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Lean Human Resource Management and Production Performance: A Quantitative Study Using Multivariate Analysis and Structural Equation Modeling.

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Abstract

Lean production systems are widely recognized for their potential to improve operational efficiency and product quality. Nevertheless, empirical findings remain heterogeneous, suggesting that technical lean practices alone do not fully explain performance differences across organizations. Drawing on the Resource-Based View (RBV), this study conceptualizes Lean Human Resource Management (Lean HRM) as an organizational capability that contributes to production performance through the development of operational discipline. Using a quantitative modeling approach combining confirmatory factor analysis, multivariate regression, and structural equation modeling, the study examines the direct and indirect relationships between Lean HRM, operational discipline, and production performance. Data were collected from 247 manufacturing firms through a structured questionnaire administered to operations managers and HR directors. The results provide strong support for the proposed theoretical framework and highlight the central role of disciplined execution in translating HR systems into operational outcomes. Operational discipline fully mediates the relationship between Lean HRM and production quality ($\beta = 0.48$, $p < 0.001$) and partially mediates its relationship with operational efficiency ($\beta = 0.36$, $p < 0.001$). The findings extend RBV theory by demonstrating how HR capabilities translate into operational outcomes through intermediate organizational mechanisms.

The findings demonstrate that Lean HRM does not improve performance directly, but creates value primarily by building operational discipline as a critical organizational capability, thereby confirming the central role of execution discipline in sustainable lean performance.

Keywords: Lean HRM; Lean production; Resource-Based View; Operational discipline; Structural equation modeling; Production performance

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1. Introduction

Lean production has become one of the most influential paradigms in operations management, shaping managerial practices across manufacturing industries worldwide (Shah & Ward, 2007; Womack et al., 1990). Initially developed within the automotive sector, lean production emphasizes waste elimination, process stability, standardization, and continuous improvement (Liker, 2004). Over time, lean has evolved from a set of shop-floor tools into a comprehensive managerial philosophy aimed at achieving sustainable operational excellence (Netland, 2016). Despite its widespread adoption, the outcomes of lean implementation remain uneven. Organizations implementing similar lean tools frequently report divergent performance results, raising questions about the conditions under which lean systems generate superior outcomes (Bamber & Dale, 2000; Bhasin & Burcher, 2006). This observation has motivated researchers to move beyond purely technical explanations and to emphasize the human and organizational foundations of lean systems (Tortorella et al., 2018).

Human resource management plays a central role in lean production, as lean relies heavily on employee involvement, problem-solving capabilities, adherence to standards, and continuous learning (MacDuffie, 1995). Consequently, the concept of Lean Human Resource Management (Lean HRM) has emerged to describe HR systems explicitly aligned with lean principles (Bonavia & Marin-Garcia, 2011). Lean HRM encompasses recruitment oriented toward problem-solving skills, continuous improvement training, empowerment within standardized processes, participative decision-making, and performance appraisal systems emphasizing quality and process discipline.

However, the mechanisms through which Lean HRM contributes to production performance remain insufficiently theorized and empirically tested. Much of the existing literature focuses on direct relationships between HR practices and performance, overlooking the organizational processes that transform HR systems into operational outcomes (Boselie et al., 2005). This study addresses this gap by proposing **operational discipline** as a mediating mechanism linking Lean HRM to production performance within a Resource-Based View framework.

The contribution of this study is threefold. First, it extends RBV theory by demonstrating how HR capabilities translate into operational performance through intermediate organizational mechanisms. Second, it provides rigorous empirical evidence using structural equation modeling to test both direct and mediated relationships. Third, it offers practical insights for managers seeking to leverage HR systems as strategic tools for operational improvement.

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The objective of this research is to examine how Lean Human Resource Management contributes to production performance and to test the mediating role of operational discipline within a Resource-Based View framework. To achieve this objective, the paper is structured as follows. The next section reviews the theoretical foundations and develops the research hypotheses. The third section presents the methodology and research design. The fourth section reports the empirical results. The fifth section discusses the theoretical and managerial implications. Finally, the last section concludes the paper and outlines limitations and directions for future research.

2. Theoretical Background and Hypotheses Development

2.1. Lean Production: From Technical Practices to Organizational System

Early lean research conceptualized lean production primarily as a collection of technical practices such as just-in-time production, kanban systems, and standardized work (Sugimori et al., 1977). While this approach facilitated early empirical investigations, it also led to conceptual fragmentation and inconsistent findings (Shah & Ward, 2003). To address these limitations, subsequent studies emphasized the need to conceptualize lean as a multidimensional and systemic construct, integrating technical, organizational, and behavioral components (Shah & Ward, 2007).

Validated measurement models have since demonstrated that lean production can be reliably operationalized through interrelated dimensions capturing process flow, quality management, continuous improvement, and supplier integration (Nahm et al., 2004). These models highlight that lean effectiveness depends not only on the presence of individual practices but also on their internal coherence and alignment with organizational routines (Netland & Ferdows, 2016).

More recent research has further reinforced this systemic view of lean production by emphasizing its dynamic and evolutionary nature. Rather than being a static bundle of tools, lean is increasingly conceptualized as a continuous organizational transformation process that requires sustained managerial commitment and capability development (Netland et al., 2020; Tortorella et al., 2021). Large-scale empirical and review studies show that the performance effects of lean are highly contingent on organizational and contextual factors, and that purely technical implementations tend to generate limited or short-lived results (Sony & Naik, 2020; Tortorella et al., 2021). These findings confirm that lean should be understood as an integrated socio-technical system in which routines, behaviors, and managerial processes play a central role in shaping operational outcomes.

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Importantly, the systemic view of lean underscores the importance of execution consistency. Lean systems require stable processes, disciplined adherence to standards, and continuous reinforcement through managerial routines (Spear & Bowen, 1999). Without these conditions, lean initiatives risk degenerating into isolated tools with limited impact (Bhasin & Burcher, 2006).

2.2. Human Resource Management in Lean Systems

Human resource management has long been recognized as a critical enabler of lean production. Lean systems rely on employees' ability to identify problems, suggest improvements, and adhere to standardized work (MacDuffie, 1995). Consequently, HR practices must support skill development, learning, and behavioral alignment (Bonavia & Marin-Garcia, 2011).

Lean HRM differs from traditional HRM by explicitly embedding lean principles into HR processes (Bortolotti et al., 2015). Recruitment emphasizes problem-solving and teamwork; training focuses on continuous improvement methods; empowerment is structured within clearly defined standards; and performance management systems prioritize quality, process compliance, and collective outcomes (Jaca et al., 2012). Rather than promoting unrestricted autonomy, Lean HRM seeks to balance empowerment and control by embedding discretion within standardized routines (Adler & Borys, 1996).

Empirical studies suggest that Lean HRM enhances employee engagement, reduces resistance to change, and supports continuous improvement (de Treville & Antonakis, 2006). However, evidence regarding its direct impact on operational performance remains mixed (Bortolotti et al., 2015), indicating the need to identify intermediate mechanisms through which HR practices exert their influence.

Recent empirical research has increasingly framed Lean HRM and related people management systems as critical enablers of organizational capabilities rather than as direct performance drivers. In particular, studies grounded in the dynamic capabilities and resource-based perspectives show that HR systems contribute to performance primarily by shaping organizational routines, coordination mechanisms, and disciplined execution processes (Dubey et al., 2022; Jiang et al., 2021). In the context of lean transformations, Tortorella et al. (2022) demonstrate that the institutionalization of lean routines and behaviors plays a more decisive role than the mere adoption of lean practices. This stream of research reinforces the idea that the performance effects of Lean HRM are largely indirect and mediated by organizational capabilities, thereby supporting the relevance of introducing operational discipline as a central explanatory mechanism in the present study.

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2.3. Resource-Based View and HR Systems

The Resource-Based View provides a powerful theoretical lens for understanding the strategic role of HR systems (Barney, 1991; Wright et al., 2001). According to RBV, firms achieve sustained performance advantages through resources and capabilities that are valuable, rare, difficult to imitate, and effectively organized (Barney, 1991). From this perspective, HR practices do not directly generate performance but contribute indirectly by enabling the development of organizational capabilities (Wright et al., 1994).

Lean HRM can be conceptualized as a capability-building system that embeds tacit knowledge, routines, and social complexity (Becker & Huselid, 2006). These characteristics make Lean HRM difficult to replicate and potentially valuable as a source of sustained advantage. By shaping employee behaviors and reinforcing disciplined execution, Lean HRM transforms human capital into operational capabilities (Jiang et al., 2012).

2.4. Operational Discipline as an Organizational Capability

Operational discipline refers to the collective ability of an organization to execute standardized routines reliably and consistently over time (da Silveira, 2006). It encompasses adherence to standard work, stability of processes, systematic auditing, visual management, and continuous monitoring of deviations. Prior research in operations management emphasizes that discipline and simplicity are essential for achieving both efficiency and flexibility (da Silveira, 2006; Spear & Bowen, 1999).

Operational discipline represents a critical capability within lean systems. While lean tools provide the technical foundation, disciplined execution ensures that these tools are applied consistently and sustainably (Spear, 2004). From an RBV perspective, operational discipline constitutes an organizational capability that mediates the relationship between HR systems and performance outcomes (Grant, 1991).

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Table 1 : Literature synthesis

Author(s)	Context	Method	Key Constructs	Main Findings
MacDuffie (1995)	Automotive industry	Survey	HR bundles, performance	HR systems improve operational performance
Bortolotti et al. (2015)	Manufacturing	Survey	Lean practices, culture	Soft practices are critical for lean success
Tortorella et al. (2021)	Multiple sectors	Systematic review	Lean, performance	Lean performance depends on organizational enablers
Dubey et al. (2022)	Manufacturing	SEM	HR capabilities, performance	HR → capabilities → performance
Netland & Ferdows (2016)	Multinational plants	Longitudinal	Lean maturity	Lean performance requires discipline and routines

2.5. Hypotheses Development

Building on the above arguments, Lean HRM is expected to enhance production performance by fostering operational discipline. Lean HR practices shape employee behaviors, reinforce standards, and promote learning, thereby enabling disciplined execution of routines (MacDuffie, 1995). In turn, disciplined execution improves operational efficiency and product quality (da Silveira, 2006).

Accordingly, the following hypotheses are proposed:

- **H1: Lean HRM positively affects operational efficiency.**
- **H2: Lean HRM positively affects production quality.**
- **H3: Lean HRM positively affects operational discipline.**
- **H4: Operational discipline positively affects operational efficiency.**
- **H5: Operational discipline positively affects production quality.**
- **H6a: Operational discipline mediates the relationship between Lean HRM and operational efficiency.**
- **H6b: Operational discipline mediates the relationship between Lean HRM and production quality.**

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Table 2 : Hypotheses anchoring

Hypothesis	Relationship	Theoretical Basis	Key References
H1	**Lean HRM → Operational Efficiency**	**RBV, HR-performance**	**Wright et al. (2001); Jiang et al. (2012)**
H2	**Lean HRM → Production Quality**	**Lean HRM theory**	**Bonavia & Marin-Garcia (2011)**
H3	**Lean HRM → Operational Discipline**	**Capability building**	**Barney (1991); Becker & Huselid (2006)**
H4	**Operational Discipline → Efficiency**	**Operations discipline**	**da Silveira (2006); Spear & Bowen (1999)**
H5	**Operational Discipline → Quality**	**Process stability**	**Flynn et al. (1994); Spear & Bowen (1999)**
H6a/b	**Mediation**	**RBV, mediation logic**	**Grant (1991); Jiang et al. (2012)**

3. Methodology

3.1. Epistemological Positioning and Research Logic

This study adopts a positivist epistemological stance, which assumes that organizational phenomena can be objectively measured and explained through empirical observation and statistical analysis. In line with this perspective, the research seeks to test theoretically derived hypotheses using quantitative data and to identify regularities in the relationships between Lean HRM, operational discipline, and production performance. The study follows a hypothetico-deductive reasoning approach, whereby hypotheses are derived from the Resource-Based View and lean management literature, and subsequently tested using structural equation modeling. This approach is consistent with established practices in operations management and strategic HRM research, which emphasize theory testing, measurement validity, and causal modeling (Creswell, 2014; Saunders et al., 2019; Bryman, 2016).

3.2. Research Design and Sample

The study adopts a quantitative research design consistent with a positivist epistemological stance. A cross-sectional survey was conducted targeting manufacturing firms operating in diverse industrial sectors. The unit of analysis was the production facility, and data were collected from two informants per site: operations managers and HR directors, to reduce common method bias (Podsakoff et al., 2003).

A structured questionnaire was developed based on validated scales from prior literature. The questionnaire was pre-tested with five academics and ten industry practitioners to ensure

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content validity and clarity. Minor adjustments were made to adapt the language to the francophone African manufacturing context.

The sampling frame consisted of 650 manufacturing firms registered in the national industrial database. A stratified random sampling approach was used to ensure representation across firm size and industry sectors. The questionnaire was administered electronically and via postal mail between March and September 2025. After three rounds of follow-up, 247 usable responses were obtained, representing a response rate of 38%, which is considered acceptable for organizational survey research (Baruch & Holtom, 2008).

Non-response bias was assessed by comparing early and late respondents on key demographic variables. No significant differences were found ($p > 0.05$), suggesting that non-response bias was not a major concern. The final sample comprised firms from automotive (22%), food processing (18%), textiles (15%), electronics (14%), chemicals (11%), and other sectors (20%). Firm size ranged from 50 to 1,500 employees (mean = 312, SD = 187).

3.3. Measurement of Constructs

All constructs were measured using multi-item scales adapted from validated instruments. A 7-point Likert scale (1 = strongly disagree, 7 = strongly agree) was employed for all items to ensure sufficient variance.

Lean HRM was measured using a 12-item scale adapted from Bonavia and Marin-Garcia (2011) and Bortolotti et al. (2015). The scale captured four dimensions: (1) selective recruitment emphasizing problem-solving and teamwork (3 items), (2) continuous improvement training (3 items), (3) empowerment within standardized processes (3 items), and (4) performance appraisal focused on quality and process compliance (3 items). Sample item: "Our recruitment process emphasizes candidates' problem-solving abilities and teamwork skills."

Operational Discipline was operationalized using a 9-item scale developed from da Silveira (2006) and Spear and Bowen (1999). The scale measured adherence to standardized work (3 items), process stability and control (3 items), and systematic audit and visual management (3 items). Sample item: "Work procedures are strictly followed by employees on the shop floor."

Operational Efficiency was assessed using a 6-item scale adapted from Shah and Ward (2007), measuring manufacturing cycle time reduction, inventory turnover, resource utilization, waste reduction, and labor productivity. Sample item: "Our manufacturing cycle time has significantly decreased over the past two years."

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Production Quality was measured using a 6-item scale from Flynn et al. (1994), capturing defect rates, first-pass yield, customer complaints, scrap rates, and quality consistency. Sample item: "The defect rate of our products is significantly lower than industry average."

Control variables included firm size (number of employees), industry sector (dummy variables), and competitive intensity (3-item scale adapted from Jaworski & Kohli, 1993).

3.4. Common Method Bias Assessment

Given that data were collected through self-reported questionnaires, common method bias was a potential concern (Podsakoff et al., 2003). Several procedural and statistical remedies were employed. Procedurally, data were collected from two informants per facility, and respondents were assured of anonymity and confidentiality. Statistically, Harman's single-factor test was conducted. An exploratory factor analysis with all items loaded onto a single factor explained only 34.2% of the total variance, well below the 50% threshold, suggesting that common method bias was not pervasive.

Additionally, a confirmatory factor analysis marker variable technique was employed (Williams et al., 2010). A theoretically unrelated construct (organizational prestige, measured with 3 items) was included in the model. The marker variable showed no significant correlations with focal constructs ($r < 0.10$, $p > 0.05$), further confirming that common method bias was minimal.

3.5. Data Analysis Strategy

Data analysis followed a two-step approach recommended by Anderson and Gerbing (1988). First, confirmatory factor analysis (CFA) was conducted using AMOS 26.0 to assess the measurement model's reliability, convergent validity, and discriminant validity. Second, structural equation modeling (SEM) was used to test the hypothesized relationships.

Model fit was evaluated using multiple indices: χ^2/df ratio, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Following Hu and Bentler (1999), acceptable fit thresholds were: $\chi^2/df < 3$, CFI and TLI > 0.90, RMSEA < 0.08, and SRMR < 0.08.

Mediation effects were tested using the bootstrapping procedure with 5,000 resamples, as recommended by Preacher and Hayes (2008). Indirect effects were considered significant if the 95% bias-corrected confidence interval did not include zero.

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4. Results

4.1. Descriptive Statistics and Correlations

Table 1 presents descriptive statistics, Cronbach's alpha coefficients, and intercorrelations among study variables. All constructs demonstrated satisfactory internal consistency, with Cronbach's alpha ranging from 0.84 to 0.92, exceeding the recommended threshold of 0.70 (Nunnally & Bernstein, 1994).

Table 3: Descriptive Statistics and Correlations

Variable	Mean	SD	α	1	2	3	4
1. Lean HRM	**4.82**	**1.13**	**0.91**	**,**			
2. Operational Discipline	**4.96**	**1.07**	**0.89**	**0.64*** **	**,**		
3. Operational Efficiency	**5.02**	**1.02**	**0.88**	**0.58*** **	**0.71*** **	**,**	
4. Production Quality	**5.14**	**0.98**	**0.92**	**0.54*** **	**0.68*** **	**0.73*** **	**,**

*Note: N = 247. α = Cronbach's alpha. ***p < 0.001.*

Correlations among focal constructs were positive and statistically significant, providing preliminary support for the hypothesized relationships. However, multicollinearity was not a concern, as all variance inflation factors (VIFs) were below 3.0.

4.2. Measurement Model Assessment

The measurement model included all four latent constructs (Lean HRM, Operational Discipline, Operational Efficiency, Production Quality) with their respective indicators. The CFA results demonstrated acceptable model fit: $\chi^2(489) = 876.34$, $p < 0.001$; $\chi^2/df = 1.79$; CFI = 0.94; TLI = 0.93; RMSEA = 0.057 (90% CI: 0.051–0.063); SRMR = 0.052.

Convergent validity was assessed through average variance extracted (AVE) and composite reliability (CR). All constructs exceeded the threshold values (AVE > 0.50, CR > 0.70), as shown in Table 2.

Table 4: Measurement Model Results

Construct	Items	Factor Loadings	AVE	CR
Lean HRM	**12**	**0.68–0.84**	**0.58**	**0.93**
Operational Discipline	**9**	**0.71–0.87**	**0.63**	**0.92**
Operational Efficiency	**6**	**0.74–0.89**	**0.67**	**0.91**
Production Quality	**6**	**0.76–0.91**	**0.71**	**0.94**

Note: All factor loadings significant at p < 0.001.

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Discriminant validity was evaluated using the Fornell-Larcker criterion (Fornell & Larcker, 1981) and the Heterotrait-Monotrait ratio (HTMT; Henseler et al., 2015). The square root of each construct's AVE exceeded its correlations with other constructs, and all HTMT values were below 0.85, confirming discriminant validity.

4.3. Structural Model and Hypothesis Testing

The structural model was tested with control variables included (firm size, industry sector, competitive intensity). The model demonstrated good fit: $\chi^2(512) = 923.67$, $p < 0.001$; $\chi^2/df = 1.80$; CFI = 0.93; TLI = 0.92; RMSEA = 0.058; SRMR = 0.054.

Table 5: Structural Model Path Coefficients

Hypothesis	Path	β	SE	t-value	p-value	Result
H1	**Lean HRM → Operational Efficiency**	**0.21**	**0.08**	**2.63**	**0.009**	**Supported**
H2	**Lean HRM → Production Quality**	**0.09**	**0.07**	**1.29**	**0.198**	**Not Supported**
H3	**Lean HRM → Operational Discipline**	**0.68**	**0.06**	**11.33**	**<0.001**	**Supported**
H4	**Operational Discipline → Operational Efficiency**	**0.53**	**0.07**	**7.57**	**<0.001**	**Supported**
H5	**Operational Discipline → Production Quality**	**0.71**	**0.06**	**11.83**	**<0.001**	**Supported**

Note: Standardized coefficients reported. Control variables included but not shown for brevity.

H1 proposed that Lean HRM positively affects operational efficiency. The direct path was positive and significant ($\beta = 0.21$, $p = 0.009$), supporting H1.

H2 proposed that Lean HRM positively affects production quality. The direct path was not statistically significant ($\beta = 0.09$, $p = 0.198$), failing to support H2.

H3 proposed that Lean HRM positively affects operational discipline. This hypothesis received strong support ($\beta = 0.68$, $p < 0.001$), indicating that Lean HRM is a powerful predictor of operational discipline.

H4 proposed that operational discipline positively affects operational efficiency. Results strongly supported this hypothesis ($\beta = 0.53$, $p < 0.001$).

H5 proposed that operational discipline positively affects production quality. This hypothesis was also strongly supported ($\beta = 0.71$, $p < 0.001$).

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4.4. Mediation Analysis

Hypotheses H6a and H6b proposed that operational discipline mediates the relationships between Lean HRM and performance outcomes. Mediation was tested using bootstrapping with 5,000 resamples (Preacher & Hayes, 2008).

Table 6: Mediation Analysis Results

Path	Direct Effect	Indirect Effect	95% CI	Mediation Type
Lean HRM → Operational Efficiency	**0.21****	**0.36*****	**[0.28, 0.45]**	**Partial Mediation**
Lean HRM → Production Quality	**0.09 (ns)**	**0.48*****	**[0.39, 0.58]**	**Full Mediation**

*Note: **p < 0.01; ***p < 0.001; ns = not significant.*

H6a proposed that operational discipline mediates the relationship between Lean HRM and operational efficiency. The indirect effect was significant (β = 0.36, 95% CI [0.28, 0.45]), and the direct effect remained significant (β = 0.21), indicating **partial mediation**.

H6b proposed that operational discipline mediates the relationship between Lean HRM and production quality. The indirect effect was significant (β = 0.48, 95% CI [0.39, 0.58]), while the direct effect was non-significant (β = 0.09), indicating **full mediation**.

The total effect of Lean HRM on operational efficiency was β = 0.57 ($p < 0.001$), with 63% mediated through operational discipline. The total effect of Lean HRM on production quality was β = 0.57 ($p < 0.001$), fully mediated through operational discipline.

4.5. Alternative Model Testing

To strengthen confidence in the proposed model, two alternative models were tested. Alternative Model 1 posited direct effects from Lean HRM to performance outcomes without the mediator (operational discipline). This model demonstrated significantly worse fit:

$\chi^2(515) = 1{,}247.92$, $\Delta\chi^2(3) = 324.25$, $p < 0.001$; CFI = 0.87; RMSEA = 0.077.

Alternative Model 2 reversed the causal direction, proposing that operational discipline leads to Lean HRM. This model also showed inferior fit:

$\chi^2(512) = 1{,}189.45$, $\Delta\chi^2(0) = 265.78$, $p < 0.001$; CFI = 0.88; RMSEA = 0.074.

These comparisons confirm that the proposed theoretical model provides the best fit to the data.

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5. Discussion

5.1. Theoretical Contributions

This study makes three significant theoretical contributions to the operations management and strategic HRM literatures. First, it extends the Resource-Based View by demonstrating how HR capabilities translate into operational performance through intermediate organizational mechanisms. While RBV emphasizes the importance of organizational capabilities, empirical studies rarely specify the processes through which capabilities are developed and leveraged (Barney & Wright, 1998). By introducing operational discipline as a mediating construct, this study clarifies the "black box" between HR systems and performance outcomes.

These findings are fully consistent with recent empirical evidence suggesting that the performance impact of lean systems and HR architectures depends less on the formal adoption of practices than on their institutionalization into stable organizational routines and disciplined execution processes. Recent large-scale studies and systematic reviews confirm that lean success increasingly hinges on capability building, behavioral alignment, and routinization mechanisms rather than on tool deployment alone (Netland et al., 2020; Tortorella et al., 2021; Tortorella et al., 2022). Similarly, recent strategic HRM research emphasizes that HR systems create value primarily through their effects on coordination, routines, and organizational capabilities (Dubey et al., 2022; Jiang et al., 2021). By explicitly modeling operational discipline as a mediating capability, the present study directly responds to these recent theoretical developments and provides empirical support for this emerging capability-based view of lean management.

Second, the study contributes to lean production research by highlighting the primacy of execution discipline over technical practices. The strong mediation effects observed indicate that Lean HRM does not directly improve performance; rather, it enables disciplined execution, which in turn drives efficiency and quality. This finding aligns with Spear and Bowen's (1999) observation that Toyota's competitive advantage lies not in its tools but in its disciplined approach to continuous improvement.

Third, the study advances Lean HRM theory by providing rigorous quantitative evidence of its effects. Previous research on Lean HRM has been largely conceptual or based on case studies (Bonavia & Marin-Garcia, 2011; Bortolotti et al., 2015). The current study employs structural equation modeling to test both direct and mediated relationships, offering robust empirical support for the theoretical framework.

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5.2. The Central Role of Operational Discipline

The results demonstrate that operational discipline fully mediates the relationship between Lean HRM and production quality, and partially mediates its relationship with operational efficiency. These findings suggest that HR practices influence performance primarily by shaping organizational routines and behavioral patterns, rather than through direct skill enhancement alone.

The full mediation observed for production quality is particularly noteworthy. Quality outcomes depend heavily on process stability, adherence to standards, and systematic problem-solving,all core components of operational discipline (Spear & Bowen, 1999). Lean HRM fosters these behaviors through training in continuous improvement methods, empowerment within structured frameworks, and performance appraisal systems that emphasize process compliance (Adler & Borys, 1996).

The partial mediation observed for operational efficiency indicates that Lean HRM also exerts a direct effect. This may reflect the immediate productivity benefits of skill development and employee motivation, independent of disciplined execution. However, the larger indirect effect ($\beta = 0.36$) compared to the direct effect ($\beta = 0.21$) underscores that sustained efficiency gains require disciplined adherence to standardized processes.

5.3. Practical Implications

The findings offer important guidance for managers seeking to implement lean production systems. First, organizations should recognize that technical lean tools are necessary but insufficient. Without supporting HR systems that foster disciplined execution, lean initiatives risk becoming "programs of the month" with limited sustainability (Bhasin & Burcher, 2006).

Second, HR managers should explicitly align HR practices with lean principles. Recruitment should emphasize not only technical competencies but also problem-solving abilities and willingness to adhere to standards. Training programs should focus on continuous improvement methodologies such as PDCA (Plan-Do-Check-Act), root cause analysis, and error-proofing. Performance appraisal systems should balance individual accountability with collective process outcomes, reinforcing the importance of disciplined execution.

Third, operations managers should invest in building operational discipline as a strategic capability. This requires developing robust standardized work procedures, implementing visual management systems, conducting systematic audits, and creating a culture of continuous learning (da Silveira, 2006). Discipline should not be perceived as rigid bureaucracy but as enabling flexibility through stability (Adler & Borys, 1996).

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Fourth, senior leadership must recognize that lean transformation is a long-term capability-building process, not a short-term cost-cutting initiative. The development of operational discipline requires sustained commitment, resource allocation, and behavioral reinforcement over time.

5.4. Limitations and Future Research Directions

Several limitations should be acknowledged. First, the cross-sectional design limits causal inferences. While the theoretical model is grounded in RBV and supported by prior longitudinal studies (MacDuffie, 1995), future research should employ longitudinal designs to establish temporal precedence and rule out reverse causality.

Second, data were collected through self-reported questionnaires, raising concerns about common method bias. Although multiple procedural and statistical remedies were employed, future studies should incorporate objective performance measures (e.g., production data from firm records) to corroborate findings.

Third, the study was conducted in a single geographic context (francophone African countries). While the theoretical framework is universally applicable, cultural and institutional factors may influence the strength of relationships. Future research should test the model in diverse contexts to assess generalizability.

Fourth, the study treats Lean HRM as a unidimensional construct. Future research could examine whether specific HR practices (e.g., training vs. performance appraisal) have differential effects on operational discipline and performance outcomes.

Fifth, the study focuses on manufacturing firms. Service organizations increasingly adopt lean principles (Piercy & Rich, 2015), and future research should examine whether the proposed relationships hold in service contexts where operational discipline may manifest differently.

Finally, the study does not explore potential moderators. Organizational culture, leadership styles, technological complexity, and competitive environment may influence the effectiveness of Lean HRM and operational discipline. Future research should examine these boundary conditions to refine theoretical understanding.

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6. Conclusion

This study investigates the mechanisms through which Lean Human Resource Management contributes to production performance, proposing operational discipline as a critical mediating capability. Drawing on the Resource-Based View, the study conceptualizes Lean HRM as a capability-building system that enables disciplined execution of lean principles. Using structural equation modeling with data from 247 manufacturing firms, the results demonstrate that operational discipline fully mediates the relationship between Lean HRM and production quality, and partially mediates its relationship with operational efficiency.

The findings extend theoretical understanding of how HR systems generate operational value and underscore the primacy of execution discipline over technical practices. For practitioners, the study highlights the necessity of aligning HR practices with lean principles and investing in the development of operational discipline as a strategic capability. As manufacturing firms continue to face pressures for efficiency, quality, and flexibility, the integration of human resource management and operational excellence will remain a critical source of competitive advantage.

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