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IZA DP No. 18047

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ABSTRACT

Does High Involvement Management Drive Affective Commitment? Causal Tests on System Coherence and Complementarity

An employee's affective commitment to the firm is a key driver of individual and, ultimately, firm performance. We study the role of high involvement management (HIM) practices in promoting affective commitment and ask if different components of HIM, specifically power, information, rewards, and knowledge, form a coherent management system and/or are complementary across components. Coherence implies that the components are not in conflict with or substitute for each other, i.e., adding them individually generates additional positive returns, while complementarity implies that the returns from adding one component increase with the number of other components already in place. We use detailed and unique data from a large sample of German firms and their employees and find that while HIM is a coherent management system, there are no strong complementarities across practices.

JEL Classification: D2, M1, M5, L2

Keywords: high involvement management, affective commitment, coherent management system, complementarity

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1. Introduction

Organizational and management practices are often implemented in bundles to mutually reinforce a strategic goal, e.g., cost effectiveness, innovation, or, at the individual level, an engaged workforce, a cooperative mindset and culture, and so on. Picking the right bundle of practices and implementing it successfully is a key factor in the way firms are managed (Bloom and Van Reenen, 2007; Boon et al., 2019; Mitsuhashi and Nakamura, 2022). This raises two first-order questions: *first, which management practices form part of a bundle, and second, do they affect individual and firm performance?*

To address these questions, we study the use and impact of high involvement management practices (HIM), a set of practices aimed at fostering an engaged, motivated, and self-effective workforce (Lawler, 1986). HIM consists of four components: *power, information, rewards, and knowledge,* and is targeted at individual employees' attitudes towards the firm and their work. Accordingly, we study the causal impact of HIM on overall workforce affective commitment, i.e., an "…employee's emotional attachment to, identification with, and involvement in the organization" (Meyer and Allen, 1991: 67). We ask if the four components of HIM form a coherent management system, i.e., whether they are compatible with each other instead of one component fulfilling some of the functions of another. We also ask if the components complement each other, i.e., if the returns to one component increase in the number of other components already in place.

We study German private-sector firms with 50+ employees and merge linked employer-employee data on management practices, human resources, and corporate culture with firm-level data on HIM variables and other characteristics. We estimate upper and lower bounds on the true causal effect of HIM and its components on affective commitment to see if HIM is a coherent and/or complementary management system. We find that the four components individually and jointly increase employees' affective commitment and that HIM is a coherent, but not a complementary, management system. Our results are robust to numerous sensitivity tests and alternative specifications.

We make two main contributions: first, we combine organizational psychology with organization theory to evaluate the effectiveness of HIM in promoting autonomous motivation. In our setting, we understand affective commitment to be a performance-related outcome, indicating the degree to which the interests of firms and employees are aligned (Lawler, 1986). In contrast to existing work, looking at affective commitment as an outcome variable from the perspective of a coherent management system lets us assess the value of firm-wide practices on individual attitudes.

Our second contribution is conceptual and relates to the notion of HIM as a complete and self-contained management system comprising four interdependent components. We thus respond to the criticism of the demarcation of HIM to related HR systems (Lepak et al., 2006; Böckerman, 2015; Boon et al., 2019; Boxall et al., 2019; Wood, 2020; Boxall and Huo, 2021), specifically pointing to the lack of theory-based definitions of management systems, a certain arbitrariness *within* systems with regard to the practices included, as well as overlaps in practices *between* systems.[1] Our conceptual approach and its empirical operationalization avoid overlaps with other management systems.

Methodologically, we offer one of the first robust causal estimates of the interdependencies and complementarities among management practices and employ a battery of tests for robustness. Moreover, rather than giving a (possibly misspecified) point estimate, we derive an upper and lower bound of our effect, thus providing a more cautious reading of our results.

2. High involvement management – system or collection of practices?

2.1 Self-determination theory and organizational commitment

There is a vast literature on management and HR practices and how they affect organizational performance. For example, theories of incentives traditionally resort to the extrinsic motivation of employees and to monetary rewards that can get the best performance out of a firm's workforce (Gerhart and Milkovich, 1990; Jenkins et al., 1998; Lazear, 2000; Gneezy and Rusticini, 2000; Khashabi et al., 2021). Other approaches place emphasis on different aspects of working life, for example on goals (goal-setting theory, Locke and Latham, 1990; Gorgnet et al., 2015). Naturally, depending on which behavioral and motivational assumption is the starting point, different bundles of management practices seem appropriate to reach the desired goal. Accordingly, we theorize that high involvement management (HIM) drives affective commitment based on a combination of self-determination theory (Deci and Ryan, 1985; Gagne and Deci, 2005; Deci et al., 2017) and the theory of organizational commitment (Allen and Meyer, 1990; Meyer and Allen, 1991; Meyer et al., 1993). Our argument rests on two basic assumptions: First, HIM is a management system designed to align the interests of both firms and employees. However, unlike other management systems such as high-performance work systems or 'good' management comprising management practices of monitoring, targets, and incentives (Bloom and Van Reenen, 2007), HIM is aimed at improving autonomous (intrinsic) rather than controlled (extrinsic) motivation. Second, (subjective) affective commitment predicts employee performance well because (i) it is consistent with Lawler's (1986) management philosophy of involving

[1] Prior work also distinguishes high performance work systems (Appelbaum et al., 2000; Cappelli and Neumark, 2001; Colombo et al., 2007; Frick et al., 2013), high commitment systems (Walton, 1985; Arthur 1994), human resource management systems (Huselid, 1995; McDuffie, 1995; Ichniowski et al., 1997), lean production/total quality management (Wood, 1989; Womack et al., 1990; Wruck and Jensen, 1994, 1998; Hackman and Wageman, 1995) and good/modern management (Bloom and Van Reenen, 2007, 2010; Bloom et al., 2010).

employees by satisfying their needs, and (ii) self-determination theory views affective commitment as a work outcome associated with autonomous motivation (Gagne and Deci, 2005).

Self-determination theory divides the spectrum of employee motivation into three areas: amotivation, controlled motivation, and autonomous motivation. Whether employee motivation is controlled or autonomous depends on the degree to which employees internalize an external intervention of the organization into their value system. Controlled (autonomous) motivation corresponds to a low (high) degree of internalization, with the pure form of extrinsic motivation known from agency theory and intrinsic motivation (also referred to as inherently autonomous motivation) representing opposing poles on an 'internalization continuum' (Gagne and Deci, 2005).

Since self-determination theory considers the achievement of autonomous motivation desirable, management interventions must be able to satisfy the fundamental psychological needs for autonomy, relatedness, and competence.

2.2 High involvement management (HIM)

HIM meets the needs for autonomy, relatedness, and competence in a particular way. First, similar to providing employees with autonomy, involvement policies represent measures of participation and job enrichment, meaning that jobs are qualitatively expanded by equipping employees with some decision (participation) rights in addition to their previous executive work tasks. This way, HIM meets the employees' need for autonomy. Second, employees will likely perceive the participation rights implemented in HIM as an organization's signal of recognition of their previous achievements. At the same time, employees will also perceive bonuses based on team or group performance as a sign of the organization's recognition of their skills and efforts to cooperate with their teammates and colleagues. These interventions satisfy employees' need for competence. Third, employee participation explicitly requires collaborating and cooperating with co-workers, supervisors, and probably other stakeholders such as customers or suppliers. Hence, HIM also satisfies the employees' need for relatedness.

Lawler (1986) proposes four HIM components, *power*, *information*, *rewards,* and *knowledge* (PIRK), to encourage employee involvement and participation. In all components, HIM is about fostering cooperation and collaboration in the workplace to achieve organizational goals. The *power* component describes employees' discretion and involvement in organizational decision-making, where participation rights can be exercised voluntarily or institutionalized through collective voice or codetermination. The *information* component emphasizes the importance and quality of two-way communication within and especially across hierarchical levels. The *rewards* component refers to employees' confidence that the reward for good performance is distributed equitably among organizational members. Finally, the *knowledge* component reflects the extent to which employees feel they have the training and development opportunities to get their jobs done properly (Vandenberg et al., 1999; Boxall and Winterton, 2018; Boxall et al., 2019). Fundamentally, HIM is a system of participatory management. Employees are encouraged to cooperate, work together, and support each other in the pursuit of the company's goals. The philosophy behind HIM is therefore completely different from that of a management system that incentivizes individual performance and puts employees in competition to achieve organizational goals. In line with self-determination theory, the target population of HIM consists of organizations that care for the needs of their workforce and employees who pursue organizational goals (rather than private goals) (Deci and Ryan, 1985; Gagne and Deci, 2005; Deci et al., 2017).

2.3 Coherence and complementarity of high involvement management systems

Since HIM is fully geared to the basic psychological needs arising from self-determination theory, it is natural to consider HIM as a bundle of management practices to achieve autonomous motivation and to use affective commitment as a measure closely related to autonomous motivation to evaluate its effectiveness (Gagne and Deci, 2005). The theory of organizational commitment has mainly been developed in Meyer and Allen (1991), who define affective commitment as an "… *employee's emotional attachment to, identification with, and involvement in the organization*" (p. 67).[2] Hence, affective commitment arises because employees share values with the organization (Meyer et al., 1993, 2002; Brown et al., 2011), indicating alignment with autonomous motivation, in particular its intermediate form of integrated regulation, or integrated extrinsic motivation (Gagne and Deci, 2005).

Integrated regulation describes behavior based on organizational rules or interventions incorporated into an employee's value system. External rules are thus internalized as employees' needs. HIM is typically targeted at this intermediate level of autonomous motivation, and by improving employee involvement and participation, HIM can increase loyalty to the organization, although not necessarily joy at work. Affective commitment is useful as a measure of the potential of HIM as a driver of autonomous motivation if autonomous motivation is viewed as a mechanism or channel for the effect of HIM on performance-related outcomes, as proposed by Deci et al. (2017) and Boxall et al. (2019).

To see if HIM works as a management system, we apply theories of management-system coherence (Parasuraman et al., 1988; 1991; Nath and Sudharshan, 1994; Gibbs et al., 2010) and complementarity

[2] The two remaining forms of organizational commitment according to Meyer and Allen (1991) are continuance commitment and normative commitment. Continuance commitment refers to an employee's benefits from continued participation and the costs of leaving the company. Normative commitment describes employees' sense of obligation to remain with the company (Kampkötter et al. 2016). Another theory of organizational commitment by O'Reilly and Chatman (1986) distinguishes between identification with the organization, internalization of the organization's values, and compliance as forms of organizational commitment.

(Milgrom and Roberts, 1990, 1994, 1995a, 1995b; Holmstrom and Milgrom, 1994).[3] Both assume interdependencies among organizational practices, which is the essential requirement when assessing the effectiveness of multi-component management systems such as HIM. We use system coherence and complementarity to study a non-financial performance outcome, affective commitment.

To examine whether the HIM components form a coherent system in promoting affective commitment, we formally test the *content validity* and *convergent validity* of HIM systems. Intuitively, content validity asks if the practices appear in a bundle, while convergent validity asks if the individual practices and the bundle increase performance. More precisely, content validity refers to the extent to which the HIM components are meaningful and capture the key facets of the measured construct. Content validity can be identified by looking for dominant combinations or patterns of strategies or management practices (Nath and Sudharshan, 1994; Gibbs et al., 2010). Conversely, convergent validity relates to the objective function and calls for monotonically increasing performance effects as the HIM system expands gradually (Parasuraman et al., 1988, 1991; Nath and Sudharshan, 1994). The HIM system meets the convergent validity condition of coherence if adding another HIM component to a HIM subsystem increases affective commitment. Formally, convergent validity implies:

$$F(4) > F(3) > F(2) > F(1) > F(0) \ \cap \ F(4) > 0 \, , \tag{1}$$

where the numbers in parentheses represent the number of implemented or adopted HIM components, regardless of specific compositions of the HIM subsystems, and $F(\cdot)$ refers to the effect of the respective (sub)system of HIM on affective commitment.

For multiple management practices to be considered complementary, the *constraint condition* and the *payoff condition* must be satisfied. The constraint condition requires that the adoption of a particular organizational practice in a constraint set must not prevent management from additionally adopting other organizational practices that belong to the same constraint set. For example, adopting the *power* component of HIM must not prevent managers from adopting the *information* component. The payoff condition refers to the objective function (Milgrom and Roberts, 1995a), which, in our case, is a function of the determinants of affective commitment. The payoff condition requires that the (incremental) payoff to adopting two or more HIM components simultaneously or in a coordinated manner must be higher (strong complementarity) or at least not lower (weak complementarity) than the sum of the (incremental) payoffs from adopting each HIM component in isolation. Thus, the payoff condition requires that the marginal returns on affective commitment to implementing one HIM component are increasing (or at least not decreasing) in the level of the other components.

[3] Brynjolfsson and Milgrom (2013) provide an excellent survey on complementarities in organizations. Moreover, Burdin and Kato (2022) focus on complementarity in employee participation systems in their survey article.

The *cube view of complementarities* between multiple ($n > 2$) management practices, (Aral et al., 2012; Tambe et al., 2012; Brynjolfsson and Milgrom, 2013) explicitly considers the pairwise existence of complementarities and can easily be extended to systems with more than three management practices, such as the HIM system. The cube view requires that the commitment effect of one specific HIM component to an existing subsystem of HIM components must be greater (strong complementarities) or at least not less (weak complementarities) than the corresponding commitment effect of an isolated implementation for this component to be considered complementary to the other HIM components. Regardless of specific sequences or orders in which the HIM components are composed, the strong payoff condition can be written in a general form as

$$F(4) > F(3) + F(1)\,. \qquad (2)$$

This means that adding the missing fourth HIM component to any of the three-component subsystems increases affective commitment more than implementing this HIM component in isolation. Testing condition (2) thus constitutes a simple formal test for complementarities.[4]

3. Data and variables

We first describe our linked employer-employee data set and introduce the dependent and explanatory variables of our empirical analysis, i.e., affective commitment as well as the HIM variables and components. Our control variables are described in Section 3.2.2.

3.1 Datasets

We use large-scale, linked employer-employee panel data from German private-sector firms and their employees. The first data set is the Linked Personnel Panel (LPP), a linked employer-employee panel dataset comprising four waves covering the years 2012 through 2019. Each of the four waves contains two surveys, one for the firms and one for their employees. The LPP is representative of medium-sized and large firms (at least 50 employees subject to social insurance contributions) in Germany and their employees.[5] The LPP contains detailed information on staff recruiting, personnel development,

[4] With condition (2), we deviate from the conventional procedure of testing for complementarities in the cube view. According to the cube view, interaction terms are formed for each HIM (sub)system. Illustrated by the example of the *knowledge* component (K) in the PIRK system (compare Section 4.2), the payoff condition can then be written as $F(1{,}1{,}1{,}1) > F(1{,}1{,}1{,}0) + F(0{,}0{,}0{,}1)$, where 1 (0) represents the adoption (non-adoption) of a particular component, and $F(\cdot)$ refers to the commitment effect of the entire HIM system (P, I, R, K), the subsystem (P, I, R), or the component (K). Estimating models with such a large number of interaction terms creates collinearity, and the more components the management system has, the greater the risk of collinearity. This is why we run a complementarities test to test condition (2). We estimate an interaction-term model based on the cube view of complementarities as a robustness check in Section A.5 in the Online Appendix.

[5] Note that the LPP surveys establishments. For simplicity, we use the term firms when talking about establishment-level data.

compensation structure, corporate culture, digitization, as well as employee retention and satisfaction. We link this dataset with the IAB Establishment Panel (IABEP), which the LPP surveys directly build on. The IABEP is an annual panel survey with firm characteristics on a wide range of topics, including HIM.[6]

Our large-scale linked employer-employee panel dataset lets us address a wide range of methodological issues regarding the endogeneity of the HIM measures that cannot be convincingly addressed with cross-sectional observational data. Second, linking three data sources and using the information provided by multiple firm representatives (general and HR managers) and employees avoids common method bias (Podsakoff and Organ, 1986; Antonakis et al., 2010).[7] While employee-level data can generate meaningful measures of affective commitment, information from (HR) managers generates our explanatory variables on HIM components and their practices. This multiple-source approach lets us obtain the necessary information from the most knowledgeable respondents.

3.2 Measuring high involvement management (HIM)

The HIM system rests on a management philosophy centered around employee involvement (Wood, 2020). The selection of practices for the HIM system is based on this management philosophy. However, HIM is not always clearly differentiated from other management systems in the literature, leading to overlaps or misattribution of HR practices to HIM, for example, pay for individual performance, relative performance evaluations, promotion tournaments, or staff recruiting/selection. These HR practices tend to promote competition among co-workers and controlled motivation rather than involvement and autonomous motivation, inconsistent with the HIM approach (Appelbaum et al., 2000; Wood and de Menezes, 2011; Peutere et al., 2022). While HIM does not rule out monetary incentives, the focus is on incentives that stimulate collaboration and cooperation.

In contrast to Boxall et al. (2019), who use employee perceptions of the four PIRK components (*power, information, rewards, knowledge*), we apply firm-level information about actual HIM practices for several reasons. First, employees may not be able to fully evaluate firm-wide HIM practices (Boon et al., 2019). Further, using firm-level information on HIM practices helps us to avoid the common-method bias since the dependent (employee affective commitment) and independent variables are from different sources. Finally, focusing on actual implemented HIM practices ensures consistency across practices (Boon et al., 2019; Wood, 2020).

As HIM systems are designed to develop synergies within and between components, managers can only create a coherent or complementary management system if they see independencies and

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[6] For detailed information about the LPP data, see Broszeit and Wolter (2015) and Ruf et al. (2020), while detailed information about the data of the IABEP is in Fischer et al. (2009).

[7] We are only aware of Bryson and White (2019) who explicitly address common method bias in HIM practices.

synergies among management practices. We thus build the four HIM components, *power*, *information*, *knowledge*, and *rewards*, referred to as *PIRK*, as described in the following sections. Interdependencies between individual HIM practices and components mean that some individual practices cannot be clearly assigned a single HIM component. We therefore assign certain HIM practices to a specific HIM component based on theoretical considerations (Boon et al., 2019; Boxall et al., 2019).

3.2.1 Power

We operationalize the *power* component by using three binary variables expressing employee autonomy or participation in business decisions, including collective voice. The first variable, WC, represents codetermination in a firm, which indicates the presence of works councils as an institutionalized form of collective voice. Second, RT, indicates the existence of a voluntary and firm-specific form of employee representation, such as staff spokespersons or round tables. Since both practices can be viewed as substitutes, we define a dummy variable, WC_RT, indicating firms that make use of at least one of the two practices, enabling employee participation and voice (Lawler, 1986; Lawler et al., 1998; Macky and Boxall, 2007; Boxall et al., 2015). A second variable entering the *power* component of HIM captures the degree of collaboration and cooperation among employees in the workplace ($TEAM$). This variable is based on two ordinally scaled variables providing information on the interdependencies between workplaces in the individual firms and captures the essence of working in teams.[8] Finally, $SMWT$ indicates the existence of self-managed working time arrangements in firms. Self-managed working time (also referred to as trust-based working time, e.g., Viete and Erdsieck, 2020) grants employees autonomy over their working time, providing employees with control over their work (Beckmann, 2016; Beckmann et al., 2017). To combine this information into a single variable, we apply the double-z-score or double-standardization approach (Bresnahan et al., 2002; Bloom et al., 2011), i.e.,

$$HIM_{jt}^{P} = STD\{STD(WC\_RT_{jt}) + STD(TEAM_{jt}) + STD(SMWT_{jt})\},$$

where j indexes firms and t panel waves. By construction, HIM_{jt}^{P} has zero mean and unit variance.

3.2.2 Information

We operationalize the *information* component of Lawler's (1986) PIRK framework through a set of dummy variables indicating the firms' use of appraisal and feedback interviews (AFI), management by

[8] The first (second) variable captures an employee's extent of approval to the statement "*Other jobs depend directly on my job.*" ("*The job depends on the work of many different people for its completion.*"). Both variables range between 0 (does not apply at all) and 4 (fully applies). To construct the variable $TEAM$, we add both scores. The original variables are from the employee survey of the LPP. To generate a firm-level variable, we use the average level of interdependencies between employees of all respondents per establishment and year.

objectives (MBO), employee opinion surveys (EOS), and personnel development plans (PDP). All these practices require some two-way communication across hierarchical layers, i.e., between employees and their superiors. Hence, the common and indispensable feature of all practices is both a top-down (i.e., from superiors to employees) and a bottom-up (i.e., from employees to superiors) transfer of information (Boxall et al., 2015). The information transmitted will then include details on individual performance and perspectives (AFI), on agreed goals and mutual expectations (MBO), on the mood and working atmosphere within the organization (EOS), and on personal development and career planning (PDP). The resulting composite variable is generated as

$$HIM_{jt}^{I} = STD\{STD(AFI_{jt}) + STD(MBO_{jt}) + STD(EOS_{jt}) + STD(PDP_{jt})\},$$

where, again, HIM_{jt}^{I} has zero mean and unit variance by construction.

3.2.3 Rewards

To adequately map the involvement philosophy of HIM, the *rewards* component comprises remuneration practices encouraging cooperation and collaboration among employees. These practices include incentive pay with collective performance indicators such as performance pay based on team or group outcomes (Kretschmer and Puranam, 2008). Collective performance pay incentivizes cooperation and collaboration by signaling the company's willingness to let its employees participate in business decisions and success (Wood and de Menezes, 2011). We deliberately do not add measures of individual performance pay to our *rewards* variable as we consider individual performance pay at odds with the idea of employee involvement (Beer et al., 1984; Walton, 1985; Lawler, 1991; Wood and de Menezes, 2011; Böckerman et al., 2013). Hence, our *rewards* component is:

$$HIM_{jt}^{R} = STD\{STD(TEAM\_PFP_{jt}^{M}) + STD(TEAM\_PFP_{jt}^{NM})\},$$

where $TEAM\_PFP^{h}$ ($h = M, NM$) represents the percentages of the average team or group bonus for managerial (M) and non-managerial (NM) employees based on total variable remuneration, setting cases with no variable remuneration to zero. As before, HIM_{jt}^{R} has zero mean and unit variance.

3.2.4 Knowledge

Finally, the *knowledge* component is constructed from three variables. The first is the number of employees participating in further training measures during the first six months of the survey year ($\#FT$). The remaining ones are binary variables indicating the existence or application of job rotation (JR) and quality circles (QC). Both job rotation and quality circles are practices of job design aimed at enlarging (job rotation) or enriching (quality circles) workers' competencies in the form of learning-by-doing or on-the-job learning. Training and skill development are necessary for employees to participate effectively in firm affairs (Boxall and Macky, 2014). Lawler (1986) links the *knowledge* component with the other HIM components, stating that involved employees have a great responsibility, which requires them to develop both technical and "*… thinking skills because they need to plan work, schedule work, and decide on work methods*" (p. 90; see also Boxall et al., 2015). Our *knowledge* variable is thus:

$$HIM_{jt}^{K} = STD\{STD(\#FT_{jt}) + STD(JR_{jt}) + STD(QC_{jt})\}.$$

Just like the other HIM components, HIM_{jt}^{K} has zero mean and unit variance by construction.

3.3 Measuring affective commitment

Affective commitment is the employees' loyalty or identification with the goals and values of their organization. We use six items of the employee survey of the LPP, where the interviewed employees are requested to provide their degree of individual approval to the following six statements (Meyer et al., 1993):[9] (i) I would be very happy to spend the rest of my career with this organization (AC^1); (ii) This organization has a great deal of personal meaning for me (AC^2); (iii) I really feel as if this organization's problems are my own (AC^3); (iv) I do not feel a strong sense of 'belonging' to my organization (AC^4); (v) I do not feel 'emotionally attached' to this organization (AC^5); (vi) I do not feel like 'part of the family' at my organization (AC^6). The degree of individual approval is measured on an ordinal scale ranging from 1 (does not apply at all) to 5 (applies completely). After reverse-coding the latter three statements, we construct a double-standardized index variable representing the perceived individual amount of affective commitment, i.e.,

$$AC_{ijt} = STD\{STD(AC_{ijt}^1) + STD(AC_{ijt}^2) + STD(AC_{ijt}^3) + STD(AC_{ijt}^4) + STD(AC_{ijt}^5) + STD(AC_{ijt}^6)\}.$$

AC_{ijt} has zero mean and unit variance. Higher values of AC_{ijt} represent higher degrees of employee's i perceived affective commitment. In addition to the theoretical relevance of affective commitment as a performance measure, perceptual and evaluative measures such as affective commitment matter because ultimately, the perception of an HIM system within the workforce determines its success.

4. Identification strategy

We first test the two *necessary* conditions of system coherence and complementarity, i.e., the content validity condition and the constraint condition, in Section 4.1. We then test the convergent condition of management-system coherence and the payoff condition in Section 4.2. Both conditions refer to

[9] The items are from the affective commitment short scale (Meyer et al., 1993). For details, see Kampkötter et al. (2016). Addison and Teixeira (2024) recently constructed an alternative index of worker commitment based on firm perceptions regarding worker motivation as well as worker retention and absenteeism propensities.

the objective function and can thus be described as *sufficient* conditions. Empirically, it is important that both sufficient conditions entail a causal relationship between HIM and affective commitment.

4.1 Testing the content validity condition and the constraint condition

4.1.1 Content validity condition

We test for content validity of system coherence by checking for dominant combinations or patterns of HIM components (Nath and Sudharshan, 1994; Gibbs et al., 2010). We define a dominant pattern of HIM components as a combination observed more frequently in reality than suggested by chance. For example, to determine the theoretically predicted value for the PIRK combination, the shares of all four components must first be multiplied. The result is the theoretical probability for the incidence of the PIRK combination if the PIRK components were statistically independent. If the actual or observed incidence of the PIRK combination is higher than this predicted incidence, there are interdependencies between components, and the PIRK combination can be said to be dominant. The test results for the content validity condition are reported in Table 1 in Section 5.1.1.

4.1.2 Constraint condition

Statistically, the constraint condition requires positive or at least non-negative correlations between management practices belonging to the same constraint set. This is why the constraint condition is often also referred to as the *correlation condition* (Athey and Stern, 1998). We test the constraint condition of complementarity in three steps. We first calculate the unconditional correlation coefficients between the management practices entering each of the four components of HIM. We then determine the unconditional correlation coefficients between the four components of HIM. Finally, we estimate conditional correlations between the four HIM components using regressions. Specifically, we run conventional pooled ordinary least squares (POLS) regressions, where we regress one of the HIM components on the remaining components and a set of controls, i.e.,

$$HIM_{jt}^{k} = \alpha' HIM_{jt}^{l \neq k} + \beta' X_{ijt} + \delta' Z_{jt} + \nu_t + \varepsilon_{ijt} \,. \qquad (3)$$

Here, HIM_{jt}^{k} ($k \in \{P, I, R, K\}$) represents one of the four HIM components in firm j at time t, whereas $HIM_{jt}^{l \neq k}$ is a matrix that includes the other three HIM components. Further, X is a matrix of employee-level covariates, while Z is a matrix of firm-level covariates. The covariates included in X and Z are discussed in Section 4.2.2. The term ν_t represents time fixed effects captured by a series of time dummy variables, and ε_{ijt} is an idiosyncratic error term with mean zero and finite variance. Finally, α, β, and δ are the parameter vectors to be estimated, where α is the parameter vector of interest. The correlation condition is satisfied if none of the correlation coefficients is negative and statistically significant and if $\alpha \geq 0$ in equation (3), without the need for causal inference. The test results for the correlation condition are shown in Tables 3, 4, and 5 in Section 5.2.

4.2 Testing the convergent validity condition and the payoff condition

To test the convergent validity condition of management-system coherence and the payoff condition of complementarities, we explicitly account for the endogenous nature of the HIM practices and components. We gradually expand the HIM system from one to all four components and estimate the effect of each incomplete and complete HIM system on affective commitment. To do this, we construct binary variables P, I, R, and K for each of the four standardized HIM components HIM^P, HIM^I, HIM^R and HIM^K defined in Section 3.2. This binarization allows us to separate firms with strong use of a specific HIM component (adopters) from firms with low use of this specific HIM component (non-adopters). The threshold separating adopters from non-adopters of a particular HIM component is the zero mean of the respective standardized variable.[10]

To assess if the HIM components constitute a coherent or complementary management system, we construct four hierarchical HIM (sub)system variables as follows: $HIM^1 = 1$ if $P + I + R + K = 1$, $HIM^2 = 1$ if the sum of the PIRK dummies equals 2, $HIM^3 = 1$ if the sum of the PIRK dummies equals 3, and $HIM^4 = 1$ if the sum of the PIRK dummies equals 4, i.e., the firm has adopted each of the four HIM components. To interpret the effects of these variables as causal HIM effects on affective commitment, we address various endogeneity issues related to our HIM variables in our regressions.

4.2.1 Accounting for time-invariant omitted variables and reverse causation

Time-invariant unobserved heterogeneity can lead to omitted variable bias, for example individual preferences, unobserved personality traits, and abilities. To account for time-constant unobserved heterogeneity, we estimate an individual fixed effects (FE) model of the form

$$AC_{ijt} = \sum_{l=1}^{4} \alpha_l^{FE}\, HIM_{jt}^l + \beta^{FE\prime} X_{ijt}^{FE} + \delta^{FE\prime} Z_{jt} + \mu_i + \nu_t + \varepsilon_{ijt}^{FE}\,, \tag{4}$$

where HIM^l represents the four binary (sub)system variables defined above. X^{FE} includes only the time-varying variables of X, but not the time-constant variables. The parameter μ_i is an unobserved individual fixed effect, while α_l^{FE}, β^{FE}, and δ^{FE} are the parameters to be estimated, with α_l^{FE} being

[10] This approach is inspired by Ichniowski et al. (1997) on the productivity effects of human resource management (HRM) systems in U.S. steel finishing lines, as well as Kato and Morishima (2002) and Jones et al. (2017) on the productivity effects of participatory employment practices belonging to HIM. Ichniowski et al. (1997) classify four hierarchical categories of HRM systems ranging from a traditional (tayloristic) HRM system to an innovative HRM system that incorporates modern HRM practices. Kato and Morishima (2002) and Jones et al. (2017) also define their system dummies measuring different intensities of employee participation.

the four parameters of interest. The parameter estimates of α_l^{FE} are interpreted relative to the excluded reference group, the group of firms that have not implemented any of the four HIM components. The notation of the remaining variables and parameters is analogous to equation (3). The identifying assumption of the FE model (4) is that any kind of unobserved heterogeneity is time-invariant. In this case, causal effects of HIM^1, HIM^2, HIM^3, and HIM^4 on AC can be obtained by estimating equation (4) using the fixed effects within estimator.

A further source of endogeneity is simultaneous or reverse causation. Firms may adopt HIM practices if their employees already exhibit a certain degree of affective commitment, so HIM^1, HIM^2, HIM^3, and HIM^4 are determined by AC. We account for simultaneous or reverse causation by specifying a lagged dependent variable (LDV) model:

$$AC_{ijt} = \gamma^{LDV} AC_{ijt-1} + \sum_{l=1}^{4} \alpha_l^{LDV} HIM_{jt}^l + \beta^{LDV'} X_{ijt}^{LDV} + \delta^{LDV'} Z_{jt} + \nu_t + \varepsilon_{ijt}^{LDV} , \qquad (5)$$

where γ^{LDV} is the coefficient to be estimated for the LDV, i.e., AC_{ijt-1}, $X^{LDV} = X$, and α_l^{LDV}, β^{LDV}, and δ^{LDV} are the parameters to be estimated, with α_l^{LDV} representing the four parameters of interest. The identifying conditional independence assumption of the LDV model (5) is that time-varying unobserved characteristics can be captured by the included LDV AC_{ijt-1}.

According to Angrist and Pischke (2009, pp. 243-247), endogeneity issues caused by time-constant unobserved heterogeneity and simultaneous causation can be tackled separately by estimating the individual FE model (4) and the LDV model (5). The parameter estimates $\hat{\alpha}_l^{FE}$ and $\hat{\alpha}_l^{LDV}$, $(l = 1, \dots, 4)$, can be interpreted by using the bracketing property of models (4) and (5). This property means that if the true data-generating process follows either the FE model (4) or the LDV model (5), the causal effect lies somewhere in between the parameter estimates of the two models.[11] Specifically, if the conditional independence assumption for the LDV model (5) is correct, $\hat{\alpha}_l^{FE}$ tends to overestimate the true causal effect α_l. However, if the conditional independence assumption for the FE model (4) is correct, $\hat{\alpha}_l^{LDV}$ tends to underestimate α_l (Angrist and Pischke, 2009, pp. 245-246; Ding and Li, 2019). Hence, $\hat{\alpha}_l^{LDV}$ and $\hat{\alpha}_l^{FE}$ bracket the causal effect of interest, i.e., $\alpha_l \in [\hat{\alpha}_l^{LDV}, \hat{\alpha}_l^{FE}]\ \forall\ l = 1, \dots, 4$. Moreover, the dummy variables specification of HIM^l allows us to detect potential non-linearities in effect sizes, which is often not possible in other HIM studies (Boxall et al., 2019; Wood, 2020).

[11] Falk et al. (2018), Kampkötter and Sliwka (2018), and Beckmann and Kräkel (2022) also apply the bracketing-property approach to identify cause-and-effect relationships.

Building on condition (1), the convergent validity condition of management-system coherence is satisfied if $\alpha_4 \geq \alpha_3 \geq \alpha_2 \geq \alpha_1$ and $\alpha_4 > 0$ is obtained in equations (4) and (5).[12] Correspondingly, the payoff condition of complementarities (2) is satisfied if $\alpha_4 > \alpha_3 + \alpha_1$ (compare Section 2.3). The estimates for α_l^{FE} and α_l^{LDV} are displayed in Table 2 in Section 5.1.2.

4.2.2 Accounting for omitted selection via selection on observables

Given that the LPP only surveys employees who stayed with their current firm throughout the observation period, our FE model displayed in equation (4) not only accounts for individual fixed effects but also for firm fixed effects.[13] However, our FE approach cannot account for time-varying omitted variables. Likewise, AC_{ijt-1} in equation (5) may not capture all relevant omitted variables. To address potential concerns with regard to unobserved time-varying confounders, we exploit the richness of our data set to implement a selection-on-observables approach.

Self-selection biases would occur if employees selected into certain HIM practices. For example, employees with pronounced preferences for autonomous work are especially likely to select into jobs and firms where HIM practices play an important role. Further, non-random assignment would occur if firms systematically assigned employees to certain HIM practices. For example, firms are more likely to delegate HIM measures to agreeable workers with high autonomy preferences than to less agreeable workers. Since these personality traits and preferences are time-invariant, they are captured by the individual fixed effect μ_i in model (4), whereas we need to control for them in the LDV model (5) to account for time-constant selection bias. Finally, firm-specific selection would occur if certain organizational characteristics induced firms to adopt HIM. Thus, we use a set of firm-level covariates, described in more detail below, to capture the selection of firms regarding the adoption of HIM.

The matrix of covariates X^{LDV} contains a wide range of time-invariant personality traits that help mitigate or even eliminate selection bias, including the degree of extroversion, conscientiousness, neuroticism, openness, agreeableness (Big Five), trust, injustice sensitivity, and risk tolerance. By including this comprehensive set of personality traits, we capture a large part of selection into different HIM systems, which other datasets without these personality traits would not have permitted.

Related studies estimating the impact of HIM on performance, wage, motivational, or health outcomes (e.g., Brown et al., 2011; Böckerman et al., 2011, 2012, 2013; Boxall and Macky, 2014; Wood and de Menezes, 2011; Peutere et al., 2022) control for individual socio-demographic characteristics. Hence,

[12] Condition (1) is formulated more strictly with the '>' characters. The '≥' signs are intended to symbolize that the requirement of monotonically increasing HIM effects on affective commitment also permits statistically insignificant increases, which would not be unusual if the growth was concave.

[13] This data peculiarity owes to the fact that in each data wave, the surveyed employees are randomly drawn from the firms surveyed beforehand.

we add controls for age, sex, education, nationality, and the existence of children under 14 years in the household to our set of covariates. Age is a proxy for tenure with the current organization, as tenure with a firm is positively associated with exposure to HIM (Böckerman et al., 2013).

We also add job-related characteristics to X^{FE} and X^{LDV}, including managerial responsibility, white/blue collar job, contractual working time, and extra hours. Böckerman et al. (2012) show that HIM is negatively related to employee well-being due to increasing work intensification. Including these controls rules out some alternative explanations and enables more precise parameter estimates.

To capture the process of firms adopting HIM deliberately, the matrix Z comprises extensive firm-level information. First, we address the firm's business environment as firms face changes in internationalization, technology, and regulation. The more volatile the environment, the more problem-solving capabilities and decision-making authorities are needed by all employees, including those at lower hierarchical levels (Appelbaum et al., 2000; Teece, 2011; Boxall et al., 2015). Hence, we include measures of perceived competitive pressure, the technical status of the firm, and its export activities in Z. To control for regulation issues, we also include measures of firm ownership, the degree of legal and economic independence of an establishment (independent or part of a company), and a dummy indicating whether a firm is bound to a collective wage agreement with a union. With respect to legal and economic independence, Böckerman et al. (2013) argue that multi-establishment firms are more likely to be exposed to HIM than single-establishment firms.

Moreover, larger firms are more likely to use management systems such as HIM. Organizational size may affect the way in which firms benefit from HIM (Böckerman et al., 2013; Kauhanen, 2009; DeVaro and Kurtulus, 2006; Wood and Bryson, 2009; Peutere et al., 2022). In addition, manufacturing firms may benefit more than in the service sector because manufacturing firms depend especially on employees' abilities to adapt to changes in the physical environment (Combs et al., 2006; Peutere et al., 2022). We thus add a series of firm-size and sector dummies to the set of covariates.

The composition of the workforce also affects the benefits of adopting HIM. In particular, skilled employees largely determine the implementation quality of HIM and the productivity effects of HIM (Peutere et al., 2022). Our firm-level data set contains detailed information on workforce composition, hence Z includes the shares of employees by level of education, gender, working time (part-time or full-time), and contract type (fixed-term, marginal, temporary agency, and regular contract workers, apprentices, and freelancers).

Finally, Z includes further firm-level characteristics on leadership, firm age, regional affiliation, and whether the firm experienced recruitment problems. We also include dummy variables capturing the different survey modes and potential time trends (time fixed effects).

Overall, our choice of covariates is theoretically motivated. In Section A.4 of the Online Appendix, we check the robustness of this theory-based approach by applying a data-based method that selects the true and potential confounders. Nevertheless, in our theory-based selection of observable confounders, we also pay attention to correlations with the explanatory HIM variables and/or the outcome variable on affective commitment (Imbens, 2004; Austin, 2011; Li, 2013; Narita et al., 2023). We also test our set of controls for overfitting our FE and LDV models (Wooldridge, 2005) as well as the use of bad controls (Angrist and Pischke, 2009; Cinelli et al., 2024). Table A1 in the Online Appendix gives descriptive statistics for all variables used.

4.2.3 Accounting for common method bias

Studies based on observational (survey) data may be subject to common method bias when dependent and independent variables are collected using the same method and data source (Podsakoff and Organ, 1986; Antonakis et al., 2010) and build on individual and subjective responses. Common method bias can artificially inflate the estimated relationships (Jordan and Troth, 2020).

Recall that our dependent variable on affective commitment, AC, is measured at the employee level, while our main explanatory variables, i.e., HIM^1, HIM^2, HIM^3, and HIM^4, are measured on the firm level. Selecting the core variables from two different surveys answered by different individuals helps us avoid common method bias, even though our dependent variable AC is based on employee perceptions. Further, since the employee survey always takes place in the year following the firm survey, our linked employer-employee data ensures that the time-shifted sequence of dependent and explanatory variables is maintained (Bryson and White, 2019).

5. Estimation results

Our two main questions are (i) if the four HIM components constitute a coherent management system and (ii) if they are complementary in determining affective commitment. To answer these questions, we first empirically test whether the four HIM components satisfy the conditions for a coherent management system (Section 5.1). We then test the existence of complementarity effects between the HIM components with regard to their impact on affective commitment (Section 5.2).

5.1 Do the HIM components form a coherent management system?

5.1.1 Results for the content validity condition

We test the content validity condition by means of the binary HIM components P, I, R, and K. Table 1 contains the relevant descriptive statistics.

*** INSERT TABLE 1 AROUND HERE ***

The upper panel of Table 1 shows the incidence of each of the four HIM components, i.e., the probability of the respective HIM component being present in a randomly chosen firm. The $Predicted$-column displays the predicted probabilities of all HIM subsystems and the complete HIM system under the assumption that the HIM components are statistically independent of each other. In this case, the predicted probabilities simply result from the multiplication of the probabilities in the upper panel of Table 1. In contrast, the $Observed$-column indicates the actual occurrence of all subsystems and the complete HIM system as observed in the data. These actual incidences can be calculated from the respective two-, three-, and four-way interaction terms.

The complete HIM system and all subsystems satisfy the content validity condition of system coherence if the ratio $Observed/Predicted > 1$, meaning that we observe the HIM (sub)systems more frequently than random draws would suggest. This holds for all HIM subsystems and the complete HIM system. Most importantly, the observed probability of the complete HIM system is almost double the corresponding predicted probability. The content validity condition of system coherence is a necessary but not sufficient condition for management-system coherence. We now discuss the (sufficient) convergent validity condition.

5.1.2 Results for the convergent validity condition

We gradually expand the HIM system from one to all four components and estimate the effect of each HIM (sub)system on affective commitment according to equations (4) and (5). Estimation results for α_l^{FE} and α_l^{LDV} are in Table 2.[14]

*** INSERT TABLE 2 AROUND HERE ***

Our results are consistent with the convergent validity condition. The estimated coefficients in both the FE and the LDV model are positive and show monotonically increasing commitment effects until the full HIM system is completed. As expected, the effect sizes of the FE estimates are larger than those of the corresponding LDV estimates. Since both the upper-bound FE and the lower-bound LDV estimates are statistically significant (except for α_1^{LDV}), the true causal effect is also statistically significant. Figure 1 illustrates our results graphically.

*** INSERT FIGURE 1 AROUND HERE ***

[14] We use the same sample for all estimation models, meaning that we lose panel wave 1 because we need to include the LDV as a regressor variable in our estimation models. Table A4 in the Online Appendix contains the complete regression results for the specifications in Table 2.

Overall, the complete four-component HIM system are a coherent management system if the data-generating process follows the FE model or the LDV model, or a mix of the two.

5.2 Are the HIM components complementary in determining affective commitment?

5.2.1 Results for the constraint condition

The constraint condition of complementarity is satisfied if the unconditional and conditional correlations within and across HIM components are positive or at least non-negative. We first calculate unconditional pairwise correlation coefficients within each of the four HIM components, which are displayed in Table 3. As expected, the unconditional correlation coefficients for the management practices constituting the four HIM components are positive and mostly highly significant.

*** INSERT TABLE 3 AROUND HERE ***

Table 4 shows the unconditional correlation coefficients across the four HIM components.

*** INSERT TABLE 4 AROUND HERE ***

Most correlation coefficients are positive and statistically significant at the 1 percent level, clearly in line with the constraint condition of complementarities.

Table 5 reports the results from the pooled OLS (POLS) estimations of equation (3). The estimates provide information about the conditional correlations between the four HIM components. To meet the demands of the constraint condition, we need to rotate the dependent and main explanatory variables. Our results broadly confirm the constraint condition. None of the POLS coefficients is significantly negative. Most strikingly, the *information* component (HIM^I) is positively and significantly correlated with all other HIM components.

*** INSERT TABLE 5 AROUND HERE ***

5.2.2 Results for the payoff condition

The estimates in Table 2 (see Section 5.1.2) are also informative about the second complementarity condition, i.e., the payoff condition (2), which is satisfied if $\alpha_4 > \alpha_3 + \alpha_1$. We find that neither our FE nor the LDV estimates support this inequality. Therefore, we conclude that we cannot find strong complementarities between the HIM components in determining affective commitment. In Section A.5 of the Online Appendix, we conduct an alternative estimation approach to test the payoff condition of complementarities based on the methodology applied in Aral et al. (2012) and Tambe et al. (2012).

5.3 Robustness checks and supplemental analyses

We ran several sensitivity analyses to check the robustness of our FE and LDV estimates to focus on the convergent validity condition of system coherence, because in our main analysis, we only found evidence for system coherence, but not complementarity. First, we check if our coherence results change when we allow for first-order serial correlation in the error terms. Second, we discuss whether the downward bias typically found when estimating the parameters of the contemporary independent variables in LDV models, including HIM^1, HIM^2, HIM^3 and HIM^4, affects the reliability of our LDV estimates for the lower bound of our causal effect. Third, to substantiate the bracketing property approach, we estimate an alternative lower bound specifying a combined FE-LDV model that includes both fixed effects and a lagged dependent variable (Demetrescu et al., 2025). Fourth, we replace our theory-based approach of selecting covariates with a data-driven approach in which the covariates for our FE and LDV models are selected from double-selection lasso (least absolute shrinkage and selection operator) linear regressions, where lassos are used to select the relevant observed confounders from the original control variables included in X^{FE}, X^{LDV}, and Z. All these robustness checks are described and discussed in Sections A1 to A4 in the Online Appendix. Finally, we specify a four-way interaction-term model based on the cube view of complementarity (A5 in the Online Appendix).

Our results are robust to all these sensitivity checks, as shown in Table A1 in the Online Appendix. The fact that even our most conservative estimates are positive and statistically significant makes us confident that the 'true' causal effects of the HIM system on affective commitment are indeed positive and that HIM indeed forms a coherent management system. Interestingly, we do not see a "too-much-of-a-good-thing effect" (TMGT effect) (Pierce and Aguinis, 2013), where the performance effects of a management system initially increase with each additional implementation of an organizational practice, but then reach a context-specific turning point after which performance declines. Our analyses do not reveal such an inverted U-shaped pattern of the HIM effects on affective commitment; rather, we find that HIM is most effective when a company implements all four components.

6. Discussion

6.1 Comparison with other studies

Our results complement studies that describe consistent HIM systems but do not explicitly link them to Lawler's (1986) concept of four HIM components (Kato and Morishima, 2002; Jones et al., 2010; 2017; Böckerman et al., 2011, 2012, 2013; Gomez et al., 2019). We also add to work that considers complementarities between individual HIM components without formal tests (Kato and Morishima, 2002; Jones et al., 2010; Gomez et al., 2019). Moreover, our findings supplement studies such as

Appelbaum et al. (2000), Böckerman et al. (2011, 2012, 2013), Boxall and Macky (2014), Brown et al. (2011), Peutere et al. (2022), Vandenberg et al. (1999), as well as Wood and de Menezes (2011), who show that HIM can benefit both employees and firms. Employees may benefit from HIM because they may prefer employee involvement and the stimulation of autonomous motivation over a competitive work environment designed to promote controlled motivation, and because the cost of employee effort may decrease when HIM increases their commitment to the organization (Akerlof and Kranton, 2005; Brown et al., 2011; Green, 2008). In turn, firms may benefit from promoting affective commitment through investments in HIM because committed employees may provide higher effort, have a weaker bargaining position and fewer outside options, and ultimately experience lower wage growth than employees with less emotional identification (Kampkötter et al., 2021).[15] In addition, commitment and loyalty to the organization are positively associated with higher levels of organizational performance (Brown et al., 2011; Addison and Teixeira, 2024). Finally, firms can reduce extrinsic incentives in the presence of autonomous or intrinsic motivation (Cassar and Meier, 2018; Cassar, 2019; Beckmann and Kräkel, 2022), which is reflected by affective commitment in our paper. Reducing extrinsic incentives is beneficial for organizations as they are usually not only costly (Lazear, 2000) but can be gamed (Corgnet et al., 2019). Thus, as HIM promotes affective commitment by providing incentives for cooperation and collaboration, which in turn increases autonomous motivation, HIM helps align firm and employee interests, which reduces overall costs to organizations.

6.2 Limitations

Our empirical analysis has some limitations. First, by focusing on the HIM effects on affective commitment as an attitudinal outcome of employee performance, we do not speak to the costs and financial benefits of adopting HIM practices or components. This is in line with most work on the impact of HR systems that focuses on their potential benefits, but it would be enlightening to consider the cost side too. Cost could take on two meanings in this context: The monetary cost of implementing PIRK practices, but arguably even more interestingly, the cost in terms of attitudinal changes across a possibly heterogeneous workforce. Put simply, not all employees react the same to a HIM management system, and the negative reactions of some employees might offset some of the increases in affective commitment in others. Further, the definition and empirical implementation of the PIRK components and the resulting HIM management system are subject to interpretation and discussion. However, by basing our components on Lawler's (1986) initial conceptualization of employee involvement and participation and asking both if the components form a coherent system

[15] In a similar vein, Böckerman et al. (2013) find that HIM leads to only moderately higher wages once the positive selection of employees into HIM systems is taken into account.

and if they drive affective commitment in a complementary fashion, we offer empirically robust, theory-driven findings on the effects of high involvement management practices.

7. Conclusion

We studied the role of high involvement management (HIM) in promoting employees' affective commitment, an attitudinal outcome variable, which is expected to constitute the channel from HIM to financial performance. We asked two related questions. First, does the hypothesized bundle of management practices associated with a HIM system indeed constitute a coherent bundle that is distinct from other, adjacent management systems? Second, are the HIM components complementary in driving the affective commitment of employees?

Prior work has often relied on cross-sectional data, making causal interpretation challenging, and has not systematically considered whether all PIRK components form a coherent or complementary management system. We address both these gaps by basing our variables for the HIM components of *power*, *information*, *rewards*, and *knowledge* (PIRK) on Lawler's (1986) conception of HIM as a self-contained system of management practices fostering participatory decision-making and collaboration and cooperation among co-workers. Hence, we explicitly distinguish HIM and its components from related management systems, such as high-performance work systems (HPWS), lean production/total quality management, or good/modern management. Further, the bracketing property of fixed effects and lagged dependent variable models in combination with a selection-on-observables approach gives us an upper and lower bound for the true causal effect of HIM on affective commitment while accounting for issues of unobserved confounding (endogeneity) caused by omitted variable bias, selection bias, simultaneous or reverse causation, and common-method bias.

Our results suggest that the complete set of all four HIM components constitutes a coherent management system, but there are no strong complementarities between the components. The results of our main specification and their interpretation as causal HIM effects do not change in the case of a series of robustness checks. Overall, we conclude that both theory and firms "got it right" when conceptualizing HIM as a "bundle" of practices that are in harmony with each other. Conversely, observers hoping for complementarities, i.e., mutually reinforcing effects of each of the practices, may find themselves disappointed by our findings. Follow-up work could delve into potential heterogeneity of HIM effects across firms and industries to see which industry, firm, and workforce characteristics may be especially amenable to a participatory management style, and if complementarities, elusive in our setting, materialize for a specific subset of firms.

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Tables and Figures

Table 1: Test on the content validity condition of management-system coherence

$Power\ (P)$	.501		
$Information\ (I)$	.515		
$Rewards\ (R)$	.485		
$Knowledge\ (K)$	.500		
	$Predicted$	$Observed$	$\frac{Observed}{Predicted}$
$P \times I$	.258	.290	1.124
$P \times R$	.243	.263	1.082
$P \times K$	.251	.273	1.088
$I \times R$	.250	.273	1.092
$I \times K$	.258	.307	1.190
$R \times K$	.243	.267	1.099
$P \times I \times R$	.125	.162	1.296
$P \times I \times K$	.129	.181	1.403
$P \times R \times K$	.121	.160	1.322
$I \times R \times K$	.125	.175	1.400
$P \times I \times R \times K$	.063	.109	1.730

Note: Linked Personnel Panel (LPP), waves 2-4, and IAB Establishment Panel (IABEP), waves 2014/16/18. The values displayed in the upper panel as well as the $Observed$-column represent sample means. The sample size is $N = 2{,}875$.

Table 2: The impact of HIM on affective commitment (system coherence analysis)

Estimation strategy	FE	LDV
HIM system	(1)	(2)
HIM system with one PIRK component (HIM^1)	.222**	.079
	(2.33)	(1.52)
HIM system with two PIRK components (HIM^2)	.243**	.135**
	(2.42)	(2.48)
HIM system with three PIRK components (HIM^3)	.329***	.159***
	(2.77)	(2.65)
HIM system with all PIRK components (HIM^4)	.394***	.218***
	(2.61)	(3.02)
AC_{t-1}		.604***
		(36.61)
$adj\ R^2$	.095	.459
N	2,875	

Note: Linked Personnel Panel (LPP), waves 2-4, and IAB Establishment Panel (IABEP), waves 2014/16/18. The values in parentheses represent t-statistics based on robust standard errors clustered at the individual level to account for intra-individual correlation. N is the number of observations, while $adj\ R^2$ represents the adjusted R^2. All specifications additionally contain an identical set of covariates described in Section 4.2.2. * $p < .10$; ** $p < .05$; *** $p < .01$.

Figure 1: Evolution of the HIM system effect on affective commitment

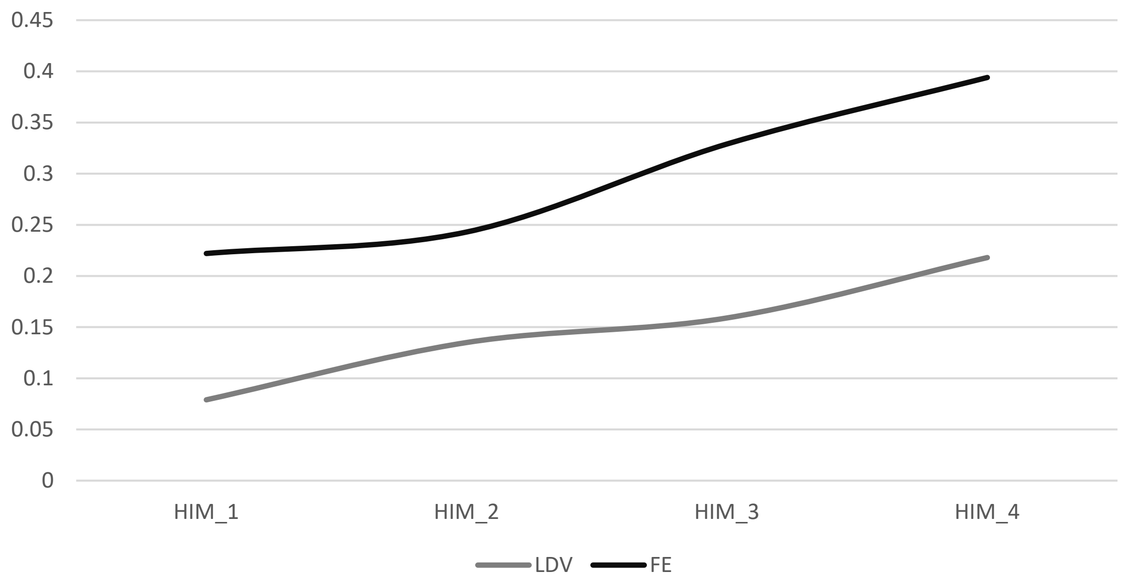

Table 3: Correlation matrices of the practices entering the HIM components

HIM component: $Power$ (HIM^P)	WC	$SMWT$	TW	
Works council / round table: WC_RT	1			
Self-managed working time: $SMWT$	.16***	1		
Teamwork: TW	.08***	.02	1	
HIM component: $Information$ (HIM^I)	AFI	MBO	EOS	PDP
Appraisal and feedback interviews: AFI	1			
Management by objectives: MBO	.27 ***	1		
Employee opinion surveys: EOS	.22***	.14***	1	
Personnel development plans: PDP	.34***	.26***	.33***	1
HIM component: $Rewards$ (HIM^R)			$TEAM\_PFP^M$	$TEAM\_PFP^{N}$
Share of variable pay based on team performance (managerial employees): $TEAM\_PFP^M$			1	
Share of variable pay based on team performance (non-managerial employees): $TEAM\_PFP^{NM}$			.51***	1
HIM component: $Knowledge$ (HIM^K)		$\%FT$	JR	QC
Number of further training participants: $\#FT$		1		
Job rotation: JR		.12***	1	
Quality circles: QC		.19 ***	.31***	1

Note: Linked Personnel Panel (LPP), waves 2-4, and IAB Establishment Panel (IABEP), waves 2014/16/18. $N =$ 2,875. *** $p < .01$.

Table 4: Correlation matrix of the four components of HIM

	Power (HIM^P)	*Information* (HIM^I)	*Rewards* (HIM^R)	*Knowledge* (HIM^K)
Power (HIM^P)	1			
Information (HIM^I)	.29***	1		
Rewards (HIM^R)	.03	.18***	1	
Knowledge (HIM^K)	.19***	.29***	.06***	1

Note: Linked Personnel Panel (LPP), waves 2-4, and IAB Establishment Panel (IABEP), waves 2014/16/18. $N =$ 2,875. *** $p < .01$.

Table 5: Conditional correlations among the components of high involvement management

Estimation strategy	POLS	POLS	POLS	POLS
Dependent variable	*Power* (HIM^P)	*Information* (HIM^I)	*Rewards* (HIM^R)	*Knowledge* (HIM^K)
Explanatory variables	(1)	(2)	(3)	(4)
Power (HIM^P)		.124***	-.031	-.057
		(2.93)	(-.51)	(-1.46)
Information (HIM^I)	.130***		.185***	.183***
	(2.83)		(4.07)	(4.51)
Rewards (HIM^R)	-.021	.123***		.017
	(-.51)	(3.64)		(.44)
Knowledge (HIM^K)	-.070	.215***	.030	
	(-1.42)	(4.38)	(.44)	
$adj\ R^2$	.331	.381	.098	.353
N	2,875			

Note: Linked Personnel Panel (LPP), waves 2-4, and IAB Establishment Panel (IABEP), waves 2014/16/18. The values in parentheses represent t-statistics based on robust standard errors clustered at the individual level to account for intra-individual correlation. N is the number of observations, while $adj\ R^2$ represents the adjusted R^2. All specifications additionally contain an identical set of covariates described in Section 4.2.2. * $p < .10$; ** $p < .05$; *** $p < .01$.

Online Appendix

"Does high involvement management drive affective commitment? Causal tests on system coherence and complementarity"

In this Online Appendix, we describe our procedure with regard to checking the robustness of our estimated HIM effects on affective commitment presented and discussed in Section 5.1.2. Hence, we restrict our sensitivity analysis to the empirical test of the convergent validity condition of system coherence. The reason for this restriction is that we identified statistically significant results only in the context of our system coherence analysis. However, we did not find any complementarities between the HIM components that have to be checked for sensitivity. In Section A.1, we explore whether our parameter estimates resulting from the FE model (4) and the LDV model (5) are robust when the respective error terms of the models, i.e., ϵ_{ijt}^{FE} and ε_{ijt}^{LDV}, do not satisfy the assumption of independence and identical distribution (i.i.d.) but instead exhibit first-order autocorrelation. In Section A.2, we discuss the consequences of a well-known concern in terms of the estimation of LDV models, according to which the coefficient of the LDV will typically be overestimated, while the remaining contemporary parameters will usually be underestimated. In Section A.3, we substantiate the bracketing property approach by following Demetrescu et al. (2025), who propose to estimate an alternative lower bound specifying an econometric model that includes both fixed effects and a lagged dependent variable. In Section A.4, we replace our theory-based approach of selecting covariates with a data-driven approach in which covariates for our FE and LDV models are selected from double-selection lasso (least absolute shrinkage and selection operator) linear regressions, where lassos are used to select the relevant observed confounders from the original control variables included in X^{FE}, X^{LDV}, and Z.

A.1 First-order autocorrelation

First-order or serial correlation is not unlikely to occur when panel data are applied. The problem with serially correlated error terms in equations (4) and (5) is that the resulting parameter estimates are likely to be inefficient, even if the respective conditional independence assumptions are met. This issue can be solved quite easily by using cluster-robust standard errors for the parameters to be estimated in the FE model (4) and heteroscedasticity- and autocorrelation-consistent (HAC) standard errors for the parameters of the LDV model displayed in equations (5).

Cluster-robust standard errors allow for correlation within panel units over time (intragroup correlation) and sufficiently correct for first-order autocorrelated error terms in short panels (Cameron and Trivedi, 2010, p. 336; Wooldridge 2010, p. 310).[1] Three panel waves, as in our case, can certainly be viewed as a short panel. Since we have already estimated the parameters of equation (4) using cluster-robust standard errors, our estimation procedure for the FE model does not need to be adapted. However, we need to re-estimate the parameters of the LDV model displayed in equation (5) using HAC standard errors. As column (1) of Table A.1 shows, the parameter estimates obtained from the Newey-West estimator using HAC standard errors virtually do not differ from those reported in column (2) of Table 2 for our baseline specification with cluster-robust standard errors. This indicates that the inclusion of the LDV AC_{t-1} in the set of covariates already makes a noticeable contribution to reducing the issue of first-order autocorrelation.

A.2 Downward biased HIM effects in the LDV model

A common problem associated with the estimation of dynamic models such as the LDV model in equation (5) is that the parameter estimate of the LDV, i.e., γ^{LDV}, tends to be biased upward, while the parameter estimates for the remaining independent variables, including HIM^1, HIM^2, HIM^3 and HIM^4, tend to be biased downward. In addition, if the error terms ϵ_{ijt}^{LDV} are serially correlated, the biases do not disappear even in large samples, meaning that the parameter estimates for the independent variables including $\hat{\alpha}_l^{LDV}$ are also inconsistent. Consequently, adding an LDV to the set of covariates might be problematic, even if its inclusion is theoretically appropriate.

From the discussion in the previous Section A.1, we know that serial correlation is not a serious issue in our empirical analysis. And in our case, neither an upward bias in the parameter estimates for AC_{t-1} (i.e., γ^{LDV}) nor a downward bias in the estimated coefficients for the explanatory variables HIM^1, HIM^2, HIM^3 and HIM^4 (i.e., $\hat{\alpha}_l^{LDV}$) compromises the internal validity of the parameter estimates. As long as the stationary condition $|\gamma^{LDV}| < 1$ is satisfied, we do not have to worry about upward-biased estimates of γ^{LDV} (Maddala and Rao, 1973; Keele and Kelly, 2006; Wilkins, 2018). But even downward-biased estimates for our parameters of interest $\hat{\alpha}_l^{LDV}$ do not call the validity of our estimated HIM effects into question because $\hat{\alpha}_l^{LDV}$ represents the lower bounds of the true causal HIM effects. Recall that we do not aim at estimating the precise magnitude of the causal effects of HIM on affective commitment. Instead, we are interested in figuring out whether causal HIM effects on affective commitment actually exist or not. For this purpose, the information that the lower bound of

[1] The authors argue that cluster-robust standard errors requiring only independence across clusters (here: panel units), while allowing for within-cluster correlation over time will sufficiently address the issue of serially correlated error terms in short panels, so that estimating the parameters using HAC standard errors is not required.

the causal HIM effect is statistically significant is completely sufficient, regardless of whether we speak of $\hat{\alpha}_l^{LDV}$ as the lower bound. Indeed, if the downward biased lower bound of the true causal HIM effect is already statistically significant, then both the precisely estimated lower bound and the true causal effect should also be statistically significant, provided that the corresponding upper bound $\hat{\alpha}_l^{FE}$ is statistically significant (Beckmann and Kräkel, 2022).

A.3 Combined fixed effects and lagged dependent variable estimates

Demetrescu et al. (2025) propose an alternative lower-bound estimate of the true causal effect using a model specification that includes both fixed effects and a lagged dependent variable (hereafter: FE-LDV). Despite the flaws of the FE-LDV model (e.g., Nickell bias), the authors' simulation shows that the FE-LDV model represents a conservative lower bound to the true causal coefficient. The resulting econometric model can be written as

$$AC_{ijt} = \gamma^{FE-LDV} AC_{ijt-1} + \sum_{l=1}^{4} \alpha_l^{FE-LDV}\, HIM_{jt}^{l} + \beta^{FE-LDV\prime} X_{ijt}^{FE} + \delta^{FE-LDV\prime} Z_{jt}$$

$$+\mu_i + \nu_t + \varepsilon_{ijt}^{FE-LDV}. \qquad \text{(A1)}$$

The estimates for α_l^{FE-LDV} are displayed in column (2) of Table A.1. The most important observation is that the magnitudes of the estimated HIM effects on affective commitment $\hat{\alpha}_l^{FE-LDV}$ are located between the lower and upper limits for the actual causal effects determined using the bracketing property approach. The estimated HIM effects turn out to be statistically significant with the expected positive sign and increase monotonically with each additional component until the full system is completed, thus confirming the convergent validity condition of management system coherence. All in all, therefore, the FE-LDV estimates confirm the results from our main analysis in terms of system coherence and complementarity. The HIM system proves to be a coherent management system, but the HIM components do not show complementary relationships in the achievement of affective commitment.

A.4 Double-selection lasso linear regression

Recall that in our baseline regressions, the choice of the set of covariates has largely been determined by theoretical considerations. Not least because of our selection-on-observables approach, our set of covariates turns out to be quite extensive. In this robustness check, we apply a data-driven approach to select the covariates for our FE and LDV models by building on double-selection lasso (least absolute shrinkage and selection operator) linear regressions, where lassos are used to select the relevant variables from the control variables originally included in X^{FE}, X^{LDV}, and Z.

The double-selection algorithm proceeds as follows. The first selection step is a lasso linear regression of the main explanatory variables HIM^l ($l = 1, \ldots, 4$) on X^{FE} (in case of the FE model (4)), X^{LDV} (in case of the LDV models (5)), and Z. The second selection step is a lasso linear regression of the dependent variable AC on X^{FE} or X^{LDV} and Z. The algorithm selects the statistically significant covariates from both steps to be included in the matrices $\tilde{X}^{FE}$, $\tilde{X}^{LDV}$, and $\tilde{Z}$, representing subsets of the original matrices X^{FE}, X^{LDV}, and Z. The final step is the re-estimation of the FE and LDV models (4) and (5), where X^{FE}, X^{LDV}, and Z are replaced by $\tilde{X}^{FE}$, $\tilde{X}^{LDV}$, and $\tilde{Z}$. With this procedure, the double-selection lasso approach selects the so-called true confounders, i.e., covariates that jointly determine the outcome and the main explanatory variables, thereby reducing selection bias, as suggested, for example, in Imbens (2004), Austin (2011), Li (2013), and Narita et al. (2023).

The estimation results of this robustness check are displayed in columns (3) and (4) of Table A.1. The parameter estimates for both the FE and the LDV models turn out to be somewhat smaller than their counterparts in our baseline specifications. Nevertheless, the coefficients are still (highly) significant, where the FE estimates still exceed the LDV estimates. Moreover, the lasso estimates confirm our previous conclusion, according to which it takes all four HIM components to form a coherent HIM system.

Table A1: The impact of HIM on affective commitment (robustness checks)

	Serial correlation (Newey-West)	FE-LDV model	Lasso covariates	
Estimation strategy	LDV	FE-LDV	FE	LDV
HIM (sub)system	(1)	(2)	(3)	(4)
HIM^{PKRI}				
HIM^1	.078	.171*	.052	.060
	(1.56)	(1.80)	(.80)	(1.21)
HIM^2	.133***	.211**	.170***	.111**
	(2.60)	(2.08)	(2.56)	(2.19)
HIM^3	.157***	.295**	.194***	.140***
	(2.87)	(2.46)	(2.77)	(2.60)
HIM^4	.217***	.304**	.222***	.198***
	(3.19)	(2.46)	(2.63)	(2.99)
AC_{t-1}	.604***	-.376***		.612***
	(28.87)	(-10.13)		(38.69)
Selected controls			31	43
$adj\ R^2$ / R^2-within	.459	.237		
N	2,875			

Note: Linked Personnel Panel (LPP), waves 2-4, and IAB Establishment Panel (IABEP), waves 2014/16/18. The values in parentheses represent t-statistics based on robust standard errors clustered at the individual level to account for intra-individual correlation. N is the number of observations, while $adj\ R^2$ represents the adjusted R^2. All specifications additionally contain an identical set of covariates described in Section 4.2.2. * $p < .10$; ** $p < .05$; *** $p < .01$.

A.5 Testing the payoff condition using a four-way interaction terms specification

According to the cube view of complementarities, a test on the payoff condition of complementarity theory can be realized by estimating regression models that include two-way, three-way, and in our case four-way interaction terms. For this purpose, we use the P, I, R, and K dummies introduced in Section 4.2. For the FE model, the empirical translation of the cube view of complementarities is based on the estimation of the model

$$\begin{aligned} AC_{ijt} = {} & \theta_P^{FE} P_{jt} + \theta_I^{FE} I_{jt} + \theta_R^{FE} R_{jt} + \theta_K^{FE} K_{jt} + \theta_{PI}^{FE}(P_{jt} \times I_{jt}) + \theta_{PR}^{FE}(P_{jt} \times R_{jt}) + \theta_{PK}^{FE}(P_{jt} \times K_{jt}) \\ & + \theta_{IR}^{FE}(I_{jt} \times R_{jt}) + \theta_{IK}^{FE}(I_{jt} \times K_{jt}) + \theta_{RK}^{FE}(R_{jt} \times K_{jt}) + \theta_{PIR}^{FE}(P_{jt} \times I_{jt} \times R_{jt}) \\ & + \theta_{PIK}^{FE}(P_{jt} \times I_{jt} \times K_{jt}) + \theta_{PRK}^{FE}(P_{jt} \times R_{jt} \times K_{jt}) + \theta_{IRK}^{FE}(I_{jt} \times R_{jt} \times K_{jt}) \\ & + \theta_{PIRK}^{FE}(P_{jt} \times I_{jt} \times R_{jt} \times K_{jt}) + \beta^{FE'} X_{ijt}^{FE} + \delta^{FE'} Z_{jt} + \mu_i + \nu_t + \varepsilon_{ijt}^{FE} , \end{aligned} \tag{A2}$$

while the corresponding LDV model can be written as

$$\begin{aligned} AC_{ijt} = {} & \gamma^{LDV} AC_{ijt-1} + \theta_P^{LDV} P_{jt} + \theta_I^{LDV} I_{jt} + \theta_R^{LDV} R_{jt} + \theta_K^{LDV} K_{jt} + \theta_{PI}^{LDV}(P_{jt} \times I_{jt}) \\ & + \theta_{PR}^{LDV}(P_{jt} \times R_{jt}) + \theta_{PK}^{LDV}(P_{jt} \times K_{jt}) + \theta_{IR}^{LDV}(I_{jt} \times R_{jt}) + \theta_{IK}^{LDV}(I_{jt} \times K_{jt}) \\ & + \theta_{RK}^{LDV}(R_{jt} \times K_{jt}) + \theta_{PIR}^{LDV}(P_{jt} \times I_{jt} \times R_{jt}) + \theta_{PIK}^{LDV}(P_{jt} \times I_{jt} \times K_{jt}) \\ & + \theta_{PRK}^{LDV}(P_{jt} \times R_{jt} \times K_{jt}) + \theta_{IRK}^{LDV}(I_{jt} \times R_{jt} \times K_{jt}) + \theta_{PIRK}^{LDV}(P_{jt} \times I_{jt} \times R_{jt} \times K_{jt}) \\ & + \beta^{LDV'} X_{ijt}^{LDV} + \delta^{LDV'} Z_{jt} + \nu_t + \varepsilon_{ijt}^{LDV} . \end{aligned} \tag{A3}$$

Recall that if payoff condition (2) is satisfied, complementarities exist in the sense that the addition of one of the HIM components to an incomplete subsystem consisting of the other three HIM components results in a higher payoff measured as affective commitment than an isolated implementation of this particular component. An empirical test of payoff condition (2) for the case of the *knowledge* component added to the subsystem consisting of the *power*, *information*, and *rewards* components is as follows in both the FE and the LDV models:

$$\begin{aligned} & (\theta_P + \theta_I + \theta_R + \theta_K + \theta_{PI} + \theta_{PR} + \theta_{PK} + \theta_{IR} + \theta_{IK} + \theta_{RK} + \theta_{PIR} + \theta_{PIK} + \theta_{PRK} + \theta_{IRK} + \theta_{PIRK}) \\ & \quad > (\theta_P + \theta_I + \theta_R + \theta_{PI} + \theta_{PR} + \theta_{IR} + \theta_{PIR}) + \theta_K . \end{aligned} \tag{A4}$$

The complementarity tests for the other components, i.e., *power*, *information*, and *rewards*, result analogously to condition (A4). The estimates of all θ-parameters are reported in Table A2.

Table A2: The impact of HIM on affective commitment (cube view of complementarity)

Estimation strategy	FE	LDV	FE	LDV
HIM system	(1)	(2)	(3)	(4)
Power (P)	-.050	.179**		
	(-.31)	(2.53)		
Information (I)	.245*	.198***		
	(1.65)	(2.73)		
Rewards (R)	-.003	.085		
	(-.02)	(1.33)		
Knowledge (K)	.256*	.151*		
	(1.87)	(1.91)		
$P \times I$	-.036	-.227**	.160	.150*
	(-.16)	(-2.02)	[1.13]	[3.54]
$P \times R$	.106	-.103	.054	.162**
	(.50)	(-.97)	[.12]	[4.17]
$P \times K$	.037	-.273**	.244	.058
	(.17)	(-2.31)	[2.59]	[.52]
$I \times R$	-.162	-.195*	.080	.088
	(-.80)	(1.73)	[.28]	[1.00]
$I \times K$	-.250	-.106	.251*	.243***
	(-1.04)	(-.96)	[3.60]	[12.25]
$R \times K$	-.221	-.022	.033	.215**
	(-1.04)	(-.20)	[.03]	[6.51]
$P \times I \times R$	.260	.215	.360**	.153**
	(.92)	(1.29)	[5.60]	[4.10]
$P \times I \times K$	.281	.274*	.484***	.196***
	(.93)	(1.67)	[9.45]	[7.96]
$P \times R \times K$	-.007	.227	.120	.246***
	(-.02)	(1.34)	[.73]	[9.87]
$I \times R \times K$	.124	.026	-.011	.137*
	(.47)	(.16)	[.00]	[3.83]
$P \times I \times R \times K$	-.251	-.235	.230*	.195***
	(-.90)	(-1.00)	[2.73]	[8.34]
AC_{t-1}		.604***		
		(36.44)		
R^2 / R^2-within	.130	.475		
N	2,875			

Note: Linked Personnel Panel (LPP), waves 2-4, and IAB Establishment Panel (IABEP), waves 2014/16/18. The values in square brackets represent F-statistics based on robust standard errors clustered at the individual level to account for intra-individual correlation. For additional information, see the note below table 2. * $p < .10$; ** $p < .05$; *** $p < .01$.

Table A2 contains all linear coefficients and all two-, three-, and four-way interaction terms. Columns (1) and (2) display the coefficients estimated from the FE and the LDV models, including the coefficients for all two-, three-, and four-way interaction *terms*, while columns (3) and (4) show the true magnitudes of all corresponding interaction *effects*.[2] Condition (A4) is based on the interaction effects, not the interaction terms. Although the four-way interaction effect is statistically significant with a positive sign in both the FE and LDV models, condition (A4) is not satisfied for any of the HIM components. This finding is consistent with the results of our baseline complementarity analysis described and discussed in Section 5.2.2. Our conclusion, therefore, is that we cannot find strong complementarities between the HIM components in determining affective commitment.

[2] For example, the true magnitude of the interaction effect $P \times I \times R$ estimated in the FE model is not $\theta_{PIR} =$ .260 as displayed in column (1) but $\theta_P + \theta_I + \theta_R + \theta_{PI} + \theta_{PR} + \theta_{IR} + \theta_{PIR} =$ .360 as reported in column (3).

A.6 Additional tables

Table A3: Summary table for estimation sample

Variable	Obs.	Mean	Std. dev.	Min	Max
outcome & focal variables					
commitment (z)	2,875	0.064	0.956	-3.005	1.642
HIM index (z)	2,875	-0.014	0.973	-2.769	3.001
HIM power index (z)	2,875	0.008	0.973	-3.906	2.540
HIM rewards index (z)	2,875	0.012	1.005	-0.628	5.034
HIM knowledge index (z)	2,875	-0.046	0.893	-1.001	5.390
HIM information index (z)	2,875	-0.005	0.990	-2.296	1.148
Single measures behind HIM					
works council or round table (WC_RT)	2,875	0.872	0.334	0	1
self-managed working time ($SMWT$)	2,875	0.500	0.500	0	1
interdependencies between employees ($TEAM$)	2,875	5.041	0.855	0	8
share of variable pay based on team performance, managerial employees ($TEAM\_PFP^M$)	2,875	11.176	18.961	0	100
share of variable pay based on team performance, non-managerial employees ($TEAM\_PFP^{NM}$)	2,875	9.681	21.462	0	100
employees in further training ($\#FT$)	2,875	248.881	575.226	1	13,173
job rotation (JR)	2,875	0.331	0.471	0	1
quality circles (QC)	2,875	0.358	0.480	0	1
appraisal / feedback interviews (AFI)	2,875	0.784	0.412	0	1
management by objective (MBO)	2,875	0.760	0.427	0	1
employee opinion surveys (EOS)	2,875	0.510	0.500	0	1
personnel development plans (PDP)	2,875	0.597	0.491	0	1
employee characteristics					
employee age					
less than 35 years old	2,875	0.100	0.300	0	1
35-59 years old	2,875	0.803	0.397	0	1
older than 59	2,875	0.097	0.296	0	1
sex (2=woman)	2,875	1.242	0.429	1	2
managerial responsibility	2,875	0.323	0.468	0	1
(highest) training & education					
apprenticeship, in-firm training	2,875	0.465	0.499	0	1
vocational school, business school	2,875	0.085	0.279	0	1
master craftsmen's or technical college	2,875	0.224	0.417	0	1
university of applied sciences degree	2,875	0.102	0.302	0	1
university degree	2,875	0.109	0.312	0	1
another training qualification	2,875	0.002	0.042	0	1
no training qualification	2,875	0.013	0.113	0	1
contractual working hours	2,875	37.258	5.120	6	90
overtime hours	2,875	3.691	4.631	0	60.2
number of children	2,875	0.340	0.706	0	5
nationality/citizenship					
German citizenship (only)	2,875	0.964	0.186	0	1
both a German and another citizenship	2,875	0.021	0.143	0	1
another citizenship	2,875	0.015	0.121	0	1
white-collar	2,875	0.618	0.486	0	1
personality					
extroversion	2,875	3.626	0.719	1.333333	5
conscientiousness	2,875	4.341	0.467	2	5
neuroticism	2,875	2.702	0.757	1	5

openness	2,875	3.623	0.617	1.25	5
agreeableness	2,875	4.037	0.554	1.667	5
injustice sensitivity	2,875	2.493	1.011	1	5
trust	2,875	3.531	0.764	1	5
risk taking behavior	2,875	5.659	1.787	0	10
workforce composition					
share of workers for low-skilled tasks	2,875	0.159	0.209	0	0.995
share of workers for medium-skilled tasks	2,875	0.142	0.147	0	0.875
share of workers for high-skilled tasks	2,875	0.650	0.207	0	1
share of women	2,875	0.259	0.201	0	0.982
share of part-time workers	2,875	0.110	0.149	0	0.964
share of fixed-term contracts	2,875	0.056	0.083	0	0.800
share of marginal employees	2,875	0.023	0.061	0	0.690
share of temps	2,875	0.045	0.076	0	0.898
share of apprentices	2,875	0.044	0.035	0	0.343
share of freelancers	2,875	0.005	0.028	0	0.435
firm characteristics					
technical state of plant and equipment					
1 up to date	2,875	0.175	0.380	0	1
2	2,875	0.583	0.493	0	1
3	2,875	0.219	0.414	0	1
4	2,875	0.018	0.135	0	1
5 completely outdated	2,875	0.004	0.064	0	1
establishment size					
<100 employees	2,875	0.105	0.306	0	1
100-199 employees	2,875	0.177	0.382	0	1
200-499 employees	2,875	0.346	0.476	0	1
500-999 employees	2,875	0.250	0.433	0	1
>999 employees	2,875	0.122	0.327	0	1
industry					
mining/energy/water/waste	2,875	0.024	0.153	0	1
food and beverage	2,875	0.041	0.199	0	1
consumables	2,875	0.030	0.170	0	1
production goods	2,875	0.231	0.422	0	1
durable goods	2,875	0.425	0.494	0	1
construction	2,875	0.035	0.183	0	1
wholesale/automotive trade and repair	2,875	0.045	0.207	0	1
retail	2,875	0.020	0.139	0	1
transport and storage	2,875	0.034	0.182	0	1
Information and communication	2,875	0.026	0.158	0	1
financial and insurance services	2,875	0.004	0.064	0	1
economic, scientific and professional services	2,875	0.053	0.223	0	1
health and social services	2,875	0.024	0.154	0	1
other services	2,875	0.008	0.089	0	1
competitive pressure					
no pressure	2,875	0.013	0.114	0	1
low pressure	2,875	0.047	0.211	0	1
medium pressure	2,875	0.377	0.485	0	1
high pressure	2,875	0.563	0.496	0	1
firm exclusively run by professional managers	2,875	0.602	0.490	0	1
independent establishment	2,875	0.494	0.500	0	1
export activity	2,875	0.652	0.476	0	1
covered by a trade union	2,875	0.719	0.450	0	1
recruiting problems	2,875	0.349	0.477	0	1
firm age					
up to 5 years	2,875	0.018	0.132	0	1
6-10 years	2,875	0.024	0.153	0	1
11-20 years	2,875	0.106	0.308	0	1

more than 20 years old	2,875	0.853	0.355	0	1
ownership					
family/founder	2,875	0.509	0.500	0	1
management	2,875	0.171	0.377	0	1
financial investors	2,875	0.204	0.403	0	1
other forms of ownership	2,875	0.115	0.320	0	1
other variables					
year					
2014	2,875	0.485	0.500	0	1
2016	2,875	0.365	0.481	0	1
2018	2,875	0.150	0.357	0	1
region					
North	2,875	0.175	0.380	0	1
East	2,875	0.273	0.446	0	1
South	2,875	0.294	0.456	0	1
West	2,875	0.258	0.438	0	1
Survey mode (2=web)	2,875	1.047	0.212	1	2

Note: Linked Personnel Panel (LPP), waves 2-4, and IAB Establishment Panel (IABEP), waves 2014/16/18.

Table A4: The impact of HIM on affective commitment (complete regression results, cf. Table 2)

Estimation strategy	FE	LDV
HIM^1 (one HIM component)	0.222**	0.0789
	(2.327)	(1.522)
HIM^2 (two HIM components)	0.243**	0.135**
	(2.423)	(2.478)
HIM^3 (three HIM components)	0.329***	0.159***
	(2.766)	(2.654)
HIM^4 (four HIM components)	0.394***	0.218***
	(2.609)	(3.023)
AC_{t-1}		0.604***
		(36.61)
reference: 34 years or younger		
35-59 years old	0.288	0.149***
	(1.331)	(3.003)
60 or older	0.377	0.325***
	(1.539)	(4.972)
female		0.00966
		(0.223)
managerial responsibility	0.0574	0.0858***
	(0.597)	(2.963)
reference: apprenticeship, in-firm training		
vocational school, business school		0.00315
		(0.0630)
master craftsmen's or technical college		0.101***
		(2.676)
university of applied sciences degree		0.0647
		(1.288)
university degree		0.0619
		(1.266)
another training qualification		0.642***
		(2.880)
no training qualification		-0.165
		(-1.411)
contractual working hours		-2.356***
		(-16.43)
overtime hours	-0.00383	0.00190
	(-0.192)	(0.664)
number of children	0.00585	0.00760**
	(0.632)	(2.476)
reference: German citizenship (only)		
both a German and another citizenship	0.162	0.0756
	(0.541)	(0.755)
another citizenship	0.568*	-0.0178
	(1.822)	(-0.159)

white-collar	-0.301**	0.00899
	(-2.045)	(0.236)
extroversion		0.0414**
		(1.984)
conscientiousness		-0.0101
		(-0.326)
neuroticism		-0.00806
		(-0.355)
openness		-0.00435
		(-0.191)
agreeableness		-0.00220
		(-0.0780)
injustice sensitivity		0.0223
		(1.577)
trust		0.0256
		(1.282)
risk taking behavior		-0.00807
		(-0.965)
% workers for high-skilled tasks	-1.279**	0.112
	(-2.100)	(0.831)
% workers for medium-skilled tasks	-0.298	0.242**
	(-0.737)	(2.509)
% women	0.341	0.269**
	(0.627)	(2.080)
% part-time workers	-1.135	-0.332
	(-1.415)	(-1.490)
% fixed-term contracts	0.827	0.250
	(1.462)	(1.199)
% marginal employees	2.135*	0.842***
	(1.720)	(2.615)
% temps	-0.132	-0.0322
	(-0.276)	(-0.150)
% apprentices	-0.886	-0.0103
	(-0.642)	(-0.0252)
% freelancers	-0.264	-0.212
	(-0.231)	(-0.425)
reference: technical state up to date (1)		
technical state: 2	-0.0255	-0.0226
	(-0.407)	(-0.629)
technical state: 3	-0.0435	-0.0324
	(-0.468)	(-0.707)
technical state: 4	0.366	0.124
	(1.332)	(1.054)
techn. state: completely outdated (5)	0.230	-0.579***
	(1.157)	(-3.916)
reference: 50-99 employees		
100-199 employees	-0.0813	-0.0907

	(-0.396)	(-1.622)
200-499 employees	-0.213	-0.106**
	(-0.824)	(-2.009)
500-999 employees	-0.319	-0.110*
	(-1.044)	(-1.733)
more than 999 employees	-0.180	-0.0537
	(-0.530)	(-0.759)
reference: mining/energy/water/waste		
food and beverages		-0.0330
		(-0.385)
consumables		0.00572
		(0.0566)
production goods		-0.0709
		(-1.039)
durable goods		-0.0593
		(-0.868)
construction		0.0508
		(0.531)
wholesale/automotive trade and repair		-0.121
		(-1.547)
retail		0.0651
		(0.472)
transport and storage		-0.258**
		(-2.500)
Information and communication		-0.219**
		(-2.189)
financial and insurance services		-0.403
		(-1.648)
economic, scientific & profess. services		-0.142
		(-1.520)
health and social services		-0.152
		(-1.224)
other services		-0.318**
		(-2.029)
reference: no competitive pressure		
low pressure	-0.662***	-0.00567
	(-3.582)	(-0.0375)
medium pressure	-0.975***	-0.00410
	(-4.696)	(-0.0333)
high pressure	-0.982***	-0.0277
	(-4.744)	(-0.233)
firm run by profess. managers	-0.0580	-0.0589
	(-0.574)	(-1.418)
independent establishment	0.0806	-0.0270
	(0.876)	(-0.812)
export activity?	0.111	0.0261
	(1.197)	(0.673)

covered by a trade union?	0.268**	0.0414
	(2.290)	(1.121)
recruiting problems?	0.0244	-0.0707**
	(0.532)	(-2.214)
reference: firm age up to 5 years		
6-10 years	0.252	-0.0853
	(0.962)	(-0.540)
11-20 years	0.334	0.157
	(1.493)	(1.126)
more than 20 years old	0.407**	0.0559
	(2.153)	(0.421)
reference: family/founder ownership		
management	0.167	0.0361
	(1.512)	(0.838)
financial investors	-0.0473	-0.0306
	(-0.395)	(-0.719)
other forms of ownership	-0.352*	-0.0147
	(-1.942)	(-0.280)
reference: 2012		
2016	0.00228	-0.00205
	(0.0610)	(-0.0645)
2018	0.146*	0.0910**
	(1.766)	(2.015)
reference: North Germany		
East		-0.0331
		(-0.700)
South		0.0274
		(0.590)
West		0.0133
		(0.323)
Survey mode (1=web; reference: telephone)	-0.0296	0.0618
	(-0.279)	(0.940)
Constant	0.705	-0.728**
	(0.751)	(-2.203)
Observations		2,875
R-squared	0.110	0.474
adj. R-squared	0.0950	0.459

Note: Linked Personnel Panel (LPP), waves 2-4, and IAB Establishment Panel (IABEP), waves 2014/16/18. For additional information, see the note below table 2. * $p < .10$; ** $p < .05$; *** $p < .01$.

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