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EFFECT OF SAFETY TRAINING ON EMPLOYEE PRODUCTIVITY IN SUGAR MANUFACTURING FIRMS IN THE LAKE REGION, KENYA

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Abstract:
This study examined the influence of safety training on employee productivity in sugar manufacturing firms within Kenya's Lake Region Economic Block. A mixed-method research design was employed, combining quantitative and qualitative approaches. The target population comprised 9,857 employees across 11 sugar manufacturing firms. A sample of 384 respondents was determined using the Krejcie and Morgan formula, with 338 usable questionnaires (88.0% response rate). Data were collected using self-administered questionnaires measuring safety training (frequency, practicality, knowledge retention, participation, training materials, and hazard identification capability) and employee productivity. Quantitative data were analyzed using descriptive statistics, Pearson correlation, and regression analysis. Qualitative data from open-ended questions were analyzed thematically. Descriptive statistics revealed moderate levels of safety training implementation (M=3.28, SD=0.962). The highest-rated aspect was comprehensiveness of training materials and manuals (M=3.43, SD=0.852), while practical, hands-on training scored lowest (M=3.08, SD=1.080). Correlation analysis indicated a strong positive relationship between safety training and employee productivity ($r=0.747$, $p<0.01$). Regression analysis confirmed that safety training has a significant positive effect on employee productivity ($B=0.410$, $\beta=0.581$, $t=10.790$, $p<0.001$), making it one of the strongest predictors among occupational health and safety practices. Qualitative findings revealed that training is predominantly theoretical, infrequent (once per year or less), and not contextualized to sugar industry hazards. Workers expressed

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need for practical, hands-on training delivered in local languages with regular refresher sessions. Safety training is a critical determinant of employee productivity in sugar manufacturing firms. Regular, practical, and context-specific safety training significantly enhances workers' hazard awareness, competence, confidence, and task efficiency. Current training programs are inadequate, being largely theoretical and sporadic, which limits their productivity-enhancing potential. Sugar manufacturing firms should transform safety training from theoretical classroom-based approaches to competency-based, practical on-the-job training. Implement regular refresher training, toolbox talks, and context-specific modules addressing sugar industry hazards. Simplify training content and deliver in local languages to improve comprehension and retention.

Keywords: safety training, employee productivity, sugar manufacturing, occupational health and safety, hazard awareness, Lake Region, Kenya

1. Introduction

The sugar manufacturing industry is a critical component of Kenya's economy, supporting millions of households through farming, processing, and auxiliary services (KNBS, 2022). The majority of sugar manufacturing firms are concentrated in the Lake Region Economic Block (LREB), making this region crucial for national sugar production. However, sugar processing involves hazardous operations including heavy machinery, high-temperature processes, chemical usage, and physically demanding manual work, exposing workers to numerous occupational risks (Muriuki & Kinyua, 2020).

Safety training is a fundamental pillar of effective occupational health and safety (OHS) systems. It equips employees with the knowledge, skills, and attitudes necessary to recognize hazards, follow safe work procedures, use protective equipment correctly, and respond appropriately to emergencies. Well-designed safety training programs have been shown to reduce accident rates, improve hazard awareness, enhance compliance with safety protocols, and directly increase employee productivity (Bayram, 2022; Mutegi *et al.*, 2023).

Globally, organizations with structured, frequent, and practical safety training report significantly lower incident rates and higher operational efficiency. The International Labour Organization (ILO) emphasizes that training is a critical component of national OHS strategies, enabling workers to participate effectively in safety management (ILO, 2024). However, in many developing country contexts, safety training remains reactive, infrequent, theoretical, and poorly evaluated, limiting its effectiveness in preventing accidents and improving productivity (Muinde & K'Obonyo, 2019).

In Kenya's sugar industry, evidence suggests that safety training is largely inadequate. Most training programs are conducted after accidents have occurred, losing their preventive value. Training is often theoretical, using PowerPoint presentations in classroom settings without practical application to real workplace hazards (Cheruiyot & Letting, 2021). Workers report that training sessions are infrequent (once per year or less),

not tailored to sugar industry-specific dangers, and delivered in technical language that many workers struggle to understand. These deficiencies directly impact workers' ability to safely operate machinery, identify hazards, and maintain productive efficiency.

1.2 Statement of the Problem

Sugar manufacturing firms in Kenya's Lake Region face significant safety training deficiencies that threaten both worker well-being and organizational productivity. Despite the hazardous nature of sugar processing, evidence reveals that safety training is sporadic, theoretical, and poorly contextualized. Workers report that training occurs once per year at most, consists of PowerPoint presentations in classroom settings, and does not prepare them for actual workplace dangers. Trainers often lack specific knowledge of sugar industry hazards, and training materials are not tailored to the unique risks of cane handling, milling, boiling, and chemical processing.

Qualitative accounts from workers describe inadequate training experiences: *"Training is once a year if we are lucky. It's a PowerPoint presentation in a hall. Very theoretical. When we go back to work, we've forgotten most of it. It does not prepare us for genuine dangers"* (R-114). Another worker noted: *"The trainers themselves don't know our job. They do safety talks but not sugar industry danger-specific. What we need is how to handle cane, how to work safely around mills, how to respond to particular emergencies"* (R-178).

These training deficiencies have direct consequences for productivity. Workers who lack adequate safety training are more likely to make errors, experience accidents, work inefficiently, and suffer from heightened anxiety that reduces focus and cognitive performance. Despite these documented challenges, a critical knowledge gap exists: there is no comprehensive empirical evidence on how safety training specifically affects employee productivity in Kenya's sugar manufacturing sector. This study therefore sought to fill this gap by determining the influence of safety training on employee productivity in sugar manufacturing firms within Kenya's Lake Region.

1.3 Objective of the Study

The specific objective of this study was to determine the influence of safety training on employee productivity in sugar manufacturing firms within Kenya's Lake Region.

1.4 Hypothesis

H_{04}: Safety training has no significant influence on employee productivity in sugar manufacturing firms within Kenya's Lake Region.

2. Literature Review

2.1 Theoretical Framework

This study was anchored on two complementary theoretical perspectives: Social Exchange Theory (SET) and the Job Demands-Resources (JD-R) Model.

Social Exchange Theory (Blau, 1964) posits that when organizations invest in employees' safety training, workers perceive this as organizational care and support. According to SET, employees reciprocate perceived organizational investment with increased commitment, engagement, and discretionary effort. Bayram (2022) found that employees who received sufficient safety training perceived organizational investment in their well-being and responded with higher productivity, better compliance, and proactive safety behaviors.

Job Demands-Resources Model (Bakker & Demerouti, 2017) conceptualizes safety training as a critical job resource that buffers the negative effects of high job demands. In hazardous work environments like sugar manufacturing, safety training reduces the strain associated with physical and psychological demands, enhances workers' capacity to meet job requirements safely, and promotes engagement and performance. Training increases employees' perceived behavioral control, confidence, and competence, directly improving task efficiency and output quality.

2.2 Empirical Literature Review

2.2.1 Global Evidence

Bayram (2022) conducted an empirical study in an OHSAS 18001-certified organization to assess factors influencing employee safety and productivity. Using survey questionnaires and productivity measures, the study found that frequent, specific safety training significantly increased employees' procedural knowledge, hazard awareness, and compliance, resulting in fewer accidents and increased task efficiency. The study was grounded in SET, demonstrating that employees reciprocate organizational investment in training with higher productivity.

Karanikas *et al.* (2018) studied the trade-off between safety and productivity in aircraft manufacturing. Using observational assessments and interviews, they found that effective safety training positively impacted hazard recognition, enhanced proactive reporting and employee collaboration, leading to less downtime and improvements in overall production metrics. The findings highlighted that training creates a psychological contract where management's investment in safety knowledge results in reciprocal employee effort.

Al Doghan and Juhari (2024) examined the impact of knowledge, skills development, and training on employee productivity in corporate settings with employee security as a mediating factor. Quantitative surveys and regression analyses indicated that training interventions significantly improved employees' competencies and sense of workplace security, consequently improving performance. The study conceptualized training as a cognitive resource and psychological motivator within the JD-R framework.

2.2.2 African Evidence

Akanmu *et al.* (2020) studied cyber-physical postural training systems for construction workers in Nigeria. Results indicated that formalized, interactive training programs

improved safety compliance and productivity while reducing musculoskeletal strain. This demonstrated both the JD-R motivational pathway and the SET reciprocity mechanism.

Assey (2019) conducted a study on occupational health and safety management in Uganda, investigating the relationship between safety management systems, training, and output. Using mixed methods, the research found that structured safety training increased compliance, hazard recognition, and reduced productivity losses due to injuries. The study emphasized the importance of safety training for operational performance.

2.2.3 Kenyan Evidence

Mutegi *et al.* (2023) investigated the effect of workplace safety, employees' safety attitude, and productivity in manufacturing firms in Kenya. Using questionnaires and performance assessment, they found that consistent safety training had a positive impact on safety attitude, reducing accident rates and improving productivity metrics. The study supported the SET perspective that employees interpret safety investments as organizational concern and respond with engagement and efficiency.

Mwaruta *et al.* (2023) examined the effect of occupational safety and health training on the performance of cement manufacturing firms in Kenya. Using surveys, interviews, and on-site observations, they found that firms providing comprehensive OSH training had lower incident rates, lower absenteeism, and higher productivity. The study confirmed that training is a job resource that reduces strain from hazardous job demands and promotes engagement.

2.3 Conceptual Framework

The conceptual framework for this study posited that safety training (independent variable) directly affects employee productivity (dependent variable). Safety training was operationalized through six indicators: frequency and regularity of training sessions, practicality and hands-on nature of training, knowledge retention and application, encouragement of participation, provision of comprehensive training materials, and training program effectiveness in enabling hazard identification and mitigation.

3. Methodology

3.1 Research Philosophy and Design

The study adopted an interpretivism research philosophy and employed a mixed-method research design combining quantitative and qualitative approaches (Taherdoost, 2021). The descriptive component systematically recorded current safety training practices and self-reported productivity outcomes, while the explanatory component examined relationships between safety training and productivity (Abbas, 2020).

3.2 Target Population and Sample

The target population comprised 9,857 employees across 11 sugar manufacturing firms in the Lake Region Economic Block (Mugo & Kwasira, 2021). A sample size of 384 was calculated using the Krejcie and Morgan (1970) formula for finite populations. A multi-stage stratified random sampling design was adopted, with firms stratified by ownership structure, production capacity, and operational status, followed by simple random sampling of employees within departments. The study achieved a usable response rate of 88.0% (338 questionnaires).

3.3 Research Instrument

Data were collected using a self-administered questionnaire distributed via the drop-and-pick method. Section A collected demographic information. Section B4 measured safety training using six Likert-scale items (1=Strongly Disagree to 5=Strongly Agree) covering training frequency, practicality, knowledge retention, participation encouragement, training materials, and hazard identification capability. Section G measured employee productivity using six self-report indicators. Open-ended questions captured qualitative data on safety training experiences and improvement suggestions.

3.4 Validity and Reliability

Face and construct validity were ensured by developing the instrument based on previous research and reliable literature (Bayram, 2022; Mwaruta *et al.*, 2023). Reliability was assessed using Cronbach's alpha, with safety training items achieving acceptable internal consistency ($\alpha > 0.70$).

3.5 Data Analysis

Quantitative data were analyzed using SPSS version 27. Descriptive statistics (frequencies, percentages, means, standard deviations) summarized the data. Inferential statistics included Pearson correlation and regression analysis at 95% confidence level ($p < 0.05$). Qualitative data from open-ended questions were analyzed thematically.

3.6 Ethical Considerations

Ethical approval was obtained from Kaimosi Friends University Ethics Review Committee and NACOSTI. Institutional permission was secured from each participating sugar company. Informed consent was obtained from all participants, with anonymity and confidentiality guaranteed. Participation was voluntary.

4. Results

4.1 Response Rate and Demographic Characteristics

Of 384 questionnaires distributed, 338 were complete and suitable for analysis (88.0% usable response rate). Respondents were predominantly male (67.2%), with females comprising 32.8%. The largest age group was 30-39 years (37.9%), followed by 40-49 years

(30.2%). Most respondents held certificate/diploma qualifications (41.7%) or KCSE/O-Levels (33.1%). Regarding length of service, 35.8% had 6-10 years of experience, 28.7% had 2-5 years, and 22.8% had over 10 years.

4.2 Diagnostic Tests

Normality was confirmed using histogram analysis. Multicollinearity tests yielded VIF values between 4.320 and 6.153 (all <10), indicating no multicollinearity. The Durbin-Watson statistic was 2.182 (within 1.5-2.5 acceptable range), confirming independence of error terms.

4.3 Descriptive Statistics for Safety Training

Table 1: Descriptive Statistics for Safety Training

Statement	N	Mean	Std. Dev.
Safety training sessions are conducted frequently and regularly	338	3.36	0.934
Safety training is practical, hands-on and directly applicable	338	3.08	1.080
I retain and apply knowledge gained from safety training	338	3.32	0.920
Participation in safety training is encouraged and supported	338	3.36	0.934
Comprehensive training materials and manuals are provided	338	3.43	0.852
Training programs equip me to identify and mitigate workplace hazards	338	3.13	1.054
Aggregate Mean		**3.28**	**0.962**

*Scale: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Results revealed moderate perception of safety training (M=3.28; SD=0.962). The highest-rated aspect was comprehensiveness of training materials and manuals (M=3.43, SD=0.852), followed by training frequency (M=3.36, SD=0.934) and participation encouragement (M=3.36, SD=0.934). Respondents moderately agreed that they retain and apply knowledge gained from training (M=3.32, SD=0.920). However, the lowest-rated items were practicality of training (M=3.08, SD=1.080) and adequacy of training programs to equip employees to identify and mitigate hazards (M=3.13, SD=1.054), indicating significant gaps in training effectiveness.

4.4 Correlation Analysis

Table 2: Pearson Correlation Matrix (Extract)

Variable	Safety Training	Employee Productivity
Safety Training	1	0.747**
Employee Productivity	0.747**	1

**Correlation is significant at the 0.01 level (2-tailed)

Pearson correlation analysis revealed a strong, positive, and statistically significant relationship between safety training and employee productivity ($r = 0.747$, $p < 0.01$),

indicating that improvements in safety training are associated with higher employee productivity.

4.5 Regression Analysis

Table 3: Regression Coefficients for Direct Effects (Safety Training)

Model	Unstandardized Coefficients (B)	Standardized Coefficients (β)	T	Sig.
(Constant)	-0.268		-3.015	0.003
Safety Training	0.410	0.581	10.790	0.000

Note: Dependent Variable: Employee Productivity.

The regression model was significant ($F = 446.855$, $p < 0.001$) with $R^2 = 0.843$, indicating that the combination of OHS practices (including safety training) explained 84.3% of the variance in employee productivity. The coefficient for safety training ($B = 0.410$, $\beta = 0.581$, $t = 10.790$, $p < 0.001$) indicates that a one-unit increase in safety training leads to a 0.410-unit increase in employee productivity, holding all other factors constant. Safety training was one of the strongest predictors in the model, second only to workplace safety.

4.6 Hypothesis Testing

The null hypothesis (H_{04}) stating that safety training has no significant influence on employee productivity was rejected ($r = 0.747$, $p < 0.001$; $B = 0.410$, $p < 0.001$). The results provide strong empirical evidence that safety training significantly and positively affects employee productivity in sugar manufacturing firms in Kenya's Lake Region.

4.7 Qualitative Findings

Thematic analysis of open-ended responses revealed three major themes related to safety training:

4.7.1 Existing Training Constraints

Workers consistently reported that training is infrequent and theoretical. A factory worker stated: *"Training is once a year if we are lucky. It's a PowerPoint presentation in a hall. Very theoretical. When we go back to work, we've forgotten most of it. It does not prepare us for genuine dangers"* (R-114). A shift supervisor added: *"The trainers themselves don't know our job. They do safety talks but not sugar industry danger-specific. What we need is how to handle cane, how to work safely around mills, how to respond to particular emergencies"* (R-178).

4.7.2 Enhancements Suggested

Workers expressed clear preferences for improved training approaches. A maintenance technician recommended: *"We need practical, hands-on training. Show us on the machines, show us the right way, let us practice. And do it regularly, not just once a year. Refresher training, toolbox talks, anything ongoing"* (R-231). A cane handler emphasized accessibility: *"Training should be easy, in our language. Some of us didn't get far in school. If*

it's too technical, we don't grasp it. Use images, demonstrations, real examples from our factory" (R-056). A senior operator suggested leveraging internal expertise: *"Engage experienced personnel in training. We know the true dangers, the methods to work safely. Management should use our knowledge, not bring in outsiders who don't know sugar factories"* (R-299).

4.7.3 Knowledge Retention Gaps

Workers reported that theoretical training does not translate into retained knowledge or changed behavior. One respondent noted: *"We sit through the presentation, but by the time we get back to the shop floor, we've forgotten most of it. There's no follow-up, no practical test. It's just a tick-box exercise"* (R-142).

5. Discussion

The findings demonstrate that safety training has a significant positive effect on employee productivity in sugar manufacturing firms in Kenya's Lake Region. The strong correlation (r=0.747) and substantial regression coefficient (B=0.410, β=0.581) align with global and regional evidence on the training-productivity relationship. Safety training was one of the strongest predictors among all OHS practices assessed, second only to workplace safety.

The moderate mean score for safety training (3.28 out of 5) indicates that while training structures exist (materials, sessions), implementation quality is suboptimal. The lowest ratings for practicality (3.08) and hazard identification capability (3.13) suggest critical gaps requiring immediate attention. These findings are consistent with Bayram (2022), who found that training effectiveness depends heavily on practical application and contextual relevance. Theoretical, one-off training sessions do not provide workers with the competencies required in high-risk manufacturing environments.

The qualitative findings revealing that training is predominantly theoretical, infrequent (once per year or less), and not contextualized to sugar industry hazards directly support Mwaruta *et al.* (2023), who found that comprehensive, practical OSH training reduces incident rates and improves productivity in Kenyan manufacturing. Workers' descriptions of PowerPoint presentations, lack of hands-on practice, and poor knowledge retention align with Muinde and K'Obonyo (2019), who reported that safety training in Kenyan manufacturing firms is largely reactive and poorly evaluated.

The finding that training materials and manuals scored highest (3.43) while practicality scored lowest (3.08) suggests that firms have invested in training documentation but have not translated this into effective competency development. This pattern is consistent with Mutegi *et al.* (2023), who found that Kenyan manufacturing firms often have safety policies and training materials but struggle with implementation and practical skill development.

Theoretically, the findings strongly support the Job Demands-Resources Model. Safety training functions as a critical job resource that buffers the negative effects of high

physical and psychological demands in sugar manufacturing. When training is practical, frequent, and context-specific, workers develop the competence and confidence to perform hazardous tasks safely and efficiently, activating the motivational pathway of the JD-R model. Conversely, when training is theoretical and infrequent, workers lack adequate resources to cope with job demands, leading to strain, errors, and reduced productivity.

The findings also support Social Exchange Theory. Workers who perceive that their organization invests in meaningful, practical safety training reciprocate with increased effort, engagement, and productivity. The qualitative data showing that workers desire practical training and value organizational investment in their safety competence confirms the reciprocity mechanism central to SET. When training is perceived as inadequate or tokenistic, workers are less likely to adopt safety behaviors and may reduce discretionary effort.

6. Conclusion and Recommendations

6.1 Conclusion

This study concludes that safety training has a significant positive influence on employee productivity in sugar manufacturing firms in Kenya's Lake Region. Regular, practical, and context-specific safety training enhances workers' hazard awareness, competence, confidence, and task efficiency, directly improving output quality and quantity. Safety training is one of the strongest predictors of employee productivity among occupational health and safety practices.

Current safety training practices are only moderately implemented, with significant gaps in practicality, hands-on application, and hazard identification capability. Training is predominantly theoretical, infrequent (often once per year or less), and not adequately contextualized to sugar industry-specific hazards. Workers express strong preference for practical, on-the-job training delivered in local languages with regular refresher sessions.

Safety training should be viewed as a strategic investment in human capital that generates productivity returns through enhanced worker competence, reduced errors, improved hazard recognition, and increased confidence. Transforming training from theoretical compliance exercises to practical competency development is essential for realizing the full productivity potential of safety training in Kenya's sugar industry.

6.2 Recommendations

6.2.1 For Sugar Manufacturing Firms:

- **Transform training delivery methods**: Shift from theoretical classroom-based training to competency-based, practical on-the-job training. Use actual machinery and workplace scenarios for demonstrations and practice sessions. Implement hands-on exercises where workers physically demonstrate safe procedures.

- **Increase training frequency**: Move from annual training to regular, ongoing safety education. Implement weekly toolbox talks (5-10 minute focused safety discussions), monthly practical drills, and quarterly comprehensive training sessions. Establish refresher training schedules to reinforce critical skills.
- **Contextualize training content**: Develop training modules specifically addressing sugar industry hazards, including cane handling, mill operations, chemical processing (lime, sulphur dioxide), bagasse dust exposure, and emergency response for sugar manufacturing scenarios. Use real incidents from the factory as case studies.
- **Simplify training delivery**: Deliver training in local languages (Luhya, Luo, Kiswahili) alongside English. Use visual aids, demonstrations, images, and videos rather than text-heavy presentations. Accommodate workers with low literacy levels through oral instruction and practical demonstrations.
- **Leverage internal expertise**: Engage experienced senior operators and long-serving workers as peer trainers. These individuals possess practical knowledge of actual workplace hazards and effective safe work practices. Combine external safety expertise with internal operational knowledge.
- **Evaluate training effectiveness**: Implement post-training assessments measuring knowledge retention, skill demonstration, and on-the-job behavior change. Use practical tests rather than written exams. Track safety performance metrics (incident rates, near misses, hazard reports) as indicators of training effectiveness.

6.2.2 For Policymakers:

- The Directorate of Occupational Safety and Health Services should mandate minimum safety training standards for sugar manufacturing, including specified frequency (minimum quarterly), practical content requirements, and language accessibility provisions.
- Develop sector-specific safety training curricula and trainer certification programs for the sugar industry, addressing unique hazards in cane processing, milling, chemical handling, and maintenance operations.
- Establish training verification systems requiring firms to document and demonstrate training effectiveness through practical competency assessments, not merely attendance records.

6.2.3 For Future Research:

- Conduct longitudinal intervention studies measuring productivity changes before and after implementation of enhanced safety training programs (e.g., transitioning from annual theoretical training to monthly practical training).
- Compare effectiveness of different training delivery methods (classroom-only vs. hands-on only vs. blended) on knowledge retention, safety behavior, and productivity outcomes in sugar manufacturing settings.

- Investigate the mediating role of safety self-efficacy and perceived behavioral control in the safety training-productivity relationship.

Conflict of Interest Statement
The authors declare no conflicts of interest.

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Appendix: Safety Training Measurement Items

Item	**Statement**
B41	Safety training sessions are conducted frequently and regularly
B42	Safety training is practical, hands-on and directly applicable
B43	I retain and apply knowledge gained from safety training
B44	Participation in safety training is encouraged and supported
B45	Comprehensive training materials and manuals are provided
B46	Training programs equip me to identify and mitigate workplace hazards

__Scale:__ 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree