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Causality Between High-Performance Work Systems and Organizational Performance

Duckjung Shin
Alison M. Konrad
Western University

Previous researchers have questioned whether the association between high-performance work systems (HPWS) and organizational performance indicates causality. Strategic human resource management theories, including the resource-based view of the firm and the behavioral perspective, have provided explanations linking human resource management practices to organizational performance. We add arguments based upon general systems theory to suggest a more complex relationship where performance provides feedback on HPWS in the form of information and resources. This feedback generates both the data and the slack resources needed to support an adaptive process of HPWS implementation. We test the causal associations between HPWS and performance using a large longitudinal data set with three time points. Findings showed that past HPWS positively contributes to later productivity as well as the reverse. The reciprocal relationship supports the need to extend strategic human resource management theory by considering productivity as an antecedent as well as an outcome of human resource management practices.

Keywords: *strategic human resource management; high-performance work systems; causality; general systems theory; human resources; productivity*

Scholars argue that advanced human resource management (HR) practices, known as high-performance work systems (HPWS), high-involvement work practices, or high-commitment HR practices, help organizations achieve better outcomes. Even with research

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Corresponding author: Duckjung Shin, Ivey Business School, Western University, 1255 Western Rd., ON N6G0N1, Canada.

E-mail: dshin.phd@ivey.ca

efforts to demonstrate the positive effects of HPWS on performance (Becker & Huselid, 2006; Messersmith, Patel, & Lepak, 2011), organizations vary substantially in implementation of HPWS (Kaufman, 2010; Pil & MacDuffie, 1999). One explanation for the gap between academic findings and practical implementation is the possibility that practitioners adaptively implement HPWS based on previous performance outcomes. HPWS implementation takes time, effort, and the development of management accounts (Gondo & Amis, 2013). Evidence of success during the early stages of adoption and implementation creates support and generates the slack resources needed to ensure further investment in HR practices. Because performance outcomes determine whether HPWS is continued, expanded, or reconsidered, the possibility of reverse causality has to be taken seriously not only to generate a realistic estimate of the size of the HPWS effect on performance (Becker & Huselid, 2006; Gerhart, Wright, Mc Mahan, & Snell, 2000; Wright, Gardner, Moynihan, & Allen, 2005) but also to explain why the diffusion of HPWS is still limited despite academic assertions of effectiveness.

Although the strategic HR perspective suggests that HR needs to be considered as a system, such consideration has been limited to synergistic interactions between HR practices (Subramony, 2009). In our approach based on general systems theory (Von Bertalanffy, 1968), firm performance results in feedback from the internal operation and the external environment. This feedback loop affects the flow of resources into the organization. Only with sufficient resource inflows can the organization build and sustain its internal throughput processes by strengthening or expanding HPWS (Kast & Rosenzweig, 1972).

In addition to building understanding of the antecedents of HPWS, the general systems approach also addresses concerns that prior theorizing has treated HPWS as something that can be implemented at will. This assumption neglects the costs associated with HPWS and the capabilities required to implement these complex systems. A high level of previous firm financial performance creates the slack resources needed to facilitate organizational implementation of new or complex practices (Cyert & March, 1963; Pfeffer & Salancik, 1978). The feedback loop in the general systems approach also suggests that HPWS is implemented through an adaptive process (Miner, 1994). Organizations incrementally adapt HPWS as they accumulate knowledge of and experience with these practices. Therefore, strong organizational performance based on HPWS supports further development of these systems.

Serious conceptual and empirical consideration of the possibility that performance causes HPWS as well as the reverse is important for both theory and practice. The possibility of reverse causality suggests that prior effect size estimates are inflated (Wright et al., 2005). If a substantial proportion of the .28 (Combs, Liu, Hall, & Ketchen, 2006) to .43 (Subramony, 2009) meta-analytic effect sizes reported for the impact of HPWS on performance is due to reverse causality, then the performance case for HPWS may have been oversold to practitioners. Also, understanding the impact of performance on adoption of HPWS helps to explain why some firms do not implement these systems, despite data suggesting that doing so will drive improved performance. Finally, findings of reverse causality potentially support the proposition that HPWS can generate competitive advantage for firms. If a substantial number of firms that would benefit from HPWS fail to do so because of insufficient resources or motivation, then competitors face difficulties in trying to imitate these systems. Processes that are difficult for competitors to imitate create longer-run competitive advantage to HPWS adopters (Barney, 1991). As such, the adaptation perspective of general systems theory extends explanations of how HPWS creates competitive advantage for firms.

Table 1
Theoretical Foundations

Theory	HPWS→Performance	Performance→HPWS
Resource-based view	Competitive advantage Investment in relatively inimitable capabilities based on human capital	
Behavioral theory	AMO framework Employee skills, abilities, and motivation	
Slack resources		Resource availability Long-term investment based on slack resources
Adaptive perspective		Adaptation process Learning by doing
General systems theory	Wholeness Synergy between individual HR practices	Feedback Performance outputs generate inputs to the system

Note: HPWS = high-performance work systems; AMO = ability, motivation, and opportunity; HR = human resource management.

The aim of this study is to test the direction of causality between HPWS and performance using a large longitudinal data set. To our knowledge, this study is the first to examine the effect of HPWS on performance as well as the effect of performance on HPWS with data from three time points.

Background and Hypotheses

Scholars have pointed out that the accumulated evidence of the positive association between HPWS and firm performance needs to be supplemented by a causal explanation of this relationship (e.g., Guest, 2011). Theories linking HPWS to performance have included the resource-based view (RBV) of the firm and the behavioral perspective. We add arguments for reverse causation whereby performance leads to implementation of HPWS based on the availability of slack resources and the adaptive implementation of HR practices. We apply general systems theory as a framework that integrates both causal directions into a larger conceptual perspective. The theoretical foundations of these causal arguments are summarized in Table 1.

General Systems Theory and Causality

Influential theories in strategic human resource management (SHRM), such as the behavioral (ability, motivation, and opportunity, or AMO) perspective and the RBV, have typically portrayed HR practices as closed systems, focusing research on the linear processes linking HPWS as an input to performance as an output (Wright & McMahan, 1992). General systems theory stresses that outputs generate the inputs that are required to maintain the system (Katz & Kahn, 1966). The theory implies that in order to understand the relationship between HPWS and performance, it is necessary to consider the feedback loop from performance to HPWS as well as the impact of HPWS as an input affecting performance outcomes.

While the RBV and AMO perspectives explain the unidirectional relationship between HPWS and firm performance, general systems theory has the potential to add an explanation of the reverse causal effect of firm performance on the implementation of HPWS. General systems theory stresses "wholeness," where systems work in totality rather than in parts (Von Bertalanffy, 1968). In this view, subsystems are synergistic in producing desirable outcomes. Thus, systems theory provides a theoretical rationale explaining why individual HR practices work as a bundle. Another key feature of systems theory is the input-throughput-output model (Kast & Rosenzweig, 1972). As such, investment in HPWS (input) transforms employee behaviors (throughput), resulting in desirable outcomes (output) (Wright & McMahan, 1992; Wright & Snell, 1998). Furthermore, organizational outputs generate responses from the environment, which affect future inputs. Within this framework, performance is a critical determinant of future resource flows into the firm. With a strong input of resources, the firm is able to build and strengthen its throughput processes, and one method of doing so is to build or extend its HPWS.

General systems theory posits that feedback can be either positive or negative (Kast & Rosenzweig, 1972; Von Bertalanffy, 1968). Under negative feedback, where increased outputs lead to a decrease in inputs, organizations may not reap long-term benefits from their activities because the effects of the throughput process plateau or diminish over time (Ashmos & Huber, 1987; Katz & Kahn, 1966). Negative feedback is also consistent with criticisms that HPWS is exploitative in nature. In this view, increases in performance will diminish over time because stresses on employees make HPWS unsustainable (Godard, 2004).

By comparison, positive feedback indicates that outcomes amplify the impact of inputs (Kast & Rosenzweig, 1972; Von Bertalanffy, 1968). Under positive feedback, where inputs produce more outputs, which in turn produce more inputs, HPWS and performance are mutually enhancing, and the HPWS-performance linkage becomes a "virtuous cycle." A positive feedback loop implies that the effect of HPWS on performance is sustainable because performance growth from HPWS is reinforced through ongoing employee participation, satisfaction, and commitment (Allen & Wright, 2007; Gollan, 2005; Pfeffer, 1995).

The presence of feedback loops constitutes a distinctive feature of general systems theory, which is the assumption of negative entropy (Kast & Rosenzweig, 1972). Unlike closed systems, where there is a tendency toward resource depletion, in open systems, strong previous performance drives the accumulation of resource inputs. These inputs provide organizations with the ability to build and maintain their internal throughput systems, including investment in HR. One possible concern for HPWS is that its benefits might deteriorate over time as implementation efforts lapse, costs grow, or competitors mimic the system. General systems theory implies, however, that such entropy is overcome through the regenerative process as organizations reinvest some of the resources generated by strong performance. Thus, from a general systems perspective, HPWS and organizational performance are likely to be mutually enhancing. By comparison, with low previous performance, discretionary resources are reduced, limiting the ability to invest in HPWS.

In addition, general systems theory posits the equifinality of means for achieving organizational goals. Pfeffer (1981) argues that departments and functions within an organization compete for limited resources. As such, when decision makers perceive performance shortfalls after implementing HPWS, they might prioritize other means to achieve profitability (Cyert & March, 1963; Salge, 2011). If the positive linkage from HPWS to organizational

performance is not established, decision makers may reduce their future investment in HPWS. In summary, strong financial performance provides organizations with the slack resources, the information, and the managerial motivation needed to make longer-term investments in practices like HPWS.

Impact of HPWS on Firm Performance

Organizations use HPWS to develop employee knowledge, skills, and abilities and enhance employee motivation by providing training, empowerment, and contingent rewards. Empirical studies have linked each of the components of HPWS to performance outcomes. For instance, investment in employee training is positively related to performance (e.g., Delaney & Huselid, 1996; Kalleberg & Moody, 1994). Employee involvement programs are designed to motivate employees to voluntarily contribute to the development of the organization. Evidence suggests that empowerment is associated with positive outcomes, such as positive employee attitudes (Tesluk, Vance, & Mathieu, 1999) and organizational innovation (Yang & Konrad, 2011). Relatively high compensation with merit-based incentives is also a key feature of HPWS. Way (2002) argues that the advantage of performance-based payment is that it promotes employee skill development and motivation to produce superior outcomes. In a study by Kalleberg and Moody (1994), high reward was positively related to performance, and Lazear (1996) found a positive relationship between merit-based payment and productivity.

Theoretical foundations. Moving beyond empirical evidence linking specific HR practices to performance, explanations of the effect of HPWS on performance have largely relied on two theoretical traditions: the RBV and the behavioral perspective (Jiang, Lepak, Hu, & Baer, 2012). The RBV posits that HR is a potential source of competitive advantage that can create value for firms (Barney, 1991). In this perspective, HPWS is a reasonable investment in the people who constitute the organization-specific human capital driving firm performance (Wright, Dunford, & Snell, 2001). The behavioral perspective suggests that HR practices encourage employees to engage in productive behaviors. Specifically, expectancy theory (Lawler, 1986) posits that HPWS creates a high level of expectancy (strengthening the effort-performance link) and instrumentality (strengthening the performance-reward link) among employees, which enhances motivation and productivity (Guest, 1997; MacDuffie, 1995). Under these perspectives, employee AMO have been suggested as key linking mechanisms that promote high performance as a result of HPWS (Appelbaum, Bailey, Berg, & Kalleberg, 2000; Lepak, Liao, Chung, & Harden, 2006).

In addition, systems perspectives stress that complex organizational systems are valuable for managing turbulent environments (Burns & Stalker, 1961; Scott, 2008). Organizations with complex systems can outperform their counterparts because structural complexity allows them to absorb environmental instability with a greater variety of managerial responses to change (Boisot & Child, 1999). Empirical evidence supports the notion that organizational complexity enhances performance (e.g., Ashmos, Duchon, & McDaniel, 2000; Walters & Bhuian, 2004). HPWS is a complex system, not a single individual practice, and its effects result from integration among the separate practices rather than the additive effects of practices in isolation (Subramony, 2009). HPWS helps organizations respond to dynamic environments by motivating employees to identify and respond to problems and opportunities

arising from environmental changes. Because employees have enhanced knowledge and skill, they are more able to respond effectively to changes. Because employees are empowered and incentivized, they are more motivated to proactively respond to changes rather than wait for instruction from management (Jiang et al., 2012).

Productivity as a performance outcome. Productivity is a commonly used measure of firm performance in the SHRM field (Combs et al., 2006). Economists argue for the importance of productivity measures for assessing the performance of both firms (Dhawan, 2001) and the economy as a whole (Zhu, 2012). Productivity measures reflect the efficiency of the processes used to transform inputs into outputs and the effective use of resources for value creation (Tangen, 2005).

HPWS generates productivity increases by providing employees with knowledge, skills, empowerment, and incentives (Lawler, 1986). Both the RBV and the AMO (behavioral) perspectives provide theoretical bases for predicting a positive effect of HPWS on firm productivity. Consistent with the RBV, skill- and knowledge-building investments help employees identify ways to make their work processes more efficient (Wright, McMahan, & McWilliams, 1994). Knowledgeable and skilled employees are more capable of generating valuable ideas to enhance productivity. Consistent with the AMO perspective, the ability to add value increases motivation to suggest improvements by strengthening the effort-performance link. Empowerment motivates employees to identify improvements by giving them the authority to act on new ideas. Such authority strengthens the effort-performance link for employees by reducing potential barriers to idea implementation. Incentives motivate employees to engage in the discretionary effort required to identify and act upon inefficiencies by strengthening the link between performance and rewards (Lawler, 1986). Also, critics of HPWS argue that a primary effect of these systems is to increase productivity by pressuring employees to work harder under increased surveillance and control (Godard, 2004). In summary, multiple conceptual arguments support the prediction that HPWS increases productivity.

Empirical testing. Theoretical perspectives suggesting a positive association between HPWS and organizational performance have been supported by empirical findings in both service and manufacturing settings. Overall, Combs et al. (2006) estimated the size of the relationship (ρ) between HPWS and firm performance at .20. Subramony's (2009) meta-analysis of the effects of HR on performance outcomes showed small to moderate effect sizes of .26 for empowerment-enhancing HR practices, .24 for motivation-enhancing practices, and .17 for skill-enhancing practices. Jiang and colleagues' (2012) meta-analysis of the effects of HR on financial performance showed small to moderate effect sizes of .20 for opportunity-enhancing HR practices, .27 for motivation-enhancing practices, and .26 for skill-enhancing practices.

However, studies of HPWS have typically relied on cross-sectional data, and the positive effect of HPWS on performance may be inflated in cross-sectional studies due to heterogeneity bias and measurement error (Huselid & Becker, 1996). To date, the most comprehensive test of the direction of the causal relationship between HPWS and performance has been that conducted by Wright and his colleagues (2005). They analyzed correlations between HR practices and past, concurrent, and subsequent performance in a sample of 45 business units. Even though the number of employee participants was 13,005, limited sample size at the

business unit level and the short time lag (3 to 15 months) limited the ability of the study to determine the direction of the causal association (Wright et al., 2005). Three to 15 months may not be a long enough time frame to observe the effects of HPWS on performance. Huselid and Becker (1996) identified "implementation-to-benefits lags" whereby the effects of HR systems on performance were stronger 1 and 2 years later compared to the contemporaneous association. This result suggests that the benefits of introducing or changing HR practices take 1 to 2 years to be realized. Hence, an appropriate test of the causal association between HPWS and performance should utilize a 1- to 2-year time lag between measures in order to model the causal effect properly.

Beyond appropriate time lags, it is also important to control for prior performance when examining the association between HPWS and later performance. A limited number of studies have done so, and some of these studies have shown no significant association between past HPWS and current performance when past performance levels are controlled (e.g., Guest, Michie, Conway, & Sheehan, 2003; Wright et al., 2005). These null findings may be due to lack of statistical power to detect a small effect after controlling for past performance. Hence, by testing the association between earlier HPWS and later performance when earlier performance is controlled in a large national data set, the current study adds an important test of the causal links between HPWS and performance. However, we will not be able to assess the mechanisms responsible for the observed effects.

Hypothesis 1: HPWS at an earlier time point is positively associated with later productivity when productivity at the earlier time point is controlled.

Impact of Performance on Implementation of HPWS

One of the factors that may be extant in the complex causal chain linking HPWS and performance is the impact of past performance on future investments in HR. Prior authors have argued that HR investments are strongly affected by firm financial performance: "Firms facing difficulties reduce their variable pay, merit increases, and training budgets" (Wright et al., 2005, p. 419). This intuition is empirically supported by studies examining the component practices of HPWS (Boselie, Paauwe, & Jansen, 2001).

A few studies have tested the possibility of reverse causality, where performance leads to HPWS (e.g., Huselid, 1994; Shih, Chiang, & Hsu, 2006; Wright et al., 2005), but conceptually, the main purpose of those studies was to demonstrate the causal effects of HPWS on performance. As such, they treated reverse causality as a possible methodological limitation that should be overcome or controlled. Guest (2011) concludes in his recent review that there is considerably more evidence for an association between HR practices and performance than for a causal relation between these two constructs. He further demonstrates that past performance strongly predicts current performance, more so than HR practices. Taking the effects of past performance seriously, we develop conceptual arguments for why organizations with strong former performance are more likely to adopt HPWS.

Theory suggests several mechanisms linking past performance to future adoption of HR practices. For instance, resource dependency theory emphasizes the importance of the availability of resources to enable organizational action (Pfeffer & Salancik, 1978). While low-performing organizations tend to pursue control-based HR practices in order to contain costs, high-performing organizations can adopt more advanced HR practices to recruit and retain

talent (Boselie, Dietz, & Boon, 2005). High-performing organizations have greater ability to develop HPWS due to the availability of slack resources generated by strong financial outcomes. Furthermore, implementation of HPWS is a process that occurs over time (Guest & Bos-Nehles, 2013). Feedback regarding performance effects at earlier stages of adoption affects management's ability and motivation to support continued HPWS implementation.

Slack resources. Organizational performance is an indicator of organizational slack because slack typically grows as organizational performance increases (Cyert & March, 1963; Singh, 1986). Previous financial performance determines the level of slack resources that an organization can invest in social domains, such as employees, community, and environment (Waddock & Graves, 1997). While slack resources can remain unabsorbed as retained earnings, they can also be absorbed by increasing investments (Singh, 1986; Tan & Peng, 2003). Thus, slack resources enable organizations to invest in HPWS.

Although HPWS is intended to enhance performance, it "also carries a cost since HR must itself be internally produced (e.g., by an HR department) or bought in external markets (e.g., HR consultants or vendors)" (Kaufman & Miller, 2011, p. 536). Because establishing HPWS can be costly, firms may not adopt HPWS even though they would benefit from doing so (Godard, 2004; Godard & Delaney, 2000). The beneficial effects of HPWS rely on human capital, which is generally a long-term investment aimed at contributing to a firm's future profitability (Lepak & Snell, 1999). Firms with slack resources based on strong financial performance can seek long-term investments, whereas firms having financial performance difficulties have little discretion to make long-term investments, including investments in people (Waddock & Graves, 1997).

Rather than investing in people and HR systems, organizations that experience declining performance may focus on reducing labor costs. Organizations adopting cost-cutting strategies are less likely to invest in long-term training and development practices (Cascio, 1993). Reducing expenses by controlling HR costs may result in short-term profits, and companies experiencing deficits may cut HR investments in order to demonstrate the profitability of their businesses to investors. In addition, companies face the principal-agent problem. Because executives are often compensated based on short-term profits, their decisions are likely to favor short-term profits over longer-term investments (Bebchuk, Cohen, & Spamann, 2010). Executives may be particularly incentivized to forgo longer-term investments when financial performance is poor because doing so maximizes retained earnings, and hence, executive bonuses.

In comparison to the situation faced by decision makers in low-performing organizations, decision makers in high-performing organizations are more likely to find that HPWS is suitable for their needs. High-performing organizations are able to provide competitive compensation and innovative practices in order to sustain their profitability. They require HR systems that support talented employees who will drive future performance. Thus, resource-rich organizations tend to adopt sophisticated HR practices to recruit and retain talent (Boselie et al., 2005).

Adaptation perspective on HPWS implementation. Relatively little research has examined the nature of HPWS implementation. Consistent with the general systems approach, we consider the adaptation perspective on the development of managerial practices. In this view,

managerial practices develop through ongoing environmental scanning, strategic response formulation, and structural adjustment processes whereby organizations achieve "adaptive advantage" by adopting new practices, recombining existing practices, and achieving interactions among practices (Miner, 1994). As such, organizations experience structural inertia or path dependence, such that consistency of HPWS over time is expected (Bowen & Ostroff, 2004). Therefore, structural changes are more often incremental than radical (Salge & Vera, 2013). Little is known about the extent to which HPWS implementation is incremental or radical; however, Pil and MacDuffie (1999) argue that organizations implement HPWS incrementally through an adaptive process because its costs are absorbed in the short term whereas its benefits take time to accumulate.

Providing a conceptual foundation for future work in this area, Guest and Bos-Nehles (2013) outline four components of the implementation process, arguing that the components are not always separate or sequential. In their view, implementation begins with a decision by HR managers and senior leaders to introduce an HR practice. HR managers then develop the practice at a particular level of quality, from superficial compliance with institutional requirements (Edelman, 1992) to purposeful customization to fit organizational needs (Gondo & Amis, 2013). Once the practice is introduced and developed by HR, the next phase involves implementation by line managers. The final component of the implementation process is the quality of line management implementation, which can vary widely (Kulik & Bainbridge, 2006).

This multifaceted view implies that the process of HPWS implementation takes substantial time and management effort with significant potential for implementation difficulties. As such, the model implies that there are no guarantees of success, which is consistent with Barney's (2001) view that capacity to implement new practices varies between organizations and can constitute a competitive advantage.

The four components of implementation focus attention on several potential problems. First, HR must introduce the concept of HPWS to senior managers and persuade them to invest in making the organizational changes needed for HPWS adoption (Guest & Bos-Nehles, 2013). Next, HR must customize HPWS to make it fit the local context, which requires substantial effort as well as stakeholder consultation. Gondo and Amis (2013) argue that practices are essentially reconstituted each time they are implemented: "Practices that diffuse widely are characterized by situated actors who continuously work at establishing deep connections between specific situational and the more abstract ideational aspects of a practice" (p. 231). Determining how the abstract idea of HPWS can work in a specific establishment requires organizational members to identify and develop new sets of skills, beliefs, and collaborative routines (Edmondson, Bohmer, & Pisano, 2001). As HR works with stakeholders to develop HPWS practices, the organization develops its own HPWS version, which line managers are then expected to implement. Implementation by line managers is known to be a problem for HR practices in general (Khilji & Wang, 2006). The quality of implementation may vary across organizational units because line managers either do not know how to or do not want to implement HPWS practices (Zbaracki, 1998). The impact of HPWS varies due to implementation quality, which can range from thorough, to superficial, to active rejection (Wright & Nishii, 2013).

Consistent with the notion of positive feedback loops in general systems theory (Von Bertalanffy, 1968), evidence of the early and ongoing success of HPWS is likely to be quite

valuable for ensuring implementation effectiveness. As the four-component model of HR implementation implies, even in cases where senior leaders support the introduction of HPWS, ongoing support is not guaranteed: "Senior executives may be unwilling to continue to invest in HR practices they perceive as providing no identifiable benefit and line managers are unlikely to persist in devoting their time to implementing practices they perceive to have no impact" (Guest & Bos-Nehles, 2013, p. 84). Guest and King (2004) documented that senior managers often hold negative views of HR practices as transient and unnecessary bureaucratic fads. As such, for HPWS implementation to be successful, HR managers must build ongoing arguments for the continued provision of managerial resources and support (Gondo & Amis, 2013). Productivity improvements are likely to be a particularly persuasive form of evidence of the value of HPWS because they imply that efficiency has improved. Productivity improvements reflect gains in the efficiency of the processes used to transform inputs into outputs and the effective use of resources for value creation (Tangen, 2005). Hence, productivity increases constitute a core source of the organizational slack needed to sustain complex organizational changes, like the implementation of HPWS.

Evidence that productivity improvements lead to ongoing HPWS enhancements, which in turn generate productivity gains, would indicate the existence of a positive feedback loop between HPWS and productivity. The positive feedback loop posited by general systems theory suggests that HPWS implementation takes place through an adaptive process. Rather than seeing HR practices as a top-down resource allocation decision at a single point in time, organizations develop HPWS through a learning-by-doing approach to translate the abstract concept of HPWS into a concrete set of practices that fit the local context (Gondo & Amis, 2013). As such, organizational adaptation of HPWS is likely to be accomplished incrementally as managers accumulate knowledge and experience in its operation. This logic suggests that previous performance is a predictor of increases in HPWS implementation because organizations adopt more HPWS based on previous successes.

Hypothesis 2: Productivity at an earlier time point is positively associated with the level of HPWS at a later time point when earlier HPWS is controlled.

Method

Sample

The Workplace and Employee Survey (WES) administered by Statistics Canada to a stratified sample of Canadian businesses provided the data for hypothesis testing (Statistics Canada, 2009). The data set is longitudinal and national in scope with more than 6,000 employers taking part. The 2001, 2003, and 2005 WES provided Time 1, 2, and 3 (T1, T2, T3) data on performance and HPWS. The response rates to the 2001, 2003, and 2005 surveys were 83.1%, 77.7%, and 85.1%, respectively. Measures for this study were taken from the workplace survey, with the respondent being a senior manager at each establishment.

We used data from employers who responded to the WES at all three time points to test longitudinal effects. Considering that small organizations are likely to be operated without advanced HR systems, companies with fewer than 20 employees were excluded from the analysis. Respondents with missing data were excluded, for a final sample of 2,228. The sample was weighted to reflect population estimates, as required by Statistics Canada. Means, standard deviations, and correlations are shown in Table 2.

Table 2
Correlation Matrix

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Productivity01[a]	11.67	0.99	—								
2. Productivity03[a]	11.71	0.92	.90**	—							
3. Productivity05[a]	11.77	0.93	.86**	.93**	—						
4. HPWS01	0.25	0.15	.27**	.27**	.30**	—					
5. HPWS03	0.24	0.15	.26**	.27**	.30**	.71**	—				
6. HPWS05	0.26	0.15	.21**	.24**	.25**	.57**	.68**	—			
7. Size[a]	3.58	0.82	.10**	.10**	.16**	.38**	.36**	.28**	—		
8. Industry	0.41	0.49	.36**	.39**	.36**	.04*	.04*	.03	.08**	—	
9. Unionization	0.27	0.45	.15**	.14**	.16**	.19**	.23**	.17**	.26**	.07**	—

Note: N = 2,228. Industry coded as 0 = service, 1 = manufacturing. Unionization coded as 0 = no, 1 = yes. HPWS = high-performance work systems.
[a]Log transformed.
*$p < .05$
**$p < .01$

Measures

HPWS. Measures of HPWS have typically included training, incentive compensation, employee involvement or empowerment, and participative work design (Combs et al., 2006; Huselid, 1995). The WES contains a set of HR practices that allows researchers to study HR practices as a system (e.g., Mohr & Zoghi, 2008; Zatzick & Iverson, 2006). Using the WES data, HPWS is measured with five sets of practices in the areas of training, employee empowerment, compensation, benefits, and work design (see Appendix A). We followed previous studies in using additive indices of HR practices (MacDuffie, 1995; Wright et al., 2005; Youndt, Snell, Dean, & Lepak, 1996). Each specific practice in these five areas is coded as a dichotomous variable (1 = yes, 0 = no). Adoption of practices in each area is obtained by calculating the mean across the specific practices. In all cases, the Kuder-Richardson formula for calculating internal consistency reliability (α) is used for indices combining dichotomous variables. While we have little information to test the validity of these measures, we did find that the correlation between the training measure and separately reported costs of training per capita indicated a medium-sized association (r = .32 at T1, r = .39 at T2, r = .41 at T3).

The *training* measure consists of survey questions regarding 13 types of classroom training and 13 types of on-the-job training (T1, α = .87; T2, α = .86; T3, α = .86). Items include new employee orientation, professional training, managerial/supervisory training, apprenticeship training, sales and marketing training, computer hardware training, computer software training, other office and nonoffice equipment training, group decision-making or problem-solving training, team-building/leadership/communication training, occupational health and safety or environmental protection training, literacy or numeracy training, and other training.

Empowerment is measured as employee participation in 12 types of decisions: daily planning of individual work, weekly planning of individual work, follow-up of results, customer relations, quality control, purchase of necessary supplies, maintenance of machinery and

equipment, setting staffing levels, filling vacancies, training, choice of production technology, and product/service development. Survey respondents indicated who in the organization normally makes decisions in each of these areas. If the respondent said that "nonmanagerial employees" or "the work group" normally makes a decision, the item was coded as yes (1); otherwise, no (0) (T1, α = .81; T2, α = .81; T3, α = .84).

The *compensation* measure consists of five items. Senior managers reported whether the compensation system at their establishment includes each of the following incentives (1 = yes, 0 = no): individual incentive systems, group incentive systems, profit-sharing plan, merit pay and skill-based pay, and employee stock plans. Reliability estimates for this measure were relatively low (T1, α = .60; T2, α = .64; T3, α = .54), which is consistent with compensation systems as formative constructs where practices potentially substitute for one another. We retained the measure because of the importance of financial incentives for the motivational aspect of HPWS.

The measure of *benefits* includes 11 items funded solely by employers or by employers and employees together (1 = yes, 0 = no): pension plan, life and/or disability insurance, supplemental medical, dental care, group RRSP (a Canadian form of defined contribution retirement savings plan), stock purchase or other savings plan, supplements to employment insurance benefits, workers' compensation, severance allowances, flexible benefits plan, and other (T1, α = .78; T2, α = .76; T3, α = .76).

Six practices are included in the *work design* portion of the HPWS measure. Managers reported whether each of the following practices existed at their establishment (1 = yes, 0 = no): an employee suggestion program, information sharing with employees, joint labor-management committees, self-directed work groups, flexible job design, and problem-solving teams (T1, α = .67; T2, α = .73; T3, α = .73).

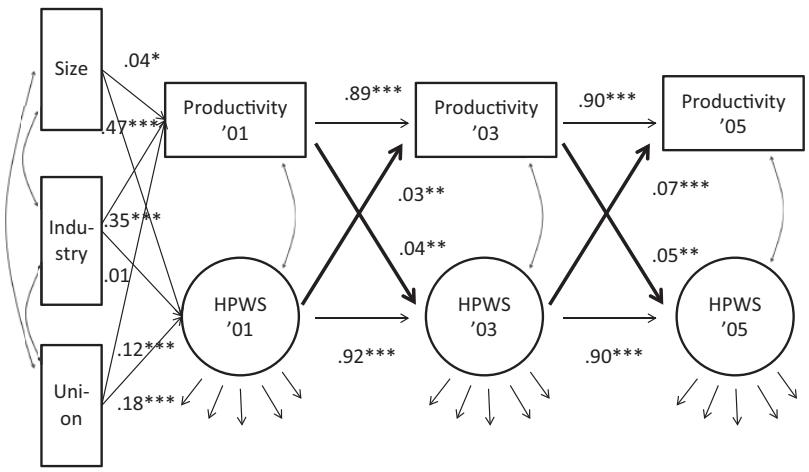
Productivity. We used the widely studied measure of productivity as a measure of financial performance. Consistent with prior research (e.g., Datta, Guthrie, & Wright, 2005; Huselid, 1995; Konrad & Mangel, 2000), productivity was calculated as the logarithm of the gross operating revenue divided by the number of employees.

Controls. Firm size, based on the logarithm of number of employees, was controlled because large firms are more likely to establish HR practices due to economies of scale (Datta et al., 2005; Huselid, 1995; Konrad & Linnehan, 1995). In addition, industry category (manufacturing and service) was controlled because industries experience different growth and performance patterns (Datta et al., 2005). Unionization has been studied as a variable that affects both HPWS and performance (Liu, Guthrie, Flood, & MacCurtain, 2009). To control for unionization, an establishment was considered to be unionized (coded 1) if one or more employees were covered by a collective bargaining agreement (otherwise, coded 0).

Analysis

To test causality between HPWS and performance, we tested a cross-lagged panel model, with structural equation modeling (using AMOS), which has been suggested as the most suitable method for analyzing cross-lagged designs (Finkel, 1995; Little, Preacher, Selig, & Card, 2007). Our cross-lagged model was designed to meet the three principles of causality provided by Gollob and Reichardt (1991): considering the ordering of causes and outcomes,

Figure 1
Cross-Lagged Structural Equation Modeling Results Testing the Causal Relationships Between High-Performance Work Systems and Productivity



Note: HPWS = high-performance work systems; CFI = comparative fit index; GFI = goodness-of-fit index; RMSEA = root mean square error of approximation; TLI = Tucker-Lewis index; RMR = root mean square residual.
*$p < .05$
**$p < .01$
***$p < .001$

controlling autoregressive influences, and setting an appropriate time lag length. Auto-correlated errors were accommodated in testing the longitudinal panel model (Little, 2013), reflecting systematic measurement error over time (Gerhart et al., 2000). HPWS at an earlier time point predicted performance at a later time point when performance at the earlier time point was controlled, and performance at an earlier time point predicted HPWS at a later time point when HPWS at the earlier time point was controlled. The 2-year time lag was based on the "implication-to-benefits lags" suggested by Huselid and Becker (1996). Following standard guidelines in designing structural equation modeling with longitudinal data (MacCallum & Austin, 2000), we include the cross-sectional correlation between HPWS and performance along with the hypothesized lagged effects. The three control variables of industry, firm size, and unionization were modeled as predictors of T1 HPWS and performance (see Figure 1). This model fit the data better than other possible models did.

Results

To examine the validity of our measurement across different time periods, we conducted three measurement invariance tests: metric invariance, invariant uniqueness, and invariant factor variance (see Table 3). Although the chi-square difference test is widely used in testing

Table 3
Tests of Measurement Invariance

	χ^2	*df*	$\Delta\chi^2$	CFI	ΔCFI	RMSEA	TLI
Initial	1014.7	72		.945		.070	.919
Metric invariance	1152.1	80	137.4***	.937	.008	.071	.917
Equal error variance	1258.9	90	106.8***	.931	.006	.070	.920
Invariant factor variance	1266.6	92	7.7*	.931	.000	.069	.921

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation; TLI = Tucker-Lewis index.
*$p < .05$
***$p < .001$

Table 4
Fit Statistics for Nested Causal Models

Model	χ^2	*df*	CFI	GFI	RMSEA	TLI	Comparison	$\Delta\chi^2$	Preference
P1. Stability	2132.6	164	.92	.92	.07	.90			
P2. Standard	2064.7	162	.92	.92	.07	.90	P1-P2	67.9***	P2
P3. Reverse	2109.6	162	.92	.92	.07	.90	P1-P3	22.9***	P3
P4. Reciprocal	2043.4	160	.92	.92	.07	.90	P2-P4	89.2***	P4
							P1-P4	21.3***	P4
							P3-P4	66.2***	P4

Note: CFI = comparative fit index; GFI = goodness-of-fit index; RMSEA = root mean square error of approximation; TLI = Tucker-Lewis index.
***$p < .001$

measurement invariance, this test is likely to reject measurement invariance because of its sensitivity to a large sample size (Vandenberg & Lance, 2000). A practical alternative for testing measurement invariance with large sample sizes is to check the change in comparative fit index (ΔCFI), and because ΔCFI was less than or equal to .01, measurement invariance for the HPWS measure was supported (Byrne & Stewart, 2006; Cheung & Rensvold, 2002; Shek & Ma, 2010).

We present results for nested model tests in Table 4. Four competing models were considered to evaluate causality between HPWS and performance. We compared a stability model without cross-lagged effects, a standard causal model with paths from earlier HPWS to later performance, a reverse causal model with paths from earlier performance to later HPWS, and a reciprocal causal model with paths from earlier HPWS to later performance and from earlier performance to later HPWS. Chi-square difference tests support the reciprocal model because adding reciprocal causation significantly improved model fit.

The overall model fit testing the relationship between productivity and HPWS is satisfactory (cmin/*df* = 12.77, $p = .000$, CFI = .92, goodness-of-fit index =.92, root mean square error of approximation = .07, Tucker-Lewis index = .90, root mean square residual = .01).

Supporting Hypothesis 1, the paths from T1 HPWS to T2 productivity ($p < .01$) and from T2 HPWS to T3 productivity ($p < .001$) are both positive and significant (see Figure 1). Supporting Hypothesis 2, the paths from H1 productivity to H2 HPWS and from H2 productivity to H3 HPWS are also significant and positive ($p < .01$).

Additional Analyses

Comparison of cross-lagged to cross-sectional models. Following prior research (Huselid & Becker, 1996), we tested the cross-sectional models to compare the size of the path coefficients to those generated by the cross-lagged model. Findings indicated that the effect of HPWS on productivity in the cross-sectional model (without controlling for previous performance) was .35 at T1, .38 at T2, and .39 at T3 ($p < .001$), compared with the effect size of .03 between T1 and T2 and .07 between T2 and T3 in the cross-lagged model ($p < .01$). These comparisons show that effect size estimates are exaggerated in cross-sectional studies (Gollob & Reichardt, 1991; MacCallum & Austin, 2000). In addition, a lagged model without controlling previous performance produced effect sizes of .36 between T1 HPWS and T2 productivity, and .38 between T2 HPWS and T3 productivity, which is similar to the cross-sectional model. These results indicate the importance of controlling for previous performance when estimating the performance effect of HPWS.

Individual practice level. Some researchers have pointed out that the association between HPWS and performance may differ across each subdimension of HPWS (Combs et al., 2006; Jiang et al., 2012; Lepak et al., 2006). We found that all components of HPWS positively predicted later performance either between T1 and T2 or between T2 and T3 or both (see Appendix B). Training positively predicted productivity from T2 to T3 but not from T1 to T2. Compensation and benefits positively predicted later productivity both from T1 to T2 and from T2 to T3. Work design showed a nonsignificant tendency ($p < .10$) in the prediction of productivity from T1 to T2 and no significant relationship to productivity from T2 to T3. The influence of T1 empowerment on T2 productivity was negative, but the influence of T2 empowerment on T3 productivity was positive. In sum, most of the HPWS components positively predicted productivity, but different practices showed different specific effects.

Productivity positively predicted later empowerment and benefits both from T1 to T2 and from T2 to T3. Productivity predicted training from T1 to T2 but not from T2 to T3. Productivity predicted compensation from T2 to T3 but not from T1 to T2. T1 productivity positively predicted T2 work design, but T2 productivity negatively predicted T3 work design. In sum, productivity positively predicted most of the HPWS components, but different practices showed different specific effects. These findings suggest that in HPWS, individual practices are organized as a whole, and their combined effects produce a general pattern of reciprocal causation between HPWS and performance.

Feedback analysis. We examined the feedback effect from productivity to HPWS by analyzing T2 productivity as a mediator linking T1 HPWS and T3 HPWS (Cole & Maxwell, 2003; Little et al., 2007; Preacher & Hayes, 2008). Before testing the mediation effect, we checked whether HPWS can be considered a time-dependent process. A Sobel test showed that T2 HPWS significantly mediated the association between T1 HPWS and T3 HPWS

($p < .001$). In addition, the correlations between the HPWS measures are higher among adjacent time points than among distant points. Specifically, the associations of T1 HPWS with T2 HPWS ($r = .71$) and T2 HPWS with T3 HPWS ($r = .68$) are stronger than the association of T1 HPWS with T3 HPWS ($r = .57$).

The main effect, the effect of T1 HPWS on T2 productivity and T2 HPWS on T3 productivity, was supported. The existence of feedback was tested by examining the effect of T2 productivity on T3 HPWS, which was supported ($p < .01$). In addition, a Sobel test confirmed that productivity at T2 mediated the effect of T1 HPWS on T3 HPWS ($p < .05$).

Discussion

Previous theorizing has focused on the potential of HPWS to have positive effects on performance and treated the possibility of reverse causality between these two constructs primarily as a methodological problem. This paper developed theory explaining how performance can be a causal factor leading to implementation of HPWS. A general systems theory perspective (Von Bertalanffy, 1968) suggests that the causal relationship between HPWS and performance is reciprocal and that high performance subsequent to the implementation of HPWS generates the information and slack resources needed for firms to continue strengthening their HR systems. SHRM theory has long considered HPWS as a system that, when effective, evidences vertical linkage to firm strategy and horizontal linkages between its component parts (Delery & Doty, 1996). This paper contributes to theory by emphasizing the importance of feedback from the environment and the impact of the feedback loop, where firm outputs affect the flow of information and resources as inputs into the organizational system. Our findings indicate positive feedback between HPWS and productivity whereby an increase in one results in a subsequent increase in the other, generating a virtuous performance cycle. The positive feedback loop contributes to logic explaining why the beneficial effects of HPWS may be difficult for competitors to imitate. As such, this model adds to understanding of how HPWS creates competitive advantage for firms (Barney, 2001).

The framework of general systems theory (Kast & Rosenzweig, 1972; Von Bertalanffy, 1968) suggests that performance outputs generate responses from the organizational environment that determine the future inflow of resources to the organization. When performance is strong, inputs in the form of continued resources and support allow the organization to build and maintain strong throughput processes, such as HPWS. This model suggests that HPWS implementation is an adaptive process based on learning by doing. Decision makers test HPWS and extend the application of the system based on successful experiences (Miner, 1994). Specific establishments develop their HPWS over time to improve its functioning and fit to the needs of the local context (Gondo & Amis, 2013). Positive productivity results create the information needed to persuade decision makers of the value of the HPWS as well as the slack resources required to make further investments in the system. Hence, the positive productivity effects of HPWS increase the firm's implementation capabilities. Firm differences in implementation capabilities mean that HPWS has the potential to create sustainable competitive advantage (Barney, 2001).

Prior research showing the association between performance and HPWS has largely relied on cross-sectional or postpredictive studies where researchers measure the relationship between current HPWS and past performance (Wright et al., 2005). Although some scholars

have raised methodological questions about the causality issue in HR studies, empirical research addressing this issue has been limited. We tried to overcome prior methodological problems by testing the associations between HPWS and performance using longitudinal data with three points in time, a 2-year lag, and a large sample size. In alignment with previous studies (Huselid & Becker, 1996), the cross-lagged model produced smaller coefficients for the effect of earlier HPWS on later performance than were observed in the cross-sectional model.

However, the smaller effect size does not mean that the contribution of HPWS on organizational performance is trivial. From the general systems perspective, the mutual causation observed between HPWS and productivity implies the existence of a positive feedback loop between these two components of the organizational input-throughput-output system (Von Bertalanffy, 1968). The positive feedback loop detected in these data indicates that the performance effects of HPWS are amplified over time. When HPWS generates productivity improvements, firms gain slack resources, which they can invest to further develop and strengthen the HPWS throughput system. Strengthening an existing HPWS may involve adding components, such as more training; expanding the system to cover more employees; and/or improving implementation to increase consistency across organizational units. Through a systemic adaptation process, firms customize their HR systems by continuously adjusting them to fit a specific, changing context, making imitation of HPWS increasingly difficult over time (Gondo & Amis, 2013). The positive feedback loop generated between HPWS and productivity helps to maintain performance gains over time by preventing implementation lapses and making the system more difficult for competitors to copy (Barney, 1991). The positive performance spiral between HPWS and performance leads to substantial differences between organizations as the positive feedback accentuates the benefits to the firm (Boisot & Child, 1999; Gell-Mann, 1994).

The strong autocorrelation between T1, T2, and T3 HPWS and between T1, T2, and T3 productivity reduced our ability to detect extant effects between HPWS and performance. Yet we detected a significant lagged effect of HPWS on productivity growth despite the strong autocorrelation between the productivity measures at different time points. As such, our findings support prior theoretical claims that HPWS strengthens firm financial performance, although the actual effect may not be as large as suggested by previous cross-sectional studies. We also detected a significant lagged effect of productivity on growth in HPWS. As such, our findings support the claim that the effect of performance on HPWS must be considered when theorizing the causal associations between HPWS and performance, especially when the outcome is productivity. This finding supports the usefulness of applying general systems theory to enhance understanding of performance as both an antecedent and an outcome of HPWS.

Some researchers have suggested the possibility that organizations with poor performance may adopt new HR practices as a means to overcome their performance problems (Pil & MacDuffie, 1996). However, our findings link high performance rather than low performance to the implementation of HPWS. We do not intend to suggest that firms cannot adopt HPWS to solve their performance problems. Rather, these findings suggest that firms with low productivity must overcome resource constraints in order to begin the process of adopting HPWS. One constraint is lack of knowledge regarding HPWS concepts and implementation. Bringing HR expertise into the firm by creating a senior HR position as part of the

executive team provides a source of HPWS knowledge and capability to link HPWS to the business strategy. Including HR experts at the highest organizational levels means the knowledge required for successful strategy implementation through HR processes is available to strategic decision makers (Buyens & De Vos, 2001). Another constraint is enhanced competition in a globalized economy (Orlitzky & Frenkel, 2005). Firm financial performance can be generated by coercive "low-road" HR models, particularly when the business competes by producing a standardized product at the lowest possible cost (Arthur, 1992). Firms must match their HR architectures to their HR needs in order to achieve financial performance benefits (Lepak & Snell, 2002). This logic suggests that using HPWS to solve financial performance problems requires consideration of strategy, the business environment, and internal HR capabilities.

Limitations and Future Research Directions

The findings of this research can be used as a basis for future work examining the causal relationship between HPWS and performance as well as mediators and moderators of that relationship. However, like all research, this study has its limitations.

First, we provided several reasons why firm performance leads to HPWS. We did not treat these explanations as competing hypotheses and could not differentiate process mechanism linking performance to HPWS. However, the finding that earlier productivity consistently leads to later HPWS suggests that empirical testing of the conceptual mechanisms linking performance to HPWS would be valuable.

Second, data at three time intervals allow us to examine the feedback loop between HPWS and performance in a very limited way. A longitudinal analysis across multiple time periods is necessary to explain the longer-term relationship between performance and HPWS. In addition, we relied on data from three specific time points (2001, 2003, and 2005) to test for causality by examining change during that time interval. Although there seemed to have been no unusual social or economic events in Canada during this time, our results may be due to the specific conditions existing between 2001 and 2005.

Third, contingent factors need to be considered to understand the impact of performance on HPWS. Despite the suggestions of the "best-practice" perspective, all firms do not make the same investments in HR solely based on their performance level (Purcell, 1999). An important principle of SHRM theorizing proposes that the value of firm investments in HR practices depends on business strategy (Arthur, 1992; Youndt et al., 1996). We tested the interactions of both HPWS and performance as independent variables with several business strategy measures but did not find any significant moderating effects on either performance or HPWS in our models. Our finding that high productivity leads to an increase in HPWS implementation suggests that performance difficulties create barriers to implementing HR practices. As such, there may be value in future research aimed at identifying the conditions under which firms with performance difficulties are able to overcome the liability of resource constraints. HR expertise among strategic decision makers and fit to the business strategy are two factors worthy of consideration, and others may exist. In addition, it would be valuable to consider mediators that explain the relationship between performance and HPWS in order to clarify our understanding of the mechanisms linking the two variables (Beltrán-Martín, Roca-Puig, Escrig-Tena, & Bou-Llusar, 2008).

A full explanation of the link between HPWS and performance requires that the HPWS measure cover the entire breadth of that construct. Our HPWS measure covered most components of HPWS, but some components, such as selection and job security, were not included in the WES data set. In fact, researchers have not reached a consensus on what constitutes HPWS (Becker & Gerhart, 1996; Edwards & Wright, 2001; Harley, 2002). For example, some scholars include job security as an important component of HPWS (e.g., Pfeffer, 1998a, 1998b), while others disagree (e.g., Edwards & Wright, 2001). Therefore, it is necessary for researchers to agree on the factors constituting both HPWS and organizational performance as constructs for this field.

Another limitation of our measure is the set of dichotomous yes/no indicators of the presence of specific HR practices. We have no information on how well the practices are implemented, how consistently they are distributed across organizational units, or what proportion of the firm's employees experience HPWS. As such, our measures imply simply that "more HR" is better for firms. This argument can be problematic because the more-HR approach ignores its costs (Kaufman & Miller, 2011). However, the general systems approach can answer the question of why organizations choose a specific level of HR practices given that a firm's previous performance level creates resources for implementation. As such, the general systems theory approach takes the cost of HR into consideration. Future studies can establish the validity of the causal association across multiple HPWS measures (Wright et al., 2001).

Finally, we found that a unidirectional interpretation of causation between HPWS and productivity can be misleading in the North American context. Whether the bidirectional causation between HPWS and performance is generalizable to other cultural contexts is a matter for future research.

Conclusions

The reciprocal nature of the relationship between HPWS and organizational performance requires HR researchers and practitioners to take a systemic view of the impact of HR practices. While SHRM theory has considered HPWS as a system of horizontally integrated practices linked to the external environment through consistency with the business strategy (Delery & Doty, 1996), previous theorizing has neglected the impact of feedback from the environment on the implementation of HPWS. The reciprocal relationship between HPWS and performance suggests both the vulnerability of preserving HPWS under environmental constraints and the importance of constant investment in HPWS in order to generate competitive advantage (Barney, 2001). High investment in HPWS results in increased productivity, which allows for further investments to extend the HPWS system and refine it to fit the local context (Gondo & Amis, 2013). The reciprocal relationship also suggests the importance of demonstrating the value of HPWS to decision makers. When HR practitioners show that HPWS creates productivity gains, decision makers are more likely to further invest in extending or strengthening HPWS. In addition, to reap the full benefits of HPWS, organizations need to be consistent in their HR practices over time (Bowen & Ostroff, 2004). If decision makers reduce investment in HR during difficult financial times, our findings suggest that the firm could fall into a downward spiral of decreasing HPWS and performance.

Appendix A

High-Performance Work Systems Measure

HR Practice	Items
Training (26 items)	Did this workplace pay for or provide any of the following types of classroom job-related training[a]? (yes/no)
	Did this workplace pay for or provide any of the following types of on-the-job training? (yes/no)
	Orientation for new employees, managerial/supervisory training, professional training, apprenticeship training, sales and marketing training, computer/hardware, computer/software, other office and nonoffice equipment, group decision making or problem solving, team building/leadership/communication, occupational health/safety/environmental protection, literacy or numeracy, other training
Empowerment (12 items)	Who normally makes decisions with respect to the following activities? (coded as 1 when decisions made by nonmanagerial employee, work group, or work supervisor; others as 0)
	Daily planning of individual work, weekly planning of individual work, follow-up of results, customer relations, quality control, purchase of necessary supplies, maintenance of machinery and equipment, setting staffing levels, filling vacancies, training, choice of production technology, product/service development
Compensation (5 items)	Does your compensation system include the following incentives? (yes/no)
	Individual incentive systems, group incentives systems, profit-sharing plan, merit pay and skill-based pay, employee stock plans
Benefits (11 items)	How are these benefits funded? (coded 1 when benefits are funded by employer only or by employee and employee; otherwise coded 0)
	Pension plan, life and/or disability insurance, supplemental medical and dental care, group RRSP, stock purchase or other savings plan, supplements to employment insurance benefits (e.g., for maternity or layoff), workers' compensation, severance allowances, flexible benefit plan, other
Work design (6 items)	For nonmanagerial employees, which of the following practices exist on a formal basis in your workplace? (yes/no)
	Employee's suggestion program, flexible job design, information sharing with employees, problem-solving teams, joint labor-management committees, self-directed work groups

Note: HR = human resource management.
[a]Classroom training includes all training activities that have a predetermined format, including a predefined objective; specific content; progress that may be monitored and/or evaluated.

Appendix B

Cross-Lagged Structural Equation Modeling Results for Component High-Performance Work System Practices

Component	Time (T)	HR→P	P→HR	Model Fit Indices
Training	T1→T2	.01	.07***	χ^2 = 348.7, *df* = 16, *p* = .000, CFI = .97,
	T2→T3	.02**	−.03	GFI = .97, RMSEA = .10, TLI = .94

(continued)

Appendix B (continued)

Component	Time (T)	HR→P	P→HR	Model Fit Indices
Empowerment	T1→T2	−.03**	.12***	χ^2 = 372.8, *df* = 16, *p* = .000, CFI = .96,
	T2→T3	.03***	.18***	GFI = .97, RMSEA = .10, TLI = .92
Compensation	T1→T2	.06***	−.01	χ^2 = 306.5, *df* = 16, *p* = .000, CFI = .97,
	T2→T3	.06***	.10***	GFI = .97, RMSEA = .09, TLI = .94
Benefits	T1→T2	.03**	.09***	χ^2 = 323.5, *df* = 16, *p* = .000, CFI = .98,
	T2→T3	.03***	.09***	GFI = .97, RMSEA = .09, TLI = .94
Work design	T1→T2	.02†	.08***	χ^2 = 279.9, *df* = 16, *p* = .000, CFI = .97,
	T2→T3	.01	−.08***	GFI = .97, RMSEA = .09, TLI = .94

Note: HR = human resource management; P = productivity; CFI = comparative fix index; GFI = goodness-of-fit index; RMSEA = root mean square error of approximation; TLI = Tucker-Lewis index.
†$p < .10$
**$p < .01$
***$p < .001$

References

Allen, M. R., & Wright, P. M. 2007. Strategic management and HRM. In P. F. Boxall, J. Purcell, & P. M. Wright (Eds.), *The Oxford handbook of human resource management*: 88-107. Oxford, UK: Oxford University Press.

Appelbaum, E., Bailey, T., Berg, P., & Kalleberg, A. L. 2000. *Manufacturing advantage: Why high-performance work systems pay off*. Ithaca, NY: Cornell University Press.

Arthur, J. B. 1992. The link between business strategy and industrial relations systems in American steel minimills. *Industrial and Labor Relations Review*, 45: 488-506.

Ashmos, D. P., Duchon, D., & McDaniel, R. R., Jr. 2000. Organizational responses to complexity: The effect on organizational performance. *Journal of Organizational Change Management*, 13: 577-595.

Ashmos, D. P., & Huber, G. P. 1987. The systems paradigm in organization theory: Correcting the record and suggesting the future. *Academy of Management Review*, 12: 607-621.

Barney, J. B. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17: 99-120.

Barney, J. B. 2001. Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management*, 27: 643-650.

Bebchuk, L. A., Cohen, A., & Spamann, H. 2010. The wages of failure: Executive compensation at Bear Stearns and Lehman 2000-2008. *Yale Journal on Regulation*, 27: 257-282.

Becker, B. E., & Gerhart, B. 1996. The impact of human resource management on organizational performance: Progress and prospects. *Academy of Management Journal*, 39: 779-801.

Becker, B. E., & Huselid, M. A. 2006. Strategic human resources management: Where do we go from here? *Journal of Management*, 32: 898-925.

Beltrán-Martín, I., Roca-Puig, V., Escrig-Tena, A., & Bou-Llusar, J. C. 2008. Human resource flexibility as a mediating variable between high performance work systems and performance. *Journal of Management*, 34: 1009-1044.

Boisot, M., & Child, J. 1999. Organizations as adaptive systems in complex environments: The case of China. *Organization Science*, 10: 237-252.

Boselie, P., Dietz, G., & Boon, C. 2005. Commonalities and contradictions in HRM and performance research. *Human Resource Management Journal*, 15: 67-94.

Boselie, P., Paauwe, J., & Jansen, P. 2001. Human resource management and performance: Lessons from the Netherlands. *International Journal of Human Resource Management*, 12: 1107-1125.

Bowen, D. E., & Ostroff, C. 2004. Understanding HRM-firm performance linkages: The role of the "strength" of the HRM system. *Academy of Management Review*, 29: 203-221.

Burns, T., & Stalker, G. M. 1961. *The management of innovation*. London: Tavistock.

Buyens, D., & De Vos, A. 2001. Perceptions of the value of the HR function. *Human Resource Management Journal*, 11: 70-89.

Byrne, B. M., & Stewart, S. M. 2006. Teacher's corner: The MACS approach to testing for multigroup invariance of a second-order structure: A walk through the process. *Structural Equation Modeling: A Multidisciplinary Journal*, 13: 287-321.

Cascio, W. F. 1993. Downsizing: What do we know? What have we learned? *Academy of Management Perspective* 7: 95-104.

Cheung, G. W., & Rensvold, R. B. 2002. Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, 9: 233-255.

Cole, D. A., & Maxwell, S. E. 2003. Testing mediational models with longitudinal data: Questions and tips in the use of structural equation modeling. *Journal of Abnormal Psychology*, 112: 558-577.

Combs, J. G., Liu, Y., Hall, A. T., & Ketchen, D. J. 2006. How much do high-performance work practices matter? A meta-analysis of their effects on organizational performance. *Personnel Psychology*, 59: 501-528.

Cyert, R. M., & March, J. G. 1963. *A behavioral theory of the firm*. Upper Saddle River, NJ: Prentice Hall.

Datta, D. K., Guthrie, J. P., & Wright, P. M. 2005. Human resource management and labor productivity: Does industry matter? *Academy of Management Journal*, 38: 135-145.

Delaney, J. T., & Huselid, M. A. 1996. The impact of human resource management practices on perceptions of organizational performance. *Academy of Management Journal*, 39: 949-969.

Delery, J. E., & Doty, D. H. 1996. Modes of theorizing in strategic human resource management: Tests of universalistic, contingency, and configurational performance predictions. *Academy of Management Journal*, 39: 802-835.

Dhawan, R. 2001. Firm size and productivity differential: Theory and evidence from a panel of US firms. *Journal of Economic Behavior & Organization*, 44: 269-293.

Edelman, L. B. 1992. Legal ambiguity and symbolic structures: Organizational mediation of civil rights law. *American Journal of Sociology*, 97: 1531-1576.

Edmondson, A., Bohmer, R. M., & Pisano, G. P. 2001. Disrupted routines: Team learning and new technology implementation in hospitals. *Administrative Science Quarterly*, 46: 685-716.

Edwards, P., & Wright, P. M. 2001. High-involvement work systems and performance outcomes: The strength of variable, contingent and context-bound relationships. *International Journal of Human Resource Management*, 12: 568-585.

Finkel, S. E. 1995. *Causal analysis with panel data*. Thousand Oaks, CA: Sage.

Gell-Mann, M. 1994. *The quark and the jaguar: Adventures in the simple and the complex*. New York: Freeman.

Gerhart, B., Wright, P. M., Mc Mahan, G. C., & Snell, S. A. 2000. Measurement error in research on human resources and firm performance: How much error is there and how does it influence effect size estimates? *Personnel Psychology*, 53: 803-834.

Godard, J. 2004. A critical assessment of the high-performance paradigm. *British Journal of Industrial Relations*, 42: 349-378.

Godard, J., & Delaney, J. T. 2000. Reflections on the "high performance" paradigm's implications for industrial relations as a field. *Industrial and Labor Relations Review*, 53: 482-502.

Gollan, P. J. 2005. High involvement management and human resource sustainability: The challenges and opportunities. *Asia Pacific Journal of Human Resources*, 43: 18-33.

Gollob, H. F., & Reichardt, C. S. 1991. Interpreting and estimating indirect effects assuming time lags really matter. In L. M. Collins & J. L. Horn (Eds.), *Best methods for the analysis of change: Recent advances, unanswered questions, future directions*: 243-259. Washington, DC: American Psychological Association.

Gondo, M. B., & Amis, J. M. 2013. Variation in practice adoption: The role of conscious reflection and discourse. *Academy of Management Review*, 38: 229-247.

Guest, D. E. 1997. Human resource management and performance: A review and research agenda. *International Journal of Human Resource Management*, 8: 263-276.

Guest, D. E. 2011. Human resource management and performance: Still searching for some answers. *Human Resource Management Journal*, 21: 3-13.

Guest, D. E., & Bos-Nehles, A. C. 2013. HRM and performance: The role of effective implementation. In J. Paauwe, D. Guest, & P. M. Wright (Eds.), *HRM and performance: Achievements and challenges*: 79-96. Chichester, UK: Wiley.

Guest, D. E., & King, Z. 2004. Power, innovation and problem-solving: The personnel managers' three steps to heaven? *Journal of Management Studies*, 41: 401-423.

Guest, D. E., Michie, J., Conway, N., & Sheehan, M. 2003. Human resource management and corporate performance in the UK. *British Journal of Industrial Relations*, 41: 291-314.

Harley, B. 2002. Employee responses to high performance work system practices: An analysis of the AWIRS95 data. *Journal of Industrial Relations*, 44: 418-434.

Huselid, M. A. 1994. Documenting HR's effect on company performance. *HR Magazine*, 39: 79-85.

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

Huselid, M. A., & Becker, B. E. 1996. Methodological issues in cross-sectional and panel estimates of the human resource-firm performance link. *Industrial Relations: A Journal of Economy and Society*, 35: 400-422.

Jiang, K., Lepak, D. P., Hu, J., & Baer, J. C. 2012. How does human resource management influence organizational outcomes? A meta-analytic investigation of mediating mechanisms. *Academy of Management Journal*, 55: 1264-1294.

Kalleberg, A. L., & Moody, J. W. 1994. Human resource management and organizational performance. *American Behavioral Scientist*, 37: 948-962.

Kast, F. E., & Rosenzweig, J. E. 1972. General systems theory: Applications for organization and management. *Academy of Management Journal*, 15: 447-465.

Katz, D., & Kahn, R. L. 1966. *The social psychology of organizations*. Oxford, UK: Wiley.

Kaufman, B. E. 2010. SHRM theory in the post-Huselid era: Why it is fundamentally misspecified. *Industrial Relations: A Journal of Economy and Society*, 49: 286-313.

Kaufman, B. E., & Miller, B. I. 2011. The firm's choice of HRM practices: Economics meets strategic human resource management. *Industrial and Labor Relations Review*, 64: 526-557.

Khilji, S. E., & Wang, X. 2006. "Intended" and "implemented" HRM: The missing linchpin in strategic human resource management research. *International Journal of Human Resource Management*, 17: 1171-1189.

Konrad, A. M., & Linnehan, F. 1995. Formalized HRM structures: Coordinating equal employment opportunity or concealing organizational practices? *Academy of Management Journal*, 38: 787-820.

Konrad, A. M., & Mangel, R. 2000. The impact of work-life programs on firm productivity. *Strategic Management Journal*, 21: 1225-1237.

Kulik, C. T., & Bainbridge, H. T. J. 2006. HR and the line: The distribution of HR activities in Australian organisations. *Asia Pacific Journal of Human Resources*, 44: 240-256.

Lawler, E. E., III. 1986. *High-involvement managment*. San Francisco: Jossey-Bass.

Lazear, E. P. 1996. *Performance pay and productivity*. NBER working paper, National Bureau of Economic Research, Cambridge, MA.

Lepak, D. P., Liao, H., Chung, Y., & Harden, E. E. 2006. A conceptual review of human resource management systems in strategic human resource management research. In J. J. Martocchio (Ed.), *Research in personnel and human resources management*, vol. 25: 217-271. Oxford, UK: Elsevier.

Lepak, D. P., & Snell, S. A. 1999. The human resource architecture: Toward a theory of human capital allocation and development. *Academy of Management Review*, 24: 31-48.

Lepak, D. P., & Snell, S. A. 2002. Examining the human resource architecture: The relationships among human capital, employment, and human resource configurations. *Journal of Management*, 28: 517-543.

Little, T. D. 2013. *Longitudinal structural equation modeling*. New York: Guilford Press.

Little, T. D., Preacher, K. J., Selig, J. P., & Card, N. A. 2007. New developments in latent variable panel analyses of longitudinal data. *International Journal of Behavioral Development*, 31: 357-365.

Liu, W., Guthrie, J. P., Flood, P. C., & MacCurtain, S. 2009. Unions and the adoption of high performance work systems: Does employment security play a role? *Industrial and Labor Relations Review*, 63: 109-127.

MacCallum, R. C., & Austin, J. T. 2000. Applications of structural equation modeling in psychological research. *Annual Review of Psychology*, 51: 201-226.

MacDuffie, J. P. 1995. Human resource bundles and manufacturing performance: Organizational logic and flexible production systems in the world auto industry. *Industrial and Labor Relations Review*, 48: 197-221.

Messersmith, J. G., Patel, P. C., & Lepak, D. P. 2011. Unlocking the black box: Exploring the link between high-performance work systems and performance. *Journal of Applied Psychology*, 96: 1105-1118.

Miner, A. S. 1994. Seeking adaptive advantage: Evolutionary theory and managerial action. In J. A. C. Baum & J. V. Singh (Eds.), *Evolutionary dynamics of organizations*: 76-89. New York: Oxford University Press.

Mohr, R. D., & Zoghi, C. 2008. High-involvement work desgin and job satisfaction. *Industrial and Labor Relations Review*, 61: 275-296.

Orlitzky, M., & Frenkel, S. J. 2005. Alternative pathways to high-performance workplaces. *International Journal of Human Resource Management*, 16: 1325-1348.

Pfeffer, J. 1981. *Power in organizations*. Marshfield, MA: Pitman.

Pfeffer, J. 1995. Producing sustainable competitive advantage through the effective management of people. *Academy of Management Executive*, 9: 55-69.

Pfeffer, J. 1998a. *The human equation: Building profits by putting people first*. Boston: Harvard Business Press.

Pfeffer, J. 1998b. Seven practices of successful organizations. *California Management Review*, 40: 96-124.

Pfeffer, J., & Salancik, G. R. 1978. *The external control of organizations: A resource dependence perspective*. New York: Harper & Row.

Pil, F. K., & MacDuffie, J. P. 1996. The adoption of high-involvement work practices. *Industrial Relations: A Journal of Economy and Society*, 35: 423-455.

Pil, F. K., & MacDuffie, J. P. 1999. Organizational and environmental factors influencing the use and diffusion of high-involvement work practices. In P. Cappelli (Ed.), *Employment practices and business strategy*: 81-106. New York: Oxford University Press.

Preacher, K., & Hayes, A. 2008. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40: 879-891.

Purcell, J. 1999. Best practice and best fit: Chimera or cul-de-sac? *Human Resource Management Journal*, 9: 26-41.

Salge, T. O. 2011. A behavioral model of innovative search: Evidence from public hospital services. *Journal of Public Administration Research and Theory*, 21: 181-210.

Salge, T. O., & Vera, A. 2013. Small steps that matter: Incremental learning, slack resources and organizational performance. *British Journal of Management*, 24: 156-173.

Scott, W. R. 2008. *Institutions and organizations: Ideas, interests, and identities*, 4th ed. Thousand Oaks, CA: Sage.

Shek, D. T. L., & Ma, C. M. S. 2010. The Chinese Family Assessment Instrument (C-FAI). *Research on Social Work Practice*, 20: 112-123.

Shih, H. A., Chiang, Y. H., & Hsu, C. C. 2006. Can high performance work systems really lead to better performance? *International Journal of Manpower*, 27: 741-763.

Singh, J. V. 1986. Performance, slack, and risk taking in organizational decision making. *Academy of Management Journal*, 29: 562-585.

Statistics Canada. 2009. Workplace and Employee Survey (WES). Retrieved August 26, 2011, from http://www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=2615&lang=en&db=imdb&adm=8&dis=2

Subramony, M. 2009. A meta-analytic investigation of the relationship between HRM bundles and firm performance. *Human Resource Management*, 48: 745-768.

Tan, J., & Peng, M. W. 2003. Organizational slack and firm performance during economic transitions: Two studies from an emerging economy. *Strategic Management Journal*, 24: 1249-1263.

Tangen, S. 2005. Demystifying productivity and performance. *International Journal of Productivity & Performance Management*, 54: 34-46.

Tesluk, P. E., Vance, R. J., & Mathieu, J. E. 1999. Examining employee involvement in the context of participative work environments. *Group & Organization Management*, 24: 271-299.

Vandenberg, R. J., & Lance, C. E. 2000. A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods*, 3: 4-70.

Von Bertalanffy, L. 1968. *General system theory: Foundations, development, applications*, rev. ed. New York: George Braziller.

Waddock, S. A., & Graves, S. B. 1997. The corporate social performance–financial performance link. *Strategic Management Journal*, 18: 303-319.

Walters, B. A., & Bhuian, S. N. 2004. Complexity absorption and performance: A structural analysis of acute-care hospitals. *Journal of Management*, 30: 97-121.

Way, S. A. 2002. High performance work systems and intermediate indicators of firm performance within the US small business sector. *Journal of Management*, 28: 765-785.

Wright, P. M., Dunford, B. B., & Snell, S. A. 2001. Human resources and the resource based view of the firm. *Journal of Management*, 27: 701-721.

Wright, P. M., Gardner, T. M., Moynihan, L. M., & Allen, M. R. 2005. The relationship between HR practices and firm performance: Examining causal order. *Personnel Psychology*, 58: 409-446.

Wright, P. M., Gardner, T. M., Moynihan, L. M., Park, H. J., Gerhart, B., & Delery, J. E. 2001. Measurement error in research on human resources and firm performance: Additional data and suggestions for future research. *Personnel Psychology*, 54: 875-901.

Wright, P. M., & McMahan, G. C. 1992. Theoretical perspectives for strategic human resource management. *Journal of Management*, 18: 295-320.

Wright, P. M., McMahan, G. C., & McWilliams, A. 1994. Human resources and sustained competitive advantage: A resource-based perspective. *International Journal of Human Resource Management*, 5: 301-326.

Wright, P. M., & Nishii, L. H. 2013. Strategic HRM and organizational behavior: Integrating multiple levels of analysis. In J. Paauwe, D. Guest, & P. M. Wright (Eds.), *HRM and performance: Achievements and challenges*: 97-110. Chichester, UK: Wiley.

Wright, P. M., & Snell, S. A. 1998. Toward a unifying framework for exploring fit and flexibility in strategic human resource management. *Academy of Management Review*, 23: 756-772.

Yang, Y., & Konrad, A. M. 2011. Diversity and organizational innovation: The role of employee involvement. *Journal of Organizational Behavior*, 32: 1062-1083.

Youndt, M. A., Snell, S. A., Dean, J. W., Jr., & Lepak, D. P. 1996. Human resource management, manufacturing strategy, and firm performance. *Academy of Management Journal*, 39: 836-866.

Zatzick, C. D., & Iverson, R. D. 2006. High-involvement management and workforce reduction: Competitive advantage or disadvantage? *Academy of Management Journal*, 49: 999-1015.

Zbaracki, M. J. 1998. The rhetoric and reality of total quality management. *Administrative Science Quarterly*, 43: 602-636.

Zhu, X. 2012. Understanding China's growth: Past, present, and future. *Journal of Economic Perspectives*, 26: 103-124.