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Safety Culture and Leadership Commitment as Determinants of Occupational Safety Performance in the Manufacturing Industry

Oluwaseun Ibuife Oluwaniyi & Oluwaranti A. Omowami
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Abstract: *The conflict between the speed of production and the safety of production workers is a paradox that usually poses a threat of disastrous failures in the high-stakes world of the manufacturing industry. This paper discusses this pathway as a causal relationship in terms of Leadership commitment, Safety Culture, and Safety performance as a strategic solution to this conflict. The study employs the Social Exchange Theory (SET) and the DuPont Bradley Curve to provide a theoretical framework in which leadership serves as the "motivational engine" which propels an organization to a high level of interdependent and collective responsibility as opposed to mere compliance. The study identifies three critical dimensions of leadership—visibility, resource allocation, and accountability—as key drivers in shaping organizational safety culture. This study aims to examine the extent to which leadership commitment influences safety culture and, in turn, improves occupational safety performance in the manufacturing industry. In conclusion, the study argues that operational excellence is achieved when leadership prioritizes safety over short-term productivity, thereby transforming safety from a perceived organizational cost into a core value and a source of sustainable competitive advantage.*

Keywords: *Leadership Commitment; Safety Culture; Safety Performance; Manufacturing Industry; Leading and Lagging Indicators*

Oluwaseun Ibuife Oluwaniyi*
Department of Occupational Risk and Safety Sciences, University of Central Missouri, United States
Email: seunibuife.oluwaniyi@gmail.com
http://orcid.org/0009-0008-1960-8442

Oluwaranti A. Omowami
Department of Occupational Risk and Safety Sciences, University of Central Missouri, United States
Email: atinukeomowami@gmail.com

1.0 Introduction

Safety Culture is the unseen foundation of operational integrity in the contemporary industrial setting, where it is the set of values, attitudes, and perceptions among employees that are held about the significance of safety (Bisbey *et al*., 2021). It extends beyond formal rules and documented procedures, reflecting the shared practices and behaviors that guide employee actions even in the absence of supervision. A strong safety culture transforms safety from a compliance-driven obligation into a fundamental organizational value, where employees demonstrate personal commitment to their own well-being and that of their colleagues (Yazdi, 2025).

Leadership Commitment is the key driver of this culture that serves as the key independent variable in the safety equation (Mokarami *et al*., 2019). When executives and operational managers move beyond symbolic commitment and actively prioritize safety over short-term financial gains, they lead by example in the whole organization. This dedication determines the maturity of the safety culture, shifting it to a reactive level of punishment avoidance to a proactive level of pursuing continual improvement (Stemn *et al*., 2019). Even the most sophisticated safety procedures

will eventually wear down under the pressure of daily operations unless supported consistently and visibly by top management (Kozhemyatov & Bulauka, 2019).

The connection between these factors creates a distinct causal process: Leadership Commitment influences the Safety Culture, which, in its turn, is the most influential factor of Safety Performance. Sultana *et al*. (2019) inferred that high safety performance is not only defined by a low number of accidents (lagging indicators), but also a high level of hazard reporting and proactive risk mitigation (leading indicators). The cultural maturity resulting from leaders investing in safety resources and workers having the ability to express their concerns will form a so-called psychological safety net that prevents minor errors from escalating into major incidents (Maximo *et al*. (2019).

The manufacturing industry is one of the industries that offer a distinctly high-stakes setting to this study because of the physical and systemic complexities inherent in it (Otegui, 2024). The manufacturing setting is usually marked by dangerous equipment, high voltage, and heavy material handling, where a single mistake in judgment may result in life-changing injuries. Moreover, the human-machine interface necessitates a more advanced level of cognitive awareness and protocol compliance, thereby making the human factor critical in ensuring a zero-harm environment (Mojumder & Ruddro, 2023).

Lastly, Raja & Iqbal (2019) described a constant dilemma in the manufacturing industry between the speed of production and the safety of the occupations. The output-at-all-costs attitude usually breeds a culture of shortcuts and safety interlocks bypassed. This study argues that efficiency should not be achieved at the expense of safety; rather, safety and productivity should be treated as complementary organizational objectives (Qayoom & Hadikusumo, 2019). This is a conceptual change that any manufacturing company seeking to gain a sustainable competitive advantage in an international market must have.

Despite the growing body of literature on safety culture and leadership, limited studies have examined their combined influence on occupational safety performance within the manufacturing industry, particularly in the context of balancing productivity demands and safety priorities. Furthermore, existing research has often treated safety performance using either leading or lagging indicators in isolation, with insufficient integration of both measures.

This study, therefore aims to investigate the causal relationship between leadership commitment, safety culture, and safety performance in the manufacturing sector, drawing on Social Exchange Theory and the DuPont Bradley Curve as guiding frameworks. The significance of this study lies in its potential to provide practical insights for industry leaders on how to foster a proactive safety culture while maintaining operational efficiency. Additionally, it contributes to the theoretical discourse by integrating leadership behavior, cultural dynamics, and performance measurement into a unified framework for understanding workplace safety.

2.0 Theoretical Framework

2.1 Social Exchange Theory

To establish a strong theoretical foundation for this study, Social Exchange Theory (SET) provides a useful psychological lens for explaining the relationship between management and the workforce (Nachmias *et al*., 2022). At its core, SET posits that social behavior is shaped by an exchange process in which individuals evaluate the potential benefits and costs of relationships. Leaders

who are sincerely committed to safety, in both observable action and investment in quality machinery, and are compassionate, provide significant value to employees in the form of a safe and secure working environment (Niu & Liu, 2022).

Wang *et al*. (2023) argue that such perceived organizational care triggers a strong norm of reciprocity among employees. Workers automatically become psychologically committed to reciprocate this investment through behaviors that reflect their perception that management prioritizes their well-being (Löffert & Diehl, 2023). This reciprocity manifests itself through a higher commitment to safety precautions, a higher attention to detail, and the willingness to do more than is required to meet their job descriptions. Consequently, compliance with safety ceases to be externally enforced and instead becomes internally motivated (Gunningham & Sinclair, 2019).

2.2 Bradley Curve (DuPont)

The Bradley Curve, a well-known model developed by DuPont to explain the evolution of the safety culture of an organization, complements the psychological perspective provided by SET (Choudhuri *et al*., 2025). The curve follows the transition between a state of being Reactive, where safety is largely driven by instinct rather than formal systems. Safety remains a priority even during night shifts or under intense production pressure. In these early phases, the manufacturing setup is typically linked to high injury rates because safety is considered an extrinsic expense, but not an internal resource, leading to trade-offs in the absence of management (Dugolli, 2021). The real transformation is the entry of an organization into the Independent and Interdependent stages of the Bradley Curve (Bodrožić & Adler, 2022). At the Independent stage, employees accept personal responsibility for their own safety and they are taught the significance of protocols in their own interest. However, the final phase of the model is the Interdependent one in which safety is a group responsibility. Employees are concerned about each other at this level, and the culture is so deeply embedded that the team is proud of its zero-harm culture. This transition largely depends on sustained leadership commitment to facilitate the transition from compliance-based safety to culture-driven safety (Ograh *et al*., 2026). An integrated theoretical perspective emerges from the combination of both frameworks. The Bradley Curve is the structural map that directs the cultural maturity, whereas Social Exchange Theory provides the motivational mechanism that drives employee behavior along this progression (Akande *et al*., 2025).

A high-pressure production environment is likely to cause the collapse of the "Dependent" stage of the Bradley Curve as employees will be more concerned with speed than with safety to satisfy perceived management expectations (Folkerts *et al*., 2020). The organization can only aspire to reach the peaks of the curve of Interdependent by altering the nature of the exchange, i.e., by showing that the management attaches greater importance to the individual than to the unit of production (Sahlmueller *et al*., 2022).

Lastly, Ji *et al*. (2019) also suggested that the combination of the two theories implied that safety performance is not solely determined by engineering controls but is dynamically shaped by human interactions. With SET, researchers can measure the quality of the leader/subordinate exchange, and the Bradley Curve allows the researcher to categorize the current level of maturity existing in the culture of the plant. Together they show that high-performance safety is achieved when

leadership commitment develops a reciprocal relationship that is so strong that safety is a self-sustaining, interdependent cultural norm despite the complexity of the equipment and the time pressure of the deadline (Dzreke, 2025).

3.0 Dimensions of Leadership Commitment

The table below outlines the key dimensions of leadership commitment that matter, beginning with visibility, the visual anchor of a safety-first culture (Elbir, 2025). By taking executives out of the boardroom and onto the shop floor to conduct their safety walkabouts, they seal the perceived rift between management and labour. This practice goes beyond physical presence by actively demonstrating concern for workplace risks. It humanizes the leadership of the workforce (Caffrey, 2024). By talking about safety in the actual production environment, leaders can build a trust foundation, signifying to workers that their physical health is a corporate objective of utmost priority and not an administrative box (Arboh *et al*., 2026).

Resource Allocation is the practical expression of the commitment of the organization to its proclaimed values, which is translated into practice (Yong *et al*., 2020). The decision to invest in quality personal protective equipment (PPE) and comprehensive and frequent safety training, rather than the lowest possible prices of quick fixes, sends a strong signal to employees in the manufacturing sector, where profit margins are often low (Singh, 2022). This aspect renders safety not an operational variable cost but an organization value. When employees understand that the management is willing to use financial resources to ensure their safety, it proves that they are valuable to the organization and helps to enforce the so-called Social Exchange because employees will return by becoming more compliant and caring (MacDonald & Dupuis, 2021).

Finally, Nawaz *et al*. (2019) suggested that the accountability aspect is what ensures that safety is not compromised as a sustainable priority even when high production is a challenge. One of the ways that the organization can align its incentive structure with its safety goals is to include safety Key Performance Indicators (KPIs) in the performance review of the management (Mahmoud *et al*., 2020). This top-down approach does not lead to the pit trap of industry where middle management might be tempted to compromise safety measures to meet aggressive production targets. Ensuring that the personal career advancement and rewards of a supervisor are conditional upon safety outcomes, one can ensure that leading by example is a mandatory leadership trait that ultimately equalizes the safety performance of the entire manufacturing plant (Haas, 2020).

Table 1: Dimensions of Leadership Commitment

Dimension	Actionable Indicator	Impact on Workforce
Visibility	Executives performing "Safety Walkabouts" on the shop floor.	Increases trust and perceived importance of safety.
Resource Allocation	Budgeting for high-quality PPE and safety training over "quick fixes."	Demonstrates that safety is a value, not just a cost.
Accountability	Integrating safety KPIs into management performance reviews.	Ensures safety isn't sacrificed for production speed.

Leadership and safety culture: Actionable indicators for the workforce **(Institution of Occupational Safety and Health, 2024).**

4.0 Conceptual Model

The conceptual model proposed is a linear, but profoundly integrated path analysis with Leadership Commitment as the main independent variable or the primary "Input" (Haque, Fernando & Caputi, 2019). Leadership is the driver that triggers the safety process in the high-stakes setting of a manufacturing plant; it is not sufficient to have any safety protocols on paper without the management actively pushing them (Coutifaris & Grant, 2022). By assigning resources to visibility, personal accountability, and safety, leaders can offer the energy and direction needed to take the organization beyond compliance. It is a commitment that forms the basis of all of the following safety behaviors (Liu *et al*., 2021). Passing through the flow, Safety Culture serves as the key mediator that translates the intent of the leadership into the action of the collective. The culture is the climate that keeps the fire burning when the spark comes with leadership. This mediator is a reflection of a collective psychological condition of the workforce, as they perceive, feel, and judge risk, through their beliefs, values and norms (Hassan *et al*., 2026). The impact of a robust input in leadership filters through the organization to nurture the safety culture, shifting it up the Bradley Curve. In the absence of this cultural mediation, the safety initiatives undertaken by management would be top-down directives that could just be disregarded by workers the moment supervision is not present (Li & Van Rooij, 2022). Safety is an issue that safety culture sustains and reinforces leadership intentions within the organization (Gärtner *et al*., 2019). The last variable of the model is Safety Performance, the measurable "Outcome" of the previous variables (Winge, Albrechtsen & Arnesen, 2019). The objective evidence of the model effectiveness is this performance, which can be measured using both lagging, like a decrease in Lost Time Injuries (LTI), and leading indicators, like a rise in the reporting of near-misses. (Borissov, 2024). Rather, an organization has to be willing to follow the reverse route: to get performance improvement, one has to grow the culture; and to get the culture growth, one has to first increase the leadership commitment.

Based on the proposed conceptual model, this study advances the following propositions: (1) Leadership commitment has a significant positive effect on safety culture; (2) Safety culture has a significant positive effect on safety performance; and (3) Safety culture mediates the relationship between leadership commitment and safety performance.

4.1 Analysis of Management Participation and Safety Metrics

To further understand the dynamics between proactive leadership behavior and operational outcomes, the correlation between management engagement and key performance indicators was evaluated. Fig. 1 illustrates the empirical relationship between the level of management participation in safety meetings and two distinct categories of safety metrics: a leading indicator (Near-Miss Reporting Rate) and a lagging indicator (Lost Time Injuries).

The scatter plot and corresponding trend lines reveal two distinct and critical operational insights.

4.1.1 Positive Correlation with Leading Indicators

As management participation in safety meetings increases from 10% to over 90%, there is a clear upward trend in the Near-Miss Reporting Rate (indicated by the blue circles and trend line). This aligns directly with Social Exchange Theory; visible leadership commitment fosters psychological safety, encouraging employees to proactively identify and report minor hazards before they escalate.

4.1.2 Negative Correlation with Lagging Indicators

Conversely, a higher percentage of management participation corresponds to a sharp decline in Lost Time Injuries (LTI) (indicated by the red crosses and trend line). This downward trend highlights that active managerial involvement drives the

organizational safety culture down from the reactive stages of the DuPont Bradley Curve toward the proactive, zero-harm interdependent phase. Ultimately, Fig. 1 demonstrates that consistent managerial visibility acts as a direct catalyst for continuous safety improvement, transforming safety from a reactive compliance exercise into a proactive operational core value.

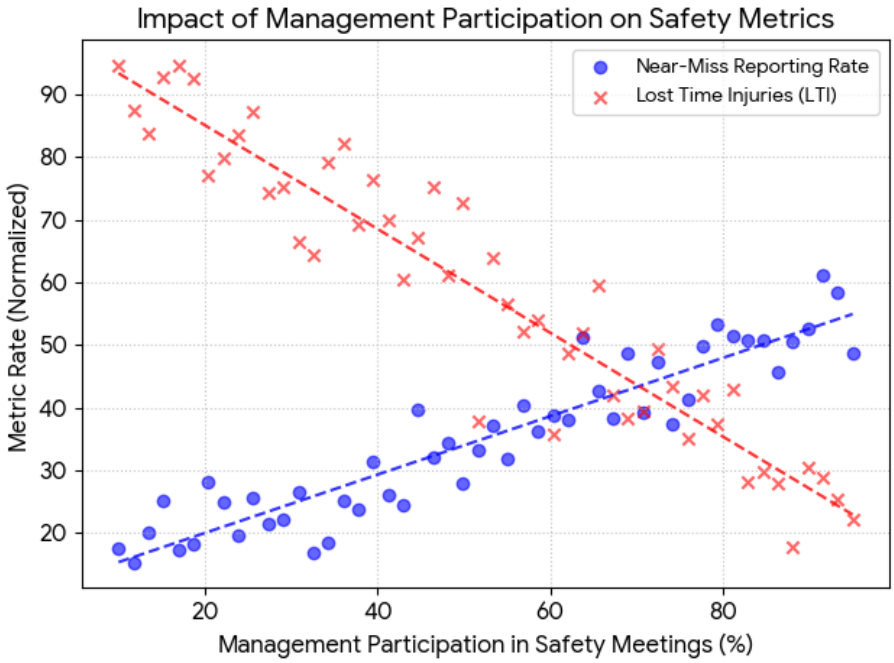

Fig. 1: Occupational health and safety annual performance review (Safety Analytics Group, 2024)

5.0 Measuring Occupational Safety Performance

In order to develop a holistic assessment of the safety situation in the manufacturing industry, Occupational Safety Performance should be regarded as a multidimensional construct instead of a mere count of accidents. (van Nunen *et al*., 2022). The use of a single data source provides a misleading representation of reality. One example is that a factory may record no injuries over a month, but this outcome may result from chance rather than an inherently safe working environment and not because it is a safe working environment. This study adopts a balanced scorecard approach that integrates both lagging and leading indicators (Jassem *et al*., 2022). This guarantees that the safety performance becomes an analytically equal entity to financial or manufacturing performance, thereby reducing reactive responses and strengthening proactive risk management practices (Barua *et al*., 2026).

Walaski (2020) inferred that Lagging Indicators are the traditional, outcome-based measures of safety, which would concentrate on the already visibly happened events. They are usually the Total Recordable Incident Rate (TRIR), the rate of Lost Time Injuries (LTI) and accident rates, including severity measured by days lost from work within a manufacturing plant. Although these measures play a crucial role in regulatory compliance, and in comparison, with the industry standards, they are inherently retrospective (Karkkainen, 2019). They narrate a tale of previous mistakes but provide limited insight into current or emerging risks or the dangers of the future. Lagging indicators in high-performing organizations should not be treated as primary objectives but rather as outcome validation measures (Hayat, 2024).

Comparatively, Mousavi *et al*. (2020) deciphered that Leading Indicators are the predictive inputs that reflect the robustness of the safety culture and the leadership commitment efficacy prior an incident takes place. These measures monitor the endeavors of proactive action, including an employee safety training participation rate (e.g., percentage of employees completing advanced safety training), management walkabouts, and the rate of near-miss reporting. In a manufacturing setting, a high volume of near-miss reports is commonly an indication of a healthy, open culture in which workers do not feel intimidated to report small mistakes (Alfayez *et al*., 2026). Through these upstream factors, the leadership can know about and identify and address potential hazards in machinery or workflows that can lead to an explosion, essentially reducing the likelihood of the lagging indicators escalating into critical incidents (George, 2024).

Table 2: Key Safety Performance Indicators

Type of Indicator	Metric	Goal
Lagging (Reactive)	Total Recordable Incident Rate (TRIR)	Decrease
Lagging (Reactive)	Severity Rate (Days lost per injury)	Decrease
Leading (Proactive)	Percentage of employees completed safety training	Increase
Leading (Proactive)	Time taken to close a reported safety hazard	Decrease

***Safety and health programs: Leading and lagging indicators (*Occupational Safety and Health Administration, 2023).**

5.1 Leadership and Safety Performance: A Statistical Analysis

To empirically validate the theoretical relationships discussed, an analysis was conducted correlating direct management engagement with both leading and lagging indicators of safety. Fig. 2 graphically represents this relationship, plotting the normalized rates of Near-Miss Reporting and Lost Time Injuries against the percentage of management participation in safety meetings. The linear regression lines fitted to the data points demonstrate strong correlations that directly support the propositions of the conceptual model.

Positive Leading Relationship: The upward-sloping dashed blue line shows that as Management Participation increases, there is a clear rise in the Near-Miss Reporting Rate. This data supports the application of Social Exchange Theory, suggesting that when leaders are visibly engaged, employees feel psychologically safer and are therefore more willing to proactively report hazards and near-misses (Alfayez et al., 2026). This proactive reporting is vital for mitigating risks upstream before they result in actual incidents.

Negative Lagging Relationship: In direct contrast, the downward-sloping dashed red line illustrates that higher levels of Management Participation strongly correlate with a decrease in Lost Time Injuries (LTI). This provides statistical validation that visible, active commitment from leadership directly transitions an organization away from reactive safety management (characterized by high incident rates) towards the interdependent, high-performance stage of the DuPont Bradley Curve (Bodrožić & Adler, 2022).

Collectively, the data in Fig. 2 illustrates that leadership commitment is not simply a symbolic administrative activity, but a direct determinant of both proactive safety behaviors and tangible reductions in severe occupational incidents.

The conflict of Production vs. Safety is the representation of a central tension within manufacturing systems paradox as the structural objectives of an organization seem to clash with each other. In the vast majority of the industrial environment, the main success factor is throughput- which, in most

cases, is measured in Units per Hour or Overall Equipment Effectiveness (OEE) (Duman & Eliiyi, 2021).

This unremitting demand to achieve quotas leads to a psychological condition where employees and bosses can view safety measures as obstacles to productivity, slowing efficiency (Hirsch, 2026). This leads to a hazardous subculture in which ignoring a mechanical glitch or disregarding safety interlocks to continue the assembly line is an acceptable behavior when incentivization of production targets becomes the priority (Brayne, Lageson & Levy, 2023).

Fig. 2: Impact of Management Participation on Safety Metrics
(Source: Adapted from Occupational Safety and Health Administration (2023)

Nevertheless, Haque, Fernando and Caputi (2019) confirmed that a conceptual shift occurs when leadership commitment reshapes and restructures the connection between safety and production. The dynamics of Production vs. Safety in a mature safety culture is not a zero-sum game but instead a symbiotic relationship (Qin *et al*., 2023). The management should clearly communicate that a safe production environment is the only way to produce quality products because disastrous failures and injuries at workplace are much more disruptive and expensive than momentary breaks in production. Reframing safety as a prerequisite for production as a precondition of production, instead of an opponent to it, displaces the paradox and shifts the staff to the state where doing it right is interpreted as doing it fast (Higgins and Richards, 2019).

The ultimate indicator of a mature safety culture is the empowerment of the individual worker to stop the Line. Once a floor operator recognizes a hazard (whether due to a frayed cable, faulty sensor, or other ergonomic risk), and the operator has the power to stop production without the fear of being reprimanded, the safety culture is at its highest maturity (Memarian *et al*., 2022). It is the most noticeable leadership commitment because it shows that the organization is willing to prioritize safety over short-term production output about forfeiting immediate Unit per Hour in order to preserve the most valued asset of the organization: people (Hassi, 2019). This mental safety is guaranteed to make the manufacturing process more resilient, sustainable, and ultimately more productive in the long run (Anos, 2025).

6.0 Conclusion

The findings of this study reinforce the argument that improved safety performance is not a matter of chance, but a deliberate outcome of sustained and well-structured

leadership commitment. Rather than being a one-time initiative, leadership serves as a continuous driving force that sustains safety practices within the demanding environment of the manufacturing industry. As production pressures intensify, initial safety efforts can easily diminish unless they are consistently reinforced through visible managerial actions, regular engagement with employees, and strategic allocation of resources. In the absence of such sustained commitment, organizations are likely to revert to reactive approaches, leading to increased incidents and weakened safety outcomes.

To achieve meaningful improvements in safety performance, organizations must move beyond compliance-based approaches and adopt transformational leadership practices. Unlike transactional leadership, which relies on enforcement and monitoring, transformational leadership fosters intrinsic motivation by encouraging employees to internalize safety as a core personal and organizational value. By clearly articulating a vision of a zero-harm workplace and demonstrating commitment through consistent actions, leaders can cultivate a culture of shared responsibility. This progression enables organizations to reach a level where safety becomes self-reinforcing, with employees actively contributing to the well-being of themselves and their colleagues.

Ultimately, the integration of strong leadership commitment and a mature safety culture represents a significant source of competitive advantage in the manufacturing sector. Effective safety management not only reduces costs associated with workplace injuries and legal liabilities but also enhances trust, employee morale, and overall productivity. By resolving the perceived conflict between production and safety, organizations can achieve high operational efficiency without compromising human well-being. This approach provides a strategic pathway for manufacturing firms seeking to attain sustainable, world-class performance.

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Oluwaseun Ibuife Oluwaniyi conceptualized the study, designed the research methodology, conducted data analysis, and drafted the original manuscript. Oluwaranti A. Omowami contributed to literature review, data collection, interpretation of results, and critically revised the manuscript for important intellectual content. Both authors reviewed, edited, and approved the final version of the manuscript.