, & Schaufeli, 2006). Similarly, Janssen, Peeters, de Jonge, Houkes, and Tummers (2004) found that, as well as being positively linked to job satisfaction, social support was negatively linked to exhaustion in nurses and nurse assistants. One explanation for such findings is that energy may be depleted not only by excessive job demands, but also by chronic shortfalls in important work-related resources that require individuals to draw on their own personal reserves to compensate (e.g. Hobfoll, 1989).

While the JD-R model is well supported empirically by a range of cross-sectional studies, there is a need for longitudinal investigations, both to establish the direction of causality between predictors and outcomes and to control for third factors that may be responsible for the relationships among them (de Lange, Taris, Kompier, Houtman, & Bongers, 2003; Frese, Garst, & Fay, 2007; Zapf, Dormann, & Frese, 1996). To this end, Mauno, Kinnunen, and Ruokolainen (2007) conducted a two-year investigation of the predictors of work engagement among a range of professional and non-professional health-care workers. Using multiple regression analyses, they examined the links from specific job-related and organisational demands (i.e. job insecurity, time pressure, work–family conflict) and resources (i.e. control, management quality, organisation-based self-esteem) to three dimensions of work engagement (vigor, dedication, and absorption) measured 2 years later. While all predicted relationships were supported in the initial analyses, once prior levels of engagement had been controlled for, only job control and job insecurity remained as significant predictors, and only of dedication. This emphasises the importance of using a longitudinal design. As noted by the authors, "the stable nature of work engagement [may make] it difficult to detect significant predictors of later work engagement" (Mauno et al., 2007, p. 168).

Hakanen et al. (2008) used SEM to analyse data from a three-year cross-lagged study of burnout, engagement, and depression among dentists. In support of the JD-R model, they found that Time 1 job demands predicted Time 2 burnout, while Time 1 job resources weakly predicted both Time 2 burnout and Time 2 work engagement. Thus, their study provided longitudinal support for both the JD-R's dual process and the cross-link between job resources and health impairment.

The Present Study

The present study employed a longitudinal design, in which both causal and reversed causal (i.e. reciprocal) relationships were investigated in university academics. Measures were taken on two occasions, separated by a three-year interval, to examine the impact of selected job demands and job resources on

psychological strain and organisational commitment. A three-year time lag was chosen so that the second wave of data collection would take place at the same phase of the triennial enterprise bargaining cycle (i.e. negotiations between unions and university management over working conditions) as did the first wave.

The study commenced at a time of considerable upheaval throughout the Australian higher education sector, during which changes to federal government funding policies resulted in substantial increases in student-to-staff ratios (leading to increased demands) and decreases in baseline levels of research funding (leading to decreased resources; see also Gillespie, Walsh, Winefield, Dua, & Stough, 2001; Winefield, Boyd, Saebel, & Pignata, 2008; Winefield, Gillespie, Stough, Dua, Hapuarachchi, & Boyd, 2003). In line with the JD-R model, therefore, the selection of particular demands and resources was intended to reflect the circumstances of the study population, in this case, one experiencing a significant decline in available resources across the sector. Following a series of focus groups (see Gillespie et al., 2001), measures were developed based on the factors identified by academic staff as having most impact on their occupational stress and well-being. These included the demands of work pressure and academic workload; and the resources of job autonomy and procedural fairness.

Several of these job characteristics feature prominently in the literature on occupational stress and well-being. Work pressure (or time pressure), the sense of having too much work to do in the time available (Kahn & Byosiere, 1992), is routinely treated as an indicator of workload or quantitative job demands (e.g. Demerouti, Bakker, & Bulters, 2004; Geurts, Kompier, Roxburgh, & Houtman, 2003) and has been linked to increased anxiety, psychological distress and, over the longer term, to physical health complaints (see Sonnentag & Frese, 2003, for a review).

Academic workload captures job demands that are unique to academic work. Previous research (e.g. Gillespie et al., 2001; Kinman, 2001; Winefield et al., 2008; Winefield et al., 2003) has shown that high levels of teaching commitments, the pressure to attract external funding, and high levels of role conflict (e.g. among the triple demands of teaching, research, and administration) constitute important sources of job-related stress for academics, while role conflict has, in turn, been linked to high levels of job dissatisfaction and anxiety (see Sonnentag & Frese, 2003).

Job autonomy, the capacity of employees to influence decisions over important matters such as the pacing and timing of their work, is routinely incorporated as a resource in tests of the JD-R model (Bakker & Demerouti, 2007). According to self-determination theory (Deci & Ryan, 2000), autonomy is a basic human need which, if satisfied, leads to increased motivation and persistence, but which, if deprived, leads to apathy and alienation

(van Prooijen, 2009). By helping to meet this human need, therefore, the presence of job-related autonomy increases work-related motivation (van Prooijen, 2009). Job autonomy has been identified as a contributor to affective organisational commitment (Aube, Rousseau, & Morin, 2007; Jernigan, Beggs, & Kohut, 2002), and is a foundational component of the demand-control model (Karasek, 1979) and other work-characteristic models of stress and well-being (e.g. Hackman & Oldham, 1980).

The second job resource, procedural fairness, refers to the perceived fairness or equity of the processes by which organisational decisions are made and outcomes determined (Cohen-Charash & Spector, 2001; Colquitt, Conlon, Wesson, Porter, & Ng, 2001). An important component is "voice", the perceived opportunity to express opinions in relation to decision-making processes, which is in turn related to perceptions of autonomy (van Prooijen, 2009). Procedural fairness is also conceptually linked to the psychological contract that exists between employers and employees. That is, when fair practices and procedures are seen to be the norm, and the psychological contract is honored, employees feel valued by the organisation (e.g. Lester, Kickul, & Bergmann, 2007) and in return, respond with greater organisational commitment (see also Eisenberger, Armeli, Rexwinkel, Lynch, & Rhoades, 2001). Procedural fairness is a reliable and strong predictor of organisational commitment, and has also been positively linked to job satisfaction, organisational citizenship behaviors, and job performance (Cohen-Charash & Spector, 2001; Colquitt et al., 2001).

Psychological strain and affective organisational commitment were chosen as outcomes in the present study. The JD-R model was originally designed to investigate two dimensions of burnout, exhaustion and disengagement (Demerouti et al., 2001), and more recently has focused on work engagement as the positive antithesis of burnout (e.g. Bakker, 2009; Bakker, Hakanen, Demerouti, & Xanthopoulou, 2007; Hakanen et al., 2008). The present study extends the outcomes beyond a strict focus on exhaustion and engagement, to incorporate psychological strain and organisational commitment (see Winefield et al., 2003). Like exhaustion, psychological strain is regarded as a response to occupational stress (see Le Blanc, de Jonge, & Schaufeli, 2008). Characterised by subjective feelings of distress and other negative symptoms (e.g. anxiety, depression, self-deprecation, social withdrawal; Massé, Poulin, Dassa, Lambert, Bélair, & Battaglini, 1998), it has frequently been investigated as an outcome in job stress research (e.g. Harvey, Kelloway, & Duncan-Leiper, 2003; Mansell, Brough, & Cole, 2006; van Gelderen, Heuven, van Veldhoven, Zeelenberg, & Croon, 2007). It has also been identified as a predictor of sickness absence in longitudinal research (Virtanen et al., 2007).

Affective organisational commitment, the employee's degree of attachment to, identification with, and pride in the organisation, is an important

aspect of state or attitudinal engagement (as distinct from trait or behavioral; Macey & Schneider, 2008), as well as being an indicator of work-related motivation (Schaufeli & Bakker, 2004). Affective organisational commitment has been linked to a variety of positive behavioral outcomes, including job performance and organisational citizenship behavior (e.g. Hunter & Thatcher, 2007; Lambert, Hogan, & Griffin, 2008). Hence, while not equivalent to a state of immersion in, and dedication to, the job (e.g. Bakker et al., 2007), affective organisational commitment may be considered a suitable outcome with which to conduct a longitudinal test of the JD-R model.

Hypotheses: Causal Effects

The causal hypotheses below reflect the dual processes proposed by the JD-R model, together with the documented cross-link between job resources and heath impairment.

Hypothesis 1: Job demands at Time 1 will positively predict psychological strain at Time 2.

Hypothesis 2: Job resources at Time 1 will positively predict organisational commitment at Time 2.

Hypothesis 3: Job resources at Time 1 will negatively predict psychological strain at Time 2.

Reversed Effects: Well-being Predicting Job Characteristics

In addition to the causal effects, the present study also examined reversed causal effects. There is a growing interest in reversed causation processes in the work stress literature, stemming from the notion that the relationship between working conditions and mental health over time may be bidirectional, rather than unidirectional (see de Lange et al., 2004, for a detailed discussion). Two differing explanations have been advanced to account for processes of reversed causation. The "perceptual" hypothesis proposes that increased strain or commitment may lead to changes in individuals' *perceptions* of job conditions. That is, increasing psychological strain and declining energy levels may lead employees, over time, to perceive their work environment more negatively (i.e. as more demanding), even though actual working conditions have not changed. This interpretation is consistent with the energy depletion hypothesis of the JD-R model (e.g. Schaufeli & Bakker, 2004). In other words, because the individual's capacity (his or her own resources) to meet demands has declined, demands themselves are perceived as more burdensome.

By contrast, the "selection" or "drift" hypothesis argues that, just as work characteristics may influence mental health and work attitudes over time, the reverse process might also occur (de Lange et al., 2004). In the case of psychological strain or exhaustion, for example, increasing levels may lead individuals to perform more poorly (as a result of impaired effort, confidence, help-seeking, or problem-solving abilities; see Bakker et al., 2004) and subsequently "drift" into less desirable jobs with more demands (e.g. pressure) and fewer resources (e.g. autonomy) than they enjoyed previously. Due to the restricted job mobility of academic staff (the sample examined in this study), such "drift" often involves remaining in the same job, but with more demands (e.g. greater volume of teaching, and administrative duties) and fewer resources (e.g. less autonomy, discretion, and social support). Employees under high strain may also behave in a less civil manner towards their colleagues and engage in less organisational citizenship behavior (see Chang, Johnson, & Yang, 2007, for a meta-analysis), undermining collaborative relationships and further weakening the resources and support available to them.

By contrast, individuals with high levels of motivation and organisational commitment may, as a result of enhanced dedication, vigor, and performance, be rewarded by the organisation with better jobs that are rich in resources such as decision latitude, consultation, and remuneration. For example, highly motivated academics may be best able to communicate their enthusiasm about science to others, and may be more successful in obtaining research grants, publishing articles in high-quality journals, and attracting talented PhD students, which in turn, increase job resources. Successful, committed academics typically have more control and discretion over their work (e.g. what courses to teach and when), more negotiation power to obtain resources, and are more likely to have a positive experience with university procedures, such as promotions and performance appraisals.

Longitudinal findings concerning the existence of reversed causation effects are mixed (see de Lange et al., 2004, for a review), and the relative merits of the perceptual and drift hypotheses have yet to be thoroughly addressed. Nevertheless, the plausibility of both hypotheses warrants the investigation of reversed causal effects in studies of the relationships between work characteristics and work attitudes and outcomes (de Lange et al., 2004). On this basis, we propose the following hypotheses.

Hypotheses: Reversed Causal Effects

Hypothesis 4: Psychological strain at Time 1 will positively predict job demands at Time 2.

Hypothesis 5: Organisational commitment at Time 1 will positively predict job resources at Time 2.

Hypothesis 6: Psychological strain at Time 1 will negatively predict job resources at Time 2.

METHOD

Participants and Procedure

Participants consisted of salaried academic employees from 12 universities across Australia, who answered anonymous questionnaires as part of a national survey of work stress in university staff. Full details of the sample characteristics are available elsewhere (see Winefield, Gillespie, Stough, Dua, & Hapuarachchi, 2002; Winefield et al., 2008; Winefield et al., 2003). The survey was conducted in 2000 and 2003. This study focuses on only those 12 universities that took part on both occasions. In 2000, 2,583 academics from the 12 universities responded, of whom 2,298 provided usable data, and in 2003, 2,150 completed the survey. This represented a response rate of 25 per cent at Time 1 and 22 per cent at Time 2 (see Winefield et al., 2008). Of the total number of Time 1 academic respondents, 296, or 12.9 per cent, provided usable data at Time 2.

Table 1 shows the characteristics of both the study sample ($N = 296$) and the Time 1 only respondents ($N = 2{,}002$), and the means and standard deviations on the variables under investigation. The two groups differed in three ways: the study sample contained a higher percentage of women than the Time 1 only sample (52% compared with 41%) and a lower percentage of professors (5% compared with 9%), and the study sample reported higher levels of Time 1 work pressure. There were no other significant differences between the two groups (see Table 1).

The study sample consisted of 143 men (48%) and 153 women (52%). The average age in 2000 was 46.37 years ($SD = 8.41$) while the average tenure was 9.51 years ($SD = 7.55$). The majority of staff were either lecturers ($n = 105$, 36%) or senior lecturers ($n = 93$, 31%). Around two-thirds ($n = 201$, 68%) remained in the same employment classification throughout the study, while just under one-third ($n = 88$, 30%) were promoted between Time 1 and Time 2. The vast majority ($n = 292$, 99%) remained at the same university.

The survey was administered on two occasions separated by a three-year interval. At Time 1, a paper questionnaire was distributed to all tenured and contract staff at the participating universities, and pre-addressed reply-paid envelopes were supplied to enable participants to return the questionnaire directly to the research team. At follow-up, the survey was conducted electronically. With the cooperation of each university's administration, a link to

TABLE 1
Attrition Analyses

	Study sample (N = 296)		*Time 1 only sample (N = 2,002)*		
	n	%	n	%	χ^2 (1)
Gender					
Male	143	48.3	1132	56.5	9.63**
Female	153	51.7	823	41.1[a]	
Level of appointment					
Associate lecturer/research associate	45	15.2	286	14.3	0.18
Lecturer	105	35.5	687	34.3	0.91
Senior lecturer	93	31.4	608	30.4	0.13
Associate professor	39	13.2	240	12.0	0.34
Professor	14	4.7	181	9.0	6.17*
	M	SD	M	SD	t (370–421)
Age	46.37	8.41	45.91	10.23	0.46
Years of tenure	9.51	7.55	9.47	7.65	0.53
Work pressure T1	3.45	0.55	3.35	0.59	2.89**
Academic workload T1	3.50	0.80	3.45	0.54	1.04
Autonomy T1	3.13	0.75	3.11	0.81	0.42
Procedural fairness T1	2.87	0.90	2.86	0.86	0.18
Organisational commitment T1	3.35	0.71	3.34	0.76	0.59
Psychological strain T1	14.33	6.51	13.58	5.91	1.87

[a] 47 respondents (2.3%) did not disclose their gender; * $p < .05$; ** $p < .01$.

the survey website was distributed to all tenured and contract staff via email. Reminder notices were sent to staff at 2-, 4- and 6-week intervals following the initial email. The measurement equivalence of paper-and-pencil and internet organisational surveys was recently demonstrated in a large-scale examination across 16 countries (see De Beuckelaer & Lievens, 2009).

To ensure maximum participation, the survey was conducted anonymously on both occasions. Each respondent was asked to supply a unique code identifier (the same on both occasions), which was used to link Time 1 and Time 2 data.

Measures

In addition to the measures listed below, demographic data, including respondents' age (in years), gender, years of tenure at the university, and level of appointment, were collected on both occasions. The measures of job demands, resources, and outcomes described below all had internal

reliabilities of between .60 and .99 (Cronbach's alpha coefficients), thus indicating acceptable reliability (see Table 3).

Job Demands. Work pressure: Three items from Beehr, Walsh, and Taber's (1976) work pressure scale assessed work overload. An example item is "I am rushed in doing my job" (1 = *definitely false*, 4 = *definitely true*).

Academic workload: Three items, based on prior focus group discussions (see Gillespie et al., 2001), were included in the present study to reflect the demands of teaching, research, and administration associated with academic work (1 = *strongly disagree*, 5 = *strongly agree*). The items were "I do not have enough time to perform quality research", "The number of hours I am expected to teach has increased in recent years", and "The amount of administration I am expected to do is manageable, given my other responsibilities" (reverse scored).

Job Resources. Workplace autonomy: Four items, drawn from the Moos Work Environment Scale autonomy sub-scale (Moos & Insel, 1974) were used to measure the degree of autonomy experienced by staff in regulating their work and work environment. Example items are "Staff are encouraged to make their own decisions", and "Staff function fairly independently of management" (1 = *strongly disagree*, 5 = *strongly agree*).

Procedural fairness: A five-item scale developed from focus group discussions (Gillespie et al., 2001) asked staff to rate the fairness of performance appraisal, appointment, and promotion procedures in their workplace (1 = *strongly disagree*, 5 = *strongly agree*). Example items are "In my university, promotions procedures are fair", and "I have been adequately consulted about changes made within my workplace".

Psychological Strain. The 12-item version of the General Health Questionnaire (GHQ-12: Goldberg & Williams, 1988) was used to assess psychological strain. The GHQ-12 has been used in over 600 scientific studies to measure stress, psychological strain, resilience, and other measures associated with stress and strain. It is a highly reliable scale that assesses the participant's current experience. It has been used in both cross-sectional (e.g. Banks, Clegg, Jackson, Kemp, Stafford, & Wall, 1980; Harvey et al., 2003; Whaley, Morrison, Payne, Fritschi, & Wall, 2005) and longitudinal (e.g. Mansell et al., 2006; Virtanen et al., 2007) investigations of job stress, and has also been used in population-based studies (e.g. Andrews, Hall, Teeson, & Henderson, 1999; Mäkikangas, Feldt, Kinnunen, Tolvanen, Kinnunen, & Pulkkinen, 2006; Netuveli, Wiggins, Montgomery, Hildon, & Blane, 2008).

Items were rated using a 4-point Likert scale. Example items are "Have you recently felt constantly under strain?" (1 = *not at all*, 4 = *much more than usual*), "Have you recently been able to face up to your problems?" (1 = *more*

so than usual, 4 = *much less than usual*), and "Have you recently been able to concentrate on what you are doing?" (1 = *better than usual*, 4 = *much worse than usual*). Higher scores indicate greater psychological strain.

Organisational Commitment. Five items were adapted from Porter, Steers, Mowday, and Boulian's (1974) measure of affective organisational commitment to measure the extent to which employees identified with their university and were committed to its goals. Example items are: "I am willing to put in a great deal of effort beyond that normally expected in order to help this university be successful", and "My values and this university's values are very similar". Scoring was on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*).

Analytical Strategy

Analyses were conducted in three stages. First, confirmatory factor analyses (CFAs) were performed on the measures of job demands and resources, and on the two outcome measures. Second, descriptive statistics and variable inter-correlations were calculated. Third, structural equation models were tested using the AMOS 7 software package (Arbuckle, 2003). Latent variables were formed and hypotheses tested using the maximum likelihood method of estimation. According to Cortina, Chen, and Dunlap (2001), the maximum likelihood method is robust to violations of multivariate normality, and is preferable to distribution-free methods that require much larger samples than those that are typically available in organisational research.

RESULTS

Confirmatory Factor Analyses

Job Demands. CFA of the work pressure and academic workload items showed that a four-factor solution (work pressure and academic workload at Time 1 and Time 2) fit the data well, and better than a two-factor solution (job demands at Time 1 and Time 2; see Table 2 for fit indices and $\Delta\chi^2$ values). To test for factorial invariance across time, a model in which the loadings for corresponding items at Time 1 and Time 2 were constrained to be equal was compared with an unconstrained model, in which loadings were freely estimated. The two models were not statistically different, $\Delta\chi^2(4) = 8.79$, *ns*, supporting factorial invariance. The factors were correlated at $r = .74$ at Time 1 and $r = .71$ at Time 2.

Job Resources. The four autonomy items were pooled with the five procedural fairness items at Time 1 and Time 2. Again, a four-factor solution

TABLE 2
Results of Confirmatory Factor Analyses (Maximum Likelihood Estimates), $N = 296$

Measure	n *items*	*Model*	n *factors*	χ^2	*df*	χ^2/df	*GFI*	*CFI*	*TLI*	*RMSEA*	$\Delta\chi^2$
Job demands (work pressure + academic workload)	6	1	2	115.95	47	2.47	.94	.94	.92	.07	
		2	4	43.07	42	1.03	.97	.99	.99	.01	72.88***
Job resources (fairness + autonomy)	9	1	2	459.68	126	3.68	.82	.83	.80	.10	
		2	4	184.91	121	1.53	.93	.97	.96	.04	274.77***
Psychological strain	12	1	2	603.67	233	2.59	.85	.91	.80	.07	
		2	6	470.63	220	2.14	.89	.94	.93	.06	133.04***
Organisational commitment	5	1	2	243.22	29	8.39	.87	.85	.77	.16	
		2	4	46.54	24	1.94	.97	.98	.97	.05	196.68***

Note: $\Delta\chi^2$ values refer to differences between successive nested (unconstrained) models (Model 1—Model 2).
*** $p < .001$.

(autonomy and procedural fairness at Times 1 and 2) fit the data better than a two-factor solution (job resources at Times 1 and 2; see Table 2). Comparison of constrained and unconstrained models supported factorial invariance, $\Delta\chi^2$ (7) = 7.29, *ns*. Correlations between the factors were r = .65 at Time 1 and r = .64 at Time 2.

Psychological Strain. Recent research has indicated that rather than measuring a unitary construct, the GHQ forms three highly correlated factors, corresponding to anxiety/depression, social dysfunction, and loss of confidence (French & Tait, 2004; Mäkikangas et al., 2006; Shevlin & Adamson, 2005). The present study confirmed that a three-factor structure fit the data satisfactorily and better than a one-factor model (see Table 2). Comparison of constrained and unconstrained models supported factorial invariance across time, $\Delta\chi^2$ (9) = 13.91, *ns*. Correlations among the factors ranged from .71 between social dysfunction and loss of confidence at Time 1, to .93 between social dysfunction and anxiety/depression at Time 2.

Organisational Commitment. For the 10 organisational commitment items (five for each measurement occasion), a two-factor solution (organisational commitment at Time 1 and Time 2) fit the data poorly (see Table 2). Modification indices identified substantial cross-sectional error correlations between the same two items on both occasions. Allowing these two items to form a separate factor at both Time 1 and Time 2 improved the fit substantially (see Table 2). The resulting two factors corresponded to (1) Care about, and (2) Pride in the university (composed of two and three items, respectively). However, factorial invariance across time was not supported as the constrained and unconstrained models were significantly different, $\Delta\chi^2(3)$ = 9.20, $p < .05$. Removal of two constraints (those making the Time 1 factor loadings of "I really care about the future of this university" and "My values and this university's values are very similar" equal to their Time 2 counterparts) eliminated this difference between the constrained and the unconstrained models, $\Delta\chi^2(1)$ = .12, *ns*, indicating that the item pairs in question were the source of factorial instability. The two factors were correlated at r = .43 at Time 1 and r = .66 at Time 2.

Descriptive Statistics

Indicator variables corresponding to each of the factors identified by the foregoing CFAs were formed either by averaging the scores of the relevant items, or, in the case of psychological strain, by summing them. As a result, there were two indicators each for job demands (work pressure, academic workload), job resources (procedural fairness, autonomy), and organisational commitment (pride in, and care about, the university). There were

three indicators for psychological strain (social dysfunction, anxiety/depression, loss of confidence).

Inspection of the variable distributions showed that the third factor of the GHQ (loss of confidence) was substantially positively skewed on both occasions. A logarithmic transformation was applied to reduce the level of skew to within acceptable limits (i.e. $p > .001$; Tabachnick & Fidell, 2001). This strategy was successful ($z = 2.43$, $p > .001$ at Time 1; $z = 2.80$, $p > .001$ at Time 2). While the other two factors of the GHQ displayed positive kurtosis, we did not attempt transformation, as Tabachnick and Fidell state that associated problems with underestimates of variance disappear with samples of 100 or more. All other variables had acceptable distributions and no multivariate outliers were identified.

Table 3 shows the alpha coefficients, means, standard deviations, and inter-correlations for the manifest variables at Time 1 and Time 2. There were two significant changes in mean scores between Time 1 and Time 2: there was an increase in Academic workload, $t(295) = 3.15$, $p < .01$, and a decrease in Care about the university, $t(295) = -2.91$ $p < .01$.

Results of SEM of the Hypothesised Model

The indicators of demands (work pressure and academic workload), resources (procedural fairness and autonomy), psychological strain (social dysfunction, anxiety/depression, loss of confidence), and organisational commitment (pride and care about the university) were specified to load on their respective latent variables at Time 1 and Time 2. All factor loadings were significant, ranging from a relatively low .30 for Care about the university on organisational commitment at Time 1, to .99 for Pride in the university on organisational commitment at Time 1 and Time 2.

For longitudinal SEM analyses, the procedures advocated by de Lange et al. (2004) were adopted (see also Zapf et al., 1996). First, a stability model was specified, in which estimates were calculated from Time 1 latent variables to their Time 2 counterparts. As well as providing a baseline against which to evaluate subsequent models, incorporation of stability estimates helps to control for third variables (e.g. personality characteristics) that might account for the associations among the target variables (Zapf et al., 1996). In this model, and in all subsequent models, Time 1 latent variables were allowed to inter-correlate, as were Time 2 residuals of the latent variables. In addition, in accordance with accepted practice, corresponding error terms of the indicators were allowed to covary across the two time points, to allow for the effects of shared method variance over time (Demerouti et al., 2004; Martens & Haase, 2006).

To test causation hypotheses, paths were specified from Time 1 demands to Time 2 strain, and from Time 1 resources to Time 2 commitment (H1 and

TABLE 3
Descriptive Statistics and Variable Inter-Correlations ($N = 296$)

	M	SD	α	1	2	3	4	5	6	7	8	9	10
1. Age	46.37	8.41	–										
2. Tenure	9.51	7.55	–	.57[a]									
3. Work pressure T1	3.45	.55	.76	.10	.09								
4. Work pressure T2	3.46	.54	.76	−.05	−.02	.47							
5. Academic workload T1	3.50	.80	.62	.11	.18	.53	.32						
6. Academic workload T2	3.65	.81	.62	−.01	.01	.41	.51	.49					
7. Autonomy T1	3.13	.75	.73	−.18	−.21	−.16	−.09	−.32	−.19				
8. Autonomy T2	3.12	.86	.82	−.09	−.07	−.14	−.11	−.26	−.33	.46			
9. Procedural fairness—T1	2.87	.74	.74	−.05	−.08	−.17	−.09	−.33	−.28	.46	.29		
10. Procedural fairness—T2	2.87	.90	.82	−.02	.01	−.04	−.04	−.18	−.35	.25	.48	.58	
11. OC—All T1	3.35	.71	.78	−.04	−.08	−.11	−.14	−.20	−.22	.24	.19	.38	.30
12. OC—All T2	3.33	.84	.83	−.09	−.13	−.07	−.12	−.20	−.24	.16	.26	.38	.42
13. OC—Care T1	2.92	.90	.79	−.10	−.09	−.18	−.14	−.28	−.23	.32	.20	.49	.34
14. OC—Care T2	2.99	.98	.80	−.14	−.12	−.13	−.16	−.25	−.31	.25	.30	.46	.50
15. OC—Pride T1	3.99	.80	.82	.08	−.03	.07	−.07	.02	−.10	.00	.08	.02	.08
16. OC—Pride T2	3.85	.90	.83	.00	−.10	.04	−.03	−.05	−.05	−.02	.11	.13	.17
17. PS—All T1	14.33	6.51	.92	.03	.08	.29	.19	.24	.24	−.18	−.22	−.26	−.20
18. PS—All T2	14.49	6.86	.93	−.08	−.04	.10	.26	.22	.32	−.11	−.28	−.19	−.24
19. PS—Social dysfunction T1	7.57	3.06	.86	.05	.09	.25	.17	.20	.18	−.11	−.18	−.21	−.20
20. PS—Social dysfunction T2	7.65	3.16	.83	−.03	−.01	.08	.20	.19	.27	−.06	−.24	−.15	−.22
21. PS—Anxiety/depression T1	5.23	2.73	.84	.00	.06	.34	.20	.27	.28	−.21	−.23	−.27	−.18
22. PS—Anxiety/depression T2	5.21	2.72	.86	−.13	−.08	.12	.30	.27	.35	−.17	−.32	−.21	−.24
23. PS—Loss of confidence T1	1.53	1.47	.78	.01	.05	.13	.13	.15	.16	−.19	−.18	−.21	−.15
24. PS—Loss of confidence T2	1.63	1.64	.84	−.08	−.03	.07	.20	.10	.24	−.06	−.20	−.15	−.20

TABLE 3
Continued

	11	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*
12. OC—All T2	.64												
13. OC—Care T1	.91	.62											
14. OC—Care T2	.60	.93	.65										
15. OC—Pride T1	.70	.38	.34	.24									
16. OC—Pride T2	.51	.81	.38	.55	.48								
17. PS—All T1	−.22	−.24	−.26	−.28	−.04	−.09							
18. PS—All T2	−.30	−.26	−.31	−.25	−.16	−.20	.40						
19. PS—Social dysfunction T1	−.21	−.26	−.25	−.29	−.04	−.13	.92	.31					
20. PS—Social dysfunction T2	−.28	−.25	−.29	−.23	−.15	−.20	.35	.94	.30				
21. PS—Anxiety/depression T1	−.18	−.16	−.23	−.22	.00	−.02	.93	.38	.75	.31			
22. PS—Anxiety/depression T2	−.29	−.24	−.29	−.25	−.16	−.16	.37	.92	.27	.78	.39		
23. PS—Loss of confidence T1	−.21	−.21	−.22	−.24	−.10	−.10	.79	.41	.60	.34	.68	.36	
24. PS—Loss of confidence T2	−.24	−.22	−.24	−.19	−.14	−.19	.38	.85	.29	.71	.35	.71	.43

Note: OC = organisational commitment; PS = psychological strain.

[a] Correlations ≥ .12 are significant at $p < .05$.

H2), and then from Time 1 resources to Time 2 strain (H3). Next, reversed causal paths from Time 1 outcomes to Time 2 demands and resources were added in a reciprocal model. Chi-square difference ($\Delta\chi^2$) tests were used to compare successive nested models.

The results of SEM analyses are shown in Table 4. The initial baseline model provided a good fit to the data. Stability estimates were .44 for psychological strain, .60 for job resources, .64 for organisational commitment, and .65 for job demands. As could be expected, there were substantial within-time correlations between demands and strain, and between resources and commitment (see Figure 1). There were also significant negative correlations between resources and strain, and between demands and commitment at Time 1. The stability model accounted for 20 per cent of the variance in psychological strain and 43 per cent of the variance in organisational commitment.

To test the first two causation hypotheses, paths were specified from Time 1 demands to Time 2 strain and from Time 1 resources to Time 2 organisational commitment. Both paths were significant: from Time 1 demands to Time 2 strain, $\beta = .15$, $p < .05$, and from Time 1 resources to Time 2 to commitment, $\beta = .24$, $p < .01$. In addition, the overall fit of the causal model was significantly better than that of the stability model, $\Delta\chi^2(2) = 16.17$, $p < .001$. The causal model accounted for an additional 1 per cent of variance in psychological strain, and 4 per cent of variance in organisational commitment, bringing the totals to 21 per cent and 47 per cent, respectively. Thus, there was provisional support for H1 and H2.

A third causal path, from Time 1 resources to Time 2 strain, was specified (H3). Consistent with the hypothesis, the effect was significant and negative, $\beta = -.19$, $p < .01$. Furthermore, the fit of the model improved, $\chi^2(1) = 4.39$, $p < .05$, accounting for an extra 3 per cent of variance in psychological strain. However, unexpectedly, the inclusion of this third causal path meant that the path from Time 1 demands to Time 2 strain became non-significant, $\beta = .05$, *ns*. Furthermore, removal of the latter path did not result in a significant deterioration of fit, $\chi^2(1) = 0.28$, *ns*, while the regression coefficient for resources increased slightly, $\beta = -.21$, $p < .01$. Thus, in the final causal model, H2 and H3 were supported, but H1 was not. Instead, the SEM analyses suggested a mediated pathway, whereby the effect of Time 1 demands to Time 2 strain was carried by Time 1 resources. This interpretation was supported by the results of a Sobel's test, $z = 2.66$, $p < .001$.

To test H4, H5, and H6, reversed causal effects were incorporated in a reciprocal model. No further significant effects were identified and the model fit was no better than that of the causal model, $\Delta\chi^2(3) = 0.50$, *ns*. Thus, none of the reversed causation hypotheses was supported.

TABLE 4
Results of SEM Analyses (Maximum Likelihood Estimates), $N = 296$

Model	*Description*	*Modeled effects*	χ^2	*df*	χ^2/df	*GFI*	*CFI*	*TLI*	*RMSEA*	$\Delta\chi^{2a}$
1	Stability	T1 variables → T2 counterparts	332.64	157	2.12	.90	.93	.91	.062	
2	Causal: dual process	M1 + T1 demands → T2 strain, T1 resources → T2 commitment	315.83	155	2.04	.91	.94	.91	.059	16.17***
3	Causal: dual process + cross-linked	M2 + T1 resources → T2 strain	311.44	154	2.02	.91	.94	.91	.059	4.39*
4	Reciprocal	M3 + T1 strain → T2 demands, T1 strain → T2 resources T1 commitment → T2 resources	310.94	151	2.06	.91	.94	.91	.060	0.50
5	Final	M1 + T1 resources → T2 strain, T1 resources → T2 commitment	311.72	155	2.01	.91	.94	.92	.059	0.28[b]

Note: All analyses control for the effects of age, gender, and academic level of appointment. T1 = Time 1, T2 = Time 2; M1, M2 . . . M5 = Model 1, Model 2 . . . Model 5.
[a] The first three values for $\Delta\chi^2$ refer to differences between successive nested models. [b] The final value for $\Delta\chi^2$ refers to the difference M5–M3.
* $p < .05$; *** $p < .001$.

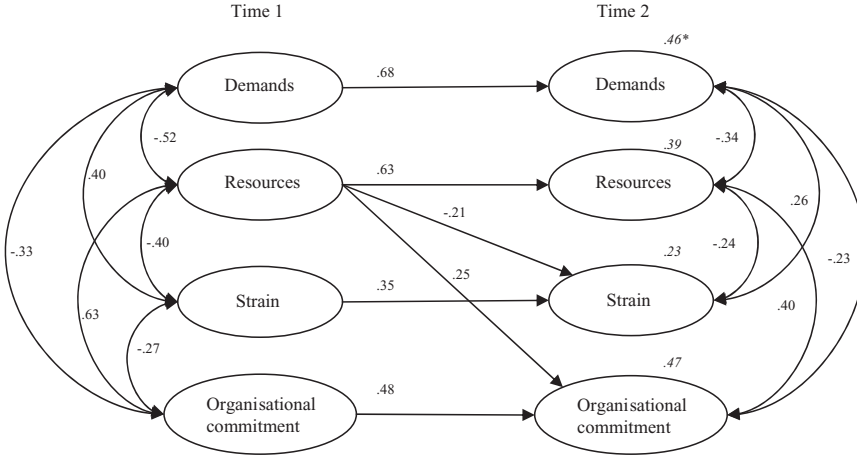

FIGURE 1. Final structural model linking Time 1 job demands and job resources to Time 2 strain and T2 organisational commitment.

Note: Only significant relationships reported ($p < .05$). * Numbers in italics refer to squared multiple correlations.

DISCUSSION

The purpose of the present study was to provide a longitudinal test of the JD-R model, using repeated measures data from a sample of Australian university academics. Both causal and reversed causal effects were tested in a reciprocal model. The results provided robust longitudinal support for the motivational pathway proposed by the model, with Time 1 resources predicting Time 2 organisational commitment, even after controlling for Time 1 levels of organisational commitment. However, the proposed health impairment pathway was only partially supported. As expected, Time 1 demands predicted Time 2 strain, but unexpectedly, its effects were wholly mediated by Time 1 resources. No evidence was found for reverse causation effects.

The results strongly underscore the importance of two job resources, procedural fairness and autonomy, for the well-being of Australian academics in this study. Indeed, this study is the first to incorporate procedural fairness as a resource in the JD-R model. While these two kinds of resources are traditionally associated with differing theoretical perspectives (i.e. the former from social exchange; Blau, 1964, and/or effort-reward imbalance; Siegrist, 1996, the latter from demand-control theory; Karasek, 1979), the results of the present study are consistent with van Prooijen's (2009) claim that the two constructs may be conceptually and empirically linked. That is, procedural

justice may be viewed as a mechanism for safeguarding autonomy, particularly when the latter is threatened, as, for example, during times of organisational change.

In the present study, it is worth noting that the first wave of data collection took place during a particularly difficult period of enterprise bargaining in the Australian higher education sector, during which academic employees' sensitivity to fairness concerning their working conditions (remuneration, opportunities for tenure and/or promotion) and to potential threats to academic freedom may have been heightened. This contextual feature may have accentuated the significance of both procedural fairness and autonomy within the study population, as well as their attendant influence on psychological strain and organisational commitment, creating effects that endured over time.

The results are consistent with prior cross-sectional research showing that, just as in other professions, job demands such as work pressure and workload contribute to psychological strain in academic staff (Kinman, 2001; Lease, 1999; McClenehan, Giles, & Mallett, 2007). A novel finding of this study, however, is the mediated relationship between demands, resources, and strain. This mediated path suggests that perceived high workload and work pressure at Time 1 fuels a sense of injustice and erodes perceptions of autonomy (also at Time 1), leading over time to increased psychological strain. This finding opens up several doors for future research. For example, Karasek and Theorell's (1990) demand-control-support model of stress suggests that control moderates the relationship between demands and strain. Our finding suggests that control in the form of autonomy, together with the fairness of procedures, mediates this relationship. Further research exploring the mediated, versus moderated, nature of these relationships is warranted.

Consistent with prior longitudinal research (e.g. de Lange et al., 2004; Dormann & Zapf, 2002), this study provided no clear evidence of reversed causal effects. Thus, despite growing interest in reversed causation processes in the stress literature, our results provide no support for either the "perceptual" or "selection/drift" perspectives. Rather, our results suggest that employee psychological strain and organisational commitment do not influence subsequent perceptions of work resources and work demands. As our study tested this relationship over a three-year period, the lack of association may be due to the long time period. Future research is required to examine whether employee mental health and commitment may influence perceived or actual work resources and demands, over a shorter period of time (e.g. 6–12 months).

Study Limitations and Suggestions for Future Research

The present study has several limitations. As previously mentioned, because of practical considerations, the lag between Time 1 and Time 2 was comparatively long, and the effects of confounding factors on the dependent

variables cannot be ruled out (e.g. actual changes to job conditions, personality factors, other life events). Generally speaking, shorter time frames are recommended (e.g. 1 or 2 years; de Lange et al., 2004; Zapf et al., 1996); however, researchers need to give careful consideration to the optimal time interval, given the focus and context of their research.

Related to this is the choice of the GHQ-12 (Goldberg & Williams, 1988) as a measure of psychological strain. Like Mäkikangas et al. (2006), we found low stability in this measure. This is perhaps not surprising, given that the GHQ captures self-perceived changes in psychological state and is therefore likely to be sensitive to changes that arise as a result of psychological responses to working conditions. Our results are consistent with Mäkikangas et al.'s suggestion that the GHQ should perhaps be regarded as an indicator of temporal mental state, rather than of long-term mental health. However, also like Mäkikangas et al., our study found factorial invariance over time, supporting their conclusion that, despite its low stability, the GHQ may nevertheless be suitable for use in longitudinal studies. Furthermore, as the design of our study included the administration of the GHQ-12 at the same time of year on both occasions, changes in GHQ-12 scores are more likely to have reflected actual changes in mental health rather than transient changes influenced by time of year or acute environmental factors.

Another possible limitation of the study is that the change in survey methodology from mail-back survey at Time 1 to online survey at Time 2 might have influenced responding, including the lower response rate at Time 2. Although it is clearly desirable to use similar methods across time and across samples, Llorens, Bakker, Schaufeli, and Salanova (2006) have reported that the JD-R model is robust across a variety of methodologies. Furthermore, two recent large-scale and multi-country studies report evidence of the measurement equivalence of paper-and-pencil and online organisational surveys (see Cole, Bedeian, & Field, 2006; De Beuckelaer & Lievens, 2009). Also, in the present study, the synchronous correlations among the variables were similar on both occasions, as were the internal reliability coefficients.

A fourth limitation of the study concerns the small proportion of the total number of Time 1 participants (around 13%) who responded at Time 2. The reasons for this low response rate are unclear, but most likely reflect a combination of turnover and mobility of academics moving between universities, and potential respondents feeling that completing the survey on one occasion was a sufficient contribution to the research. Some of the non-responders at Time 2 may also have left the profession since Time 1. However, as Time 2 responders differed from non-responders in only minor ways, selective dropout was not a major problem in the study.

With regard to future research, one clear avenue is to conduct a longitudinal investigation of the potential mediators of the relationships linking working conditions to mental health and work outcomes. Bakker and his

colleagues have already addressed the question of mediation, for example, in cross-sectional studies examining engagement and exhaustion (among others) as mediators of the relationships between job demands and resources on the one hand, and work and mental health outcomes on the other (e.g. Bakker, Demerouti, de Boer et al., 2003; Bakker et al., 2004; Schaufeli & Bakker, 2004). Hakanen et al. (2008) have examined similar questions in a longitudinal study.

Two possible mediators of the relationship between resources and work outcomes that have not yet been examined are organisational connectedness (e.g. Lewig et al., 2007) and perceived organisational support. Given the prominence of procedural fairness as a job resource in the current study, we advocate shifting the focus away from the individual's intrinsic attachment to the job (i.e. engagement) to focus on how much he or she feels valued by the organisation (i.e. connectedness, perceived support).

A third, and related, avenue for research concerns the investigation of basic need satisfaction as a motivational link between job resources and engagement. A recent cross-sectional study of Dutch workers (Van den Broeck, Vansteenkiste, De Witte, & Lens, 2008) found that, consistent with self-determination theory (Deci & Ryan, 2000), satisfaction of needs for autonomy, belongingness, and competence partially mediated the relationship between job resources (task autonomy, skill utilisation, and positive feedback) and vigor. Future research could examine the relative importance of each of these needs (and their satisfaction) as potential mediators of the resource–outcome relationship, since this might vary depending on the particular resources and context under investigation. In the present case, for example, it is conceivable that belongingness might emerge as an important mediator of the resources–commitment relationship, given the prominence of procedural fairness as an indicator of job resources. Ideally, however, three or more waves of data would be available to test mediation (e.g. Frese et al., 2007).

Practical Implications

The findings of the present study have straightforward practical implications. Given the positive and enduring effects of job resources for both staff and university management in terms of employee loyalty and commitment, and lower levels of strain, it is crucial for management and higher education unions to ensure that staff have a sense of procedural fairness and autonomy in the development and implementation of organisational policies and practices, particularly during times of organisational change. The finding that work demands have a mediated impact on psychological strain through resources further highlights the importance of unions and university management actively managing workloads and work pressure to ensure that organisational demands do not become too overwhelming.

The results suggest that management of universities can minimise psychological strain and increase organisational commitment among academics by: (1) instigating and upholding rigorous and fair human resource (HR) processes (e.g. performance appraisal, promotion, appointment and redundancy procedures); (2) creating an open climate for communication and adequately consulting staff about changes in their workplace; and (3) actively protecting and encouraging the autonomy of academics to make their own decisions, use their initiative, and function semi-autonomously from management in their day-to-day work. In some universities, effective implementation of such strategies may first require significant training and development to lift the skills and capabilities of university managers and heads of department, as well as significant investments in the HR functions.

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