Factors Shaping Ergonomic Strategy Effectiveness in Steel Manufacturing: A Panacea for Sustainable Implementation

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Abstract- ***This study investigates the factors shaping the effectiveness of ergonomic strategies in steel manufacturing and their implications for sustainable implementation. Focusing on four major factories in Southwest Nigeria, the research explores key ergonomic challenges, assesses the performance of existing interventions, and identifies organizational and contextual drivers of success. Using a descriptive survey design, data were collected from 266 workers and analyzed with SPSS. Findings reveal that inadequate lighting (68.8%), poor workstation design (62.8%), and insufficient breaks (57.1%) are major ergonomic challenges. While strategies like ergonomic chairs, sit-stand desks, and improved lighting showed moderate effectiveness, low awareness (58.6%) and lack of regular assessments limit their impact. Critical enablers of strategy adoption include management support, funding, technological access, and employee feedback. The study concludes that sustainable ergonomic practices require more than isolated interventions they demand institutional commitment, ongoing training, and a participatory approach. These insights can guide policy and organizational efforts to embed ergonomics into Nigeria's steel industry sustainably.***

Index Terms- ***Ergonomics, Steel Manufacturing, Strategy Effectiveness, Sustainable Implementation, Workplace Safety, Nigeria***

I. INTRODUCTION

The global movement toward sustainable industrialization has heightened the demand for work environments that are not only efficient but also safe, inclusive, and health-conscious. Nowhere is this need more urgent than in labour-intensive sectors such as steel manufacturing, where workers face routine exposure to high-risk tasks and poorly designed workspaces. In Nigeria, especially in the rapidly expanding steel industry of the Southwest, productivity is often prioritized over safety, resulting in increased incidence of musculoskeletal disorders (MSDs), chronic fatigue, injury-related downtime, and long-term health costs (Mbada, 2022; Małysa, 2022).

Ergonomics the science of designing work environments to fit human capabilities presents a sustainable solution to these challenges. Also known as human-centered or worker-centric design, ergonomics aims to optimize task performance, reduce physical and psychological strain, and create safer, more inclusive workplaces (Giacomin, 2014; Ajayi et al., 2015). Globally, ergonomic strategies have been shown to reduce workplace injuries, increase employee satisfaction, and enhance organizational performance (Schneider & Irastorza, 2010; Olasunkanmi et al., 2020). Yet in many Nigerian manufacturing environments, ergonomic interventions are either poorly implemented, inconsistently applied, or entirely absent.

Within the steel manufacturing sub-sector one of Nigeria's most physically demanding and structurally outdated industries critical ergonomic issues persist, including inadequate lighting, repetitive tasks, poor workstation design, and insufficient break schedules. Although global best practices exist, their successful adoption is often hindered by localized challenges such as budget constraints, poor regulatory oversight, low worker awareness, outdated machinery, and managerial inertia (Ismaila, 2010; Feng et al., 2015).

Furthermore, many existing ergonomic strategies are implemented without employee input or follow-up evaluation, reducing their practical effectiveness and sustainability.

Crucially, the issue is not simply the presence or absence of ergonomic tools, but rather the broader organizational ecosystem that determines whether such interventions are embraced, maintained, and adapted to evolving workplace needs. Factors such as management commitment, employee training, feedback mechanisms, access to equipment, and industry standards are all decisive in shaping outcomes. The failure to address these shaping factors holistically undermines the potential for sustainable ergonomic implementation in Nigerian industry.

This study therefore investigates the factors shaping ergonomic strategy effectiveness in steel manufacturing, positioning them as a panacea for sustainable implementation. It aims to move beyond problem identification to evaluate what actually enables or inhibits successful ergonomic integration. Focusing on four major steel factories in Southwest Nigeria, the research adopts study to understand how ergonomic challenges, interventions, and adoption dynamics intersect.

Study Area

The research covers key industrial hubs in Southwest Nigeria, including Ibadan, Lagos, Abeokuta, Osogbo, Akure, and Ado-Ekiti. These cities host diverse manufacturing activities, making them ideal for studying ergonomic challenges and interventions across different industrial settings.

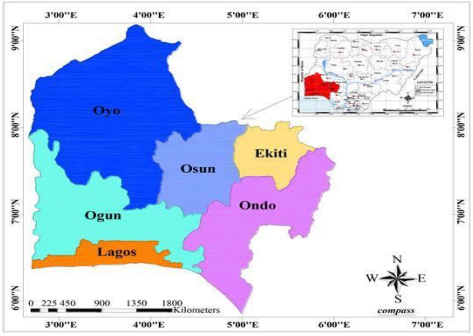

Figure 1: showing Map of South West, Nigeria
Source: United Nations cartograhic section (2022)

II. LITERATURE REVIEW

Concept and Evolution of Ergonomics

Ergonomics, also referred to as human factors engineering, is the multidisciplinary study and practice of designing work environments, tools, and processes to suit human capabilities and limitations (Zunjic et al., 2015; Park, 2009). It integrates principles from physiology, biomechanics, psychology, and industrial engineering to enhance worker comfort, reduce fatigue, and improve productivity. Workplace ergonomics aims to minimize musculoskeletal disorders (MSDs), enhance task efficiency, and ensure physical and psychological well-being (Vieira & Kumar, 2004; Ogundola, 2023).

Historically, ergonomics evolved from wartime human factors engineering to civilian industrial applications, with industries gradually adopting worker-centered design as a core operational philosophy (Meister, 1999; Roland, 2017). Over time, emphasis shifted from productivity-driven work design to a more holistic view prioritizing worker safety, comfort, and engagement (Wilson, 2000; Andrew et al., 2017).

Ergonomic Challenges in Industrial Workplaces

Industrial work environments especially in sectors like steel manufacturing are associated with high ergonomic risk due to physically demanding tasks, repetitive movements, awkward postures, and exposure to environmental stressors (Middlesworth, 2020). Common risk factors include repetitive motions, forceful exertions, poor workstation design, vibration, and contact stress, all of which contribute to MSDs and chronic fatigue (Ajayi et al., 2015; Brain & Spine, 2018).

In the Nigerian, challenges are often compounded by limited awareness, infrastructural deficiencies, outdated equipment, and poor regulatory enforcement (Ismaila, 2010; Olabode et al., 2017). Many workers operate under conditions that lack proper lighting, adjustable furniture, or ventilated environments, increasing injury risks and reducing productivity.

Effectiveness of Ergonomic Strategies

The effectiveness of ergonomic strategies in industrial settings is typically measured in terms of their ability to reduce injury rates, improve worker satisfaction, and enhance operational output. Ergonomic interventions such as adjustable workstations, anti-fatigue mats, sit-stand desks, and improved workflow layout have been widely reported to reduce the incidence of MSDs and increase task efficiency (Margherita et al., 2017; Olasunkanmi et al., 2020).

However, studies have shown that these interventions must be context-specific and data-driven to be effective. In many Nigerian industries, ergonomic strategies remain underutilized or poorly executed due to fragmented implementation, lack of continuity, and minimal post-implementation evaluation (Ajayi, 2015; Kumari & Kaur, 2018). Without feedback mechanisms and continuous ergonomic assessment, many strategies fail to deliver meaningful improvements.

Factors Influencing Adoption of Sustainable Ergonomic Practices

The success or failure of ergonomic implementation depends on several organizational and systemic factors. Among the most critical is management support, which affects everything from budget allocation to policy enforcement and staff training (Halliday et al., 2023). Studies show that companies with strong leadership commitment to ergonomics are more likely to invest in tools, integrate employee feedback, and monitor outcomes (Pacaux-Lemoine et al., 2017).

Budget constraints are also a recurring barrier, particularly in low- and middle-income economies like Nigeria. Small and medium-scale industries often lack the capital to procure ergonomic equipment or hire specialists (Romero et al., 2019). Additionally, technological advancement plays a dual role: while it offers ergonomic relief (e.g., automation, sensor-based monitoring), it requires upfront investment and workforce retraining (Roland, 2017).

Other influential factors include:

Employee awareness and training (Glander, 2017)

Access to ergonomic tools and equipment (Lušetić et al., 2018)

Regulatory compliance and enforcement (Ismaila, 2010)

Organizational culture and participatory practices (Nykänen et al., 2016)

Gaps in the Nigerian Steel Manufacturing Sector

Despite growing global evidence supporting ergonomic interventions, the Nigerian steel industry continues to experience an implementation lag. Most local studies focus on general manufacturing or construction, leaving a notable gap in context-specific research on steel factories in Southwest Nigeria (Saidu et al., 2011; Njaka et al., 2022). The limited body of knowledge on the effectiveness of current ergonomic strategies in these environments as well as the barriers to adoption hampers policy development and factory design initiatives.

There is also insufficient integration of worker feedback mechanisms in strategy development and poor institutionalization of continuous ergonomic assessment. These gaps call for empirical research that moves beyond theoretical understanding and explores real-world dynamics of ergonomics in steel manufacturing settings.

III. RESEARCH METHODOLOGY

Research Design

This study adopted a descriptive survey research design, suitable for systematically collecting and analyzing perceptions, experiences, and organizational practices related to ergonomic challenges, strategy effectiveness, and adoption factors within steel manufacturing industries in Southwest Nigeria. The design enabled the researcher to gather both qualitative insights and quantitative data directly from industrial workers and administrative personnel, making it appropriate for evaluating on-the-ground realities of ergonomic implementation.

Study Population

The study population comprised workers across various roles production staff, maintenance personnel, quality control officers, and supervisors employed in purpose-built steel manufacturing

factories within Southwest Nigeria. These individuals were considered best positioned to assess ergonomic practices, challenges faced, and the factors influencing strategy effectiveness in their workplaces.

Sample Frame and Sampling Technique

A multi-stage sampling technique was employed. First, purposive sampling was used to select steel manufacturing industries known for their operational significance and scale. Next, random sampling was applied to select individual respondents within each factory, ensuring diversity across job categories and departments.

Table 1: The selected steel factories and corresponding sample frames are presented below:

Table 1: Sample Frame

S/N	Steel Factory	State	Total Workers (Sample Frame)	Sample Size (33.5%)
1	Federated Steel Industry, Otta	Ogun	205	69
2	Kam Steel Integrated Company Ltd, Shagamu	Ogun	220	74
3	Quantum Steels Nigeria Ltd	Ogun	192	64
4	African Steel Mills Nigeria Ltd, Ikorodu	Lagos	176	59
Total			793	266

Source: Author's field survey and compilation (2024)

The Slovin's formula was used to determine the minimum sample size at a 95% confidence level, resulting in 266 respondents, representing 33.5% of the total population.

Data Collection Instruments

Primary data were collected through a structured questionnaire divided into the following key sections:

1. Section A: Identification of ergonomic challenges in the workplace.
2. Section B: Assessment of the perceived effectiveness of ergonomic strategies (e.g., workstation design, tools, job rotation, environmental controls).
3. Section C: Evaluation of factors influencing the adoption of ergonomic practices, including management support, budget allocation, training, regulatory pressures, and worker feedback.

The questionnaire featured Likert scale formats (5-point) for closed-ended responses, allowing for quantifiable analysis of perceptions and experiences. The instrument was reviewed by experts and pilot-tested for clarity and reliability before deployment.

Method of Data Analysis

The collected data were analysed using descriptive and inferential statistical techniques, including:

1. Descriptive statistics: Frequency distributions, percentages, mean scores, and standard deviations were used to summarize ergonomic challenges and perceptions of strategy effectiveness.
2. Inferential statistics:
   Weighted Mean Index: Used to rank the severity of ergonomic challenges and the perceived effectiveness of different ergonomic interventions.

All analyses were conducted using standard statistical software (e.g., SPSS), and results were presented using tables, charts, and weighted scores for clarity and interpretability.

IV. ANALYSIS AND RESULTS

Evaluation of the Effectiveness of Existing Ergonomic Design Strategies Implemented in Selected Manufacturing Industries in Southwest Nigeria.

The data presented in Figure 2 illustrates respondents' awareness of ergonomic best practices implemented in the workplace within selected manufacturing industries in southwest Nigeria. The data reveals that

a majority of respondents, 58.6%, are not aware of these ergonomic practices, while 41.4% indicate awareness.

This disparity shows that most workers lack knowledge of critical workplace ergonomic practices, which could hinder efforts to promote health, safety, and productivity in the manufacturing sector. The significant percentage of respondents unaware of these practices reveal the need for targeted awareness campaigns and training programs to bridge the knowledge gap. On the other hand, the 41.4% who are aware reflect a foundation on which organizations can build, emphasizing the importance of institutionalizing ergonomic practices across workplaces. Enhancing awareness and implementation of such practices will contribute to reducing workplace injuries, improving employee well-being, and increasing overall operational efficiency.

Implication

The data reveal a concerning imbalance in the awareness of ergonomic best practices within the manufacturing industries in southwest Nigeria, with a significant portion of employees lacking knowledge. The fact that more than half of the respondents are unaware of these practices shows a systemic gap in workplace training and education, which could lead to increased workplace injuries, reduced efficiency, and diminished employee morale. However, the awareness level among the remaining respondents provides a critical starting point for improvement. Industries can leverage this existing base of informed workers to champion ergonomic practices and influence others. Addressing the knowledge gap through targeted training programs will significantly reduce the risks associated with poor ergonomics while boosting productivity and fostering a safer, more supportive workplace environment.

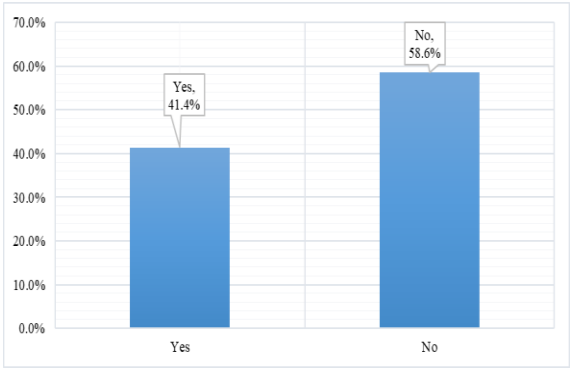

Figure 2: Awareness of the Ergonomic Best Practices Implemented in the Workplace in Selected Manufacturing Industries in Southwest Nigeria
Source: Author's Field Survey, 2024

Effectiveness of Ergonomic Design Strategies

The data below reveal respondents' perceptions of the effectiveness of various ergonomic design strategies implemented in manufacturing industries in Southwest Nigeria. The data evaluates eight ergonomic strategies, ranking them based on their Total Weighted Value (TWV) and average mean (TWV/n). With an overall average TWV/n of 3.26, the responses show that the strategies are generally perceived as moderately effective in enhancing workplace conditions and productivity.

Among the strategies, ergonomic chairs are regarded as the most effective, with the highest TWV (929) and TWV/n (3.49). A significant proportion of respondents rated this strategy as "Very Effective" or "Highly Effective". This reveal the importance of ergonomic seating in providing comfort and reducing musculoskeletal issues, contributing positively to workers' performance and health. Similarly, the use of sit-stand desks is rated highly, with a TWV of 919 and a TWV/n of 3.45. The flexibility offered by these desks is seen as a crucial factor in minimizing fatigue and physical strain, showing that they are a well-received intervention in these industries.

Proper lighting also ranks high in effectiveness, with a TWV of 889 and TWV/n of 3.34. Good lighting is essential for reducing eye strain and improving focus, making it a key factor in workplace ergonomics. The strategy of regular breaks and job rotation follows closely, with a TWV of 848 and TWV/n of 3.19. This show that practices aimed at reducing monotony and

repetitive strain are moderately effective in promoting worker satisfaction and productivity.

Other strategies, such as ventilation improvements (TWV/n 3.26) and adjustable workstations (TWV/n 3.16), are rated close to the overall average. This shows that these interventions, while effective, are not perceived as impactful as others. Similarly, lifting aids and equipment, with a TWV/n of 3.13, is moderately effective in alleviating the physical strain associated with manual handling tasks. Lastly, anti-fatigue mats, with the lowest TWV (806) and TWV/n (3.03), are the least appreciated strategy.

Table 2: Respondents response to the effectiveness of Ergonomic Design Strategies

Ergonomic Design Strategies	Not Effective (1)	Slightly Effective (2)	Moderately Effective (3)	Very Effective (4)	Highly Effective (5)	Total Frequency (f)	TWV	TWV/n
Adjustable workstations	32	45	82	62	45	266	841	3.16
Ergonomic chairs	25	35	55	86	65	266	929	3.49
Anti-fatigue mats	45	64	50	52	55	266	806	3.03
Proper lighting	22	45	66	86	47	266	889	3.34
Regular breaks/ Job rotation	28	56	75	52	55	266	848	3.19
Lifting aids and equipment	45	53	45	68	55	266	833	3.13
Ventilation improvements	30	46	75	55	60	266	867	3.26
Use of sit-stand desks	22	36	65	85	58	266	919	3.45
Total								26.06/8
								3.26

Source: Author's Field Survey, 2024

Impact of These Ergonomic Design Strategies on the Work Environment

The data reveal the respondents' perceptions of the impact of ergonomic design strategies on various aspects of the work environment in selected manufacturing industries in Southwest Nigeria. The data from Table 3 evaluates seven critical aspects of the work environment based on their Total Weighted Value (TWV) and average mean of Total Weighted Value (TWV/n). The overall average TWV/n is 3.19, showing a moderate impact of ergonomic interventions across these dimensions.

The overall work environment is perceived as the most positively impacted aspect, with the highest TWV (947) and TWV/n (3.56). This shows that ergonomic design strategies significantly enhance the general workplace atmosphere and conditions, creating a more supportive and efficient environment. Respondents overwhelmingly rated this dimension as having a "Significant Impact" or "Major Impact", revealing the comprehensive benefits of ergonomic interventions.

Worker safety ranks second, with a TWV of 932 and TWV/n of 3.50. The high ratings in the "Significant Impact" and "Major Impact" categories emphasize the effectiveness of ergonomic measures in reducing risks and ensuring safer working conditions. Similarly, the reduction in work-related injuries has a TWV of 889 and TWV/n of 3.34, showing its critical role in minimizing workplace hazards and promoting worker well-being. Worker productivity also benefits significantly, with a TWV of 869 and TWV/n of

3.27. A substantial number of respondents identified a "Significant Impact" and "Major Impact", showing that ergonomic strategies play a vital role in enhancing efficiency and overall output. Meanwhile, worker well-being is moderately impacted, with a TWV of 812 and TWV/n of 3.05. The impact of ergonomic strategies on employee retention and job satisfaction is less pronounced, with TWV/n scores of 2.82 and 2.80, respectively.

Implications

The findings reveal the substantial impact of ergonomic interventions on the overall work environment, worker safety, and reduction in work-related injuries. Employers in manufacturing industries should prioritize these areas when implementing ergonomic strategies, as they directly contribute to creating a safer, more productive, and efficient workplace. Enhancing worker productivity and well-being should also remain a focus to sustain and maximize the positive outcomes of these initiatives.

However, the relatively lower scores for employee retention and job satisfaction show that ergonomic improvements alone may not be sufficient to address these aspects comprehensively. Employers should consider integrating ergonomic strategies with broader human resource and organizational policies. Overall, ergonomic interventions are essential for improving key aspects of the work environment.

Table 3: The Impact of These Ergonomic Design Strategies on the Work Environment

Work Environment Aspects	No Impact (1)	Minor Impact (2)	Moderate Impact (3)	Significant Impact (4)	Major Impact (5)	Total Frequency (f)	TWV	TWV/n
Worker well-being	34	79	50	45	58	266	812	3.05
Worker safety	22	45	55	65	79	266	932	3.50
Worker productivity	35	50	48	75	58	266	869	3.27
Reduction in work-related injuries	27	43	66	72	58	266	889	3.34
Job satisfaction	59	72	49	34	52	266	746	2.80
Employee retention	49	72	59	49	37	266	751	2.82
Overall work environment	20	32	59	89	66	266	947	3.56
Total								22.35/7
								3.19

Source: Author's Field Survey, 2024

Identification of the Main Ergonomic Challenges and Barriers Faced in the Implementation of Best Practices in the Manufacturing Industries in Southwest Nigeria

The data in Table 4 reveal the main ergonomic challenges faced in implementing best practices in the manufacturing industries in Southwest Nigeria. Poor workstation design is a major challenge, with 62.8% of respondents identifying it as the main challenge. This issue is most pronounced in Alliance Steel Co., Ibadan, where 78.1% of workers highlighted it as a concern, while it is least significant in Universal Steel Co., Ikeja, with 43.2% noting it. Inadequate lighting emerged as the most prevalent challenge, with 68.8% of respondents citing it as a problem. This issue is particularly severe in Alliance Steel Co., Ibadan (92.2%) and Oshogbo Steel Co., Oshogbo (83.1%), pointing to critical gaps in

workplace illumination that could affect both safety and productivity. Conversely, it is less of a concern in Federated Steel Industry, Otta, where 47.8% of respondents identified it as an issue.

Insufficient breaks were reported by 57.1% of respondents as a barrier to effective ergonomic practices. Alliance Steel Co., Ibadan (70.3%) and Oshogbo Steel Co., Oshogbo (71.2%) reported the highest levels of concern in this regard, showing that work schedules in these manufacturing industries may not adequately prioritize employee recovery. In comparison, Universal Steel Co., Ikeja had only 27.0% of respondents citing this as a challenge, showing better break management practices. Repetitive tasks were noted as a significant challenge by 53.8% of respondents, with Federated Steel Industry, Otta (58.0%) and Alliance Steel Co., Ibadan (62.5%) reporting higher percentages. This reflects the physically demanding nature of work in these industries and the need for task diversification or automation to reduce the strain on workers.

Heavy lifting is another prominent challenge, cited by 44.0% of respondents. Universal Steel Co., Ikeja had the highest concern, with 60.8% of respondents identifying it as an issue, revealing a need for better lifting aids or training programs to minimize physical strain. Poor posture was reported as a challenge by 41.0% of respondents overall, with Alliance Steel Co., Ibadan (54.7%) reporting the highest percentage, highlighting the need for ergonomic furniture and posture education.

Lastly, poor job rotation practices were cited by 45.9% of respondents as a challenge. Alliance Steel Co., Ibadan had the highest percentage at 68.8%, indicating a lack of diversity in tasks assigned to workers, which could lead to burnout or repetitive stress injuries. In contrast, Federated Steel Industry, Otta had the lowest concern, with only 23.2% of respondents identifying this as an issue, possibly reflecting better job rotation policies.

Overall, the data reveal a range of ergonomic challenges in the manufacturing sector, with lighting, workstation design, and task management emerging as critical areas requiring intervention to improve workplace safety, comfort, and efficiency.

Table 4: Ergonomic challenges face at workplace in the selected manufacturing industries in southwest Nigeria

Ergonomic challenges face at workplace	Federated Steel Industry, Otta		Universal Steel Co., Ikeja		Oshogbo Steel Co., Oshogbo		Alliance Steel Co., Ibadan		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Poor workstation design	45	65.2	32	43.2	40	67.8	50	78.1	167	62.8
Inadequate lighting	33	47.8	42	56.8	49	83.1	59	92.2	183	68.8
Insufficient breaks	45	65.2	20	27.0	42	71.2	45	70.3	152	57.1
Repetitive tasks	40	58.0	30	40.5	33	55.9	40	62.5	143	53.8
Heavy lifting	25	36.2	45	60.8	22	37.3	25	39.1	117	44.0
Poor posture	22	31.9	25	33.8	27	45.8	35	54.7	109	41.0
Poor job rotation practices	16	23.2	33	44.6	29	49.2	44	68.8	122	45.9

Source: Author's Field Survey, 2024

Barriers Faced In the Implementation of Best Practices in the Manufacturing Industries in Southwest Nigeria

The data presented the respondent response to barriers faced in implementing best practices in manufacturing industries in Southwest Nigeria.

Budget constraints were the most prominent barrier, with 92.9% of respondents identifying it as an issue. This show that financial limitations are a widespread challenge across all industries surveyed, significantly affecting their ability to adopt ergonomic best practices. Limited access to ergonomic tools and equipment was another critical barrier, cited by

89.8% of respondents. This points to insufficient resources as a pervasive problem that hinders effective implementation of ergonomic strategies in these industries. Similarly, inadequate government regulations and policies were recognized as a barrier by an overwhelming 97.7% of respondents, showing the urgent need for stronger legislative and regulatory support to drive the adoption of best practices.

Lack of management support was identified by 64.3% of respondents, revealing the importance of leadership commitment in facilitating the successful implementation of ergonomic improvements. Without active management involvement, efforts to enhance workplace practices may face resistance or stagnation. Insufficient training and awareness were noted by 62.8% of respondents, showing a gap in knowledge and skill development necessary for effectively implementing ergonomic solutions.

Resistance to change was identified as a barrier by 47.7% of respondents. This show a significant cultural and organizational challenge, where employees or management may be reluctant to adopt new systems or processes due to comfort with the status quo or lack of understanding of the benefits. Overall, the data reveals that while financial and resource-related barriers are the most pressing issues, cultural, educational, and regulatory challenges also play a crucial role.

Table 5: Barriers Faced in the Implementation of Best Practices in the Manufacturing Industries in Southwest Nigeria

Barriers	Federated Steel Industry, Otta		Universal Steel Co., Ikeja		Oshogbo Steel Co., Oshogbo		Alliance Steel Co., Ibadan		Grand Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Budget constraints	60	87.0	73	98.6	59	100.0	55	85.9	247	92.9
Lack of management support	45	65.2	55	74.3	39	66.1	32	50.0	171	64.3
Resistance to change	40	58.0	35	47.3	25	42.4	27	42.2	127	47.7
Insufficient training and awareness	48	69.6	42	56.8	35	59.3	42	65.6	167	62.8
Limited accesses to ergonomic tools and equipment	69	100.0	70	94.6	43	72.9	57	89.1	239	89.8
Inadequate government regulations and policies	69	100.0	74	100.0	59	100.0	58	90.6	260	97.7
Others	0	0	0	0	0	0	0	0	0	0

Source: Author's Field Survey, 2024

How Employee Feedback Impact the Implementation of Ergonomic Best Practices in the Workplace across the Selected Manufacturing Industries in Southwest Nigeria.

Table 6 presents the responses of employees on how feedback impacts the implementation of ergonomic best practices in selected manufacturing industries in southwest Nigeria. In Federated Steel Industry, Otta, the highest proportion of respondents (43.5%) believe that employee feedback has a "high impact," followed by 34.8% who consider the impact to be "very high." A smaller percentage (17.4%) rate the impact as "moderate," and only 4.3% view it as having a "low impact." None of the respondents believe employee feedback has "no impact." At Universal Steel Co., Ikeja, a similar pattern emerges,

with 47.3% of respondents perceiving a "high impact," and 20.3% identifying a "very high impact." Additionally, 29.7% indicate a "moderate impact," while a minimal 2.7% consider the impact to be "low." Again, no respondents rated the impact as "no impact."

For Oshogbo Steel Co., Oshogbo, the majority of respondents (64.4%) view the impact of employee feedback as "high," making this the most prominent perception among all companies. A further 23.7% consider it "very high," while 8.5% see it as

"moderate," and 3.4% believe it has a "low impact." No respondents identify the feedback as having "no impact."

In Alliance Steel Co., Ibadan, 50.0% of respondents rate employee feedback as having a "high impact," while 31.3% believe it has a "very high impact." A smaller proportion (12.5%) see the feedback as having a "moderate impact," and 6.3% consider it to have a "low impact." As with the other industries, there is no response indicating "no impact."

Overall, the data shows that a majority (50.8%) of respondents across all the manufacturing industries perceive employee feedback as having a "high impact" on the implementation of ergonomic best practices. This is followed by 27.4% who rate it as having a "very high impact," and 16.5% who see it as having a "moderate impact." Only 5.3% consider the impact to be "low," while none of the respondents believe there is "no impact."

Overall, the data show a strong consensus across the surveyed manufacturing industries that employee feedback significantly influences the implementation of ergonomic best practices, with the highest ratings concentrated in the "high impact" and "very high impact" categories.

Table 6: How Employee Feedback Impact the Implementation of Ergonomic Best Practices in the Workplace across the Selected Manufacturing Industries in Southwest Nigeria

Respondent response to how employee feedback impact the implementation of ergonomic best practices in the workplace across the selected manufacturing industries in southwest Nigeria	Federated Steel Industry, Otta		Universal Steel Co., Ikeja		Oshogbo Steel Co., Oshogbo		Alliance Steel Co., Ibadan		Grand Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
No impact	0	0	0	0	0	0	0	0	0	0
Low impact	3	4.3	2	2.7	5	8.5	4	6.3	14	5.3
Moderate impact	12	17.4	22	29.7	2	3.4	8	12.5	44	16.5
High impact	30	43.5	35	47.3	38	64.4	32	50.0	135	50.8
Very high impact	24	34.8	15	20.3	14	23.7	20	31.3	73	27.4

Source: Author's Field Survey, 2024

Factors Influencing the Adoption of Ergonomic Design Strategies in Manufacturing Industries in Southwest Nigeria

The data in Table 7 presents the extent to which various factors influence the adoption of ergonomic design strategies in selected manufacturing industries in Southwest Nigeria Index. Each factor was rated on a scale from 1 (No Influence) to 5 (Major Influence). Management Support emerges as the most influential factor, with a TWV of 1160 and an average mean score (TWV/f) of 4.36. This shows that the backing of management is crucial for the successful adoption of ergonomic design strategies. When management is committed to improving workplace ergonomics, it facilitates the necessary changes and resource allocation.

Budget Constraints follow closely; with a TWV of 1155 and an average mean score TWV/f of 4.34. This shows that financial limitations significantly affect the ability to adopt ergonomic strategies. The lack of funds can restrict the purchase of ergonomic tools, equipment, and training programs, thereby impeding the implementation of ergonomic solutions. Employee Awareness and Training has a TWV of 976 and an average mean score TWV/f of 3.67, showing the importance of educating employees about ergonomics. Increasing awareness and providing training helps workers understand the

benefits of ergonomic practices, making them more likely to support and adopt these strategies.

Availability of Ergonomic Tools scored a TWV of 1109 and an average mean score TWV/f of 4.17, showing that access to appropriate ergonomic tools is a substantial factor. Without the necessary tools, implementing ergonomic improvements becomes challenging, even if there is management support and sufficient budget. Industry Standards and Best Practices have a TWV of 1063 and an average mean score TWV/f of 4.00, revealing that adherence to established standards play a significant role in driving ergonomic design strategies. Following industry best practices ensures that companies are up-to-date with effective ergonomic solutions, fostering a safer and healthier work environment.

Worker Feedback and Participation scored a TWV of 1031 and an average mean score TWV/f of 3.88. This shows that involving employees in the decision-making process regarding ergonomic changes will positively influence the adoption of these strategies. Engaging workers ensures that the ergonomic solutions implemented address their specific needs, increasing acceptance and effectiveness. Employee Health Outcomes have a TWV of 895 and an average mean score TWV/f of 3.36, showing that the perceived health benefits of ergonomic strategies are a moderate influence. Emphasizing the positive impact of ergonomics on health can motivate both management and employees to prioritize these practices. Technological Advancements scored a TWV of 1070 and a TWV/f of 4.02, showing that adopting new technologies supports ergonomic improvements. Innovations in ergonomic tools and equipment can enhance the effectiveness of ergonomic design strategies, making them more appealing to employers.

Implications

The data shows that multiple factors significantly influence the adoption of ergonomic design strategies in manufacturing industries in Southwest Nigeria. Management support and budget constraints are the most critical, showing the need for strong leadership commitment and adequate funding to successfully implement ergonomic interventions. Additionally, the availability of ergonomic tools, adherence to industry standards, and technological advancements play substantial roles in promoting ergonomic practices. Enhancing employee awareness and encouraging their feedback and participation can further drive the adoption of these strategies.

Table 7: Which of the Factors Below Influence the Adoption of Ergonomic Design Strategies in Selected Manufacturing Industries in Southwest Nigeria

Factors	No Influence (1)	Slight Influence (2)	Moderate Influence (3)	Significant Influence (4)	Major Influence (5)	Total Frequency (f)	TWV	TWV/f
Management support	0	22	35	34	175	266	1160	4.36
Budget constraints	0	17	29	66	154	266	1155	4.34
Employee awareness and training	0	45	65	89	67	266	976	3.67
Availability of ergonomic tools	0	12	45	95	114	266	1109	4.17
Industry standards and best practices	0	22	56	89	99	266	1063	4.00
Worker feedback and	0	30	67	75	94	266	1031	3.88

participation								
Employee health outcomes	0	85	65	50	66	266	895	3.36
Technological advancements	0	22	56	82	106	266	1070	4.02
Total								31.80/8
								3.98

Source: Author's Field Survey, 2024

The data in Table 8 reveal the respondents' perceptions of ergonomic practices in their workplace, measured using Total Weighted Value (TWV) and the average mean score (TWV/f). The first factor, "Our management actively supports ergonomic initiatives," has an average mean score TWV/f of 4.03. This shows a moderate level of agreement among respondents, showing that while management is perceived to play a supportive role in promoting ergonomic practices, there is room for improvement in how actively they prioritize and implement these initiatives. The second factor, "Budget constraints limit our ability to implement ergonomic design strategies," recorded an average mean score TWV/f of 4.06. This slightly higher value shows financial limitations as a significant barrier to advancing ergonomic practices.

The third factor, "Employees receive adequate training on ergonomic practices," shows an average mean score TWV/f of 3.91, which is below the average score of 3.99. This reveal a perception that training on ergonomic practices may not be adequately emphasized. This finding shows a need for organizations to increase their focus on providing employees with proper training to ensure the successful implementation of ergonomic principles. The fourth factor, "We have access to necessary ergonomic tools and equipment," has the lowest average mean score TWV/f of 3.41. This significant gap in resource availability reveal a critical area for improvement. Limited access to tools and equipment can hinder effective ergonomic practices and negatively impact employees' well-being and productivity. The fifth factor, "Regulatory requirements drive our adoption of ergonomic strategies," scored an average mean score TWV/f of 3.66. While regulatory compliance plays a role, it is not perceived as the primary driver of ergonomic practices in the workplace. This finding shows that organizations may need to look beyond mere compliance and adopt a more proactive approach to workplace ergonomics.

The sixth factor, "Industry standards influence our ergonomic practices," score an average mean score TWV/f of 4.34, showing strong agreement. This shows that industry benchmarks significantly motivate the adoption of ergonomic practices, showing that aligning with industry standards can be a key strategy for organizations aiming to enhance their workplace ergonomics. The seventh factor, "Technological advancements facilitate ergonomic improvements in our workplace," received the highest average mean score TWV/f at 4.45. This shows a strong perception that technology plays a vital role in improving workplace ergonomics. Leveraging technological advancements can be a major enabler for organizations seeking to create healthier and more efficient work environments.

Finally, the factor, "Worker feedback is considered when implementing ergonomic design strategies," recorded an average mean score TWV/f of 4.10. This shows a relatively high level of agreement, showing that employees' input is valued to some extent. However, there remains an opportunity to strengthen worker participation in decision-making processes related to ergonomics.

Table 8: Respondents response to rate the level of agreement with the following statements

Statement	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Total Frequency (f)	TWV	TWV/f
Our management actively supports ergonomic initiatives.	0	12	67	89	98	266	1071	4.03
Budget constraints limit our ability to implement ergonomic design strategies.	0	22	55	75	114	266	1079	4.06
Employees receive adequate training on ergonomic practices.	0	25	75	65	101	266	1040	3.91
We have access to necessary ergonomic tools and equipment.	12	56	75	56	67	266	908	3.41
Regulatory requirements drive our adoption of ergonomic strategies	0	33	89	79	65	266	974	3.66
Industry standards influence our ergonomic practices.	0	0	45	86	135	266	1154	4.34
Technological advancements facilitate ergonomic improvements in our workplace.	0	0	35	75	156	266	1185	4.45
Worker feedback is considered when implementing ergonomic design strategies.	0	15	56	83	112	266	1090	4.10
Total								31.96/8
								3.99

Source: Author's Field Survey, 2024

CONCLUSION

This study underscores the persistent ergonomic challenges in the Nigerian steel manufacturing sector and the inconsistent implementation of effective ergonomic strategies. Findings reveal that workers are frequently exposed to poorly designed workstations, inadequate lighting, and repetitive tasks, all of which contribute to musculoskeletal disorders and reduced productivity. While some ergonomic interventions have shown promise particularly ergonomic seating, adjustable desks, and improved lighting their impact is undermined by low awareness levels, irregular ergonomic assessments, and limited organizational support.

The study also establishes that management support, sufficient budget allocation, and access to ergonomic tools are the most critical factors influencing the successful adoption of ergonomic strategies. Furthermore, the role of employee feedback and participatory approaches cannot be overstated, as these contribute significantly to the sustainability and contextual relevance of ergonomic interventions.

Ultimately, improving ergonomics in steel manufacturing requires not just technical upgrades but a shift in organizational culture toward proactive safety planning, inclusive decision-making, and continuous monitoring. Only through a holistic, systems-level approach can the Nigerian manufacturing sector foster safer, healthier, and more productive industrial environments.

RECOMMENDATIONS

To improve ergonomic practices in Nigeria's steel manufacturing sector, management must take the lead by prioritizing ergonomics in workplace policies and funding. Regular assessments should be conducted to identify risks, while workers should receive ongoing training to build awareness. Industries must provide essential ergonomic tools, such as adjustable furniture and proper lighting, and involve employees in planning and feedback. Stronger government enforcement of ergonomic standards is needed, alongside the adoption of modern technologies to support safer, more efficient work environments.

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