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Shaping Safety Culture: A Study of Construction Project Managers in Sudan's Red Sea State

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Abstract

Safety culture is paramount in the construction industry, directly affecting worker safety and project success. This study investigates the safety culture of project managers in Sudan's Red Sea State, exploring factors influencing their commitment to safe practices. A comprehensive questionnaire, utilizing a three-point Likert scale, was administered to 50 project managers from both government and private sector construction companies. The study reveals that supportive environments, strong supervisory practices, clear communication channels, and a robust emphasis on risk assessment are crucial for promoting a positive safety culture among project managers in Sudan.

Keywords: Safety Culture, Construction, Project Managers, Sudan, Red Sea State, Risk Assessment, Communication, Supervision.

المستخلص:

تعتبر ثقافة السلامة أمرا بالغ الأهمية في صناعة البناء، حيث تؤثر بشكل مباشر على سلامة العمال ونجاح المشروع. تبحث هذه الدراسة في ثقافة السلامة لمديري المشاريع في ولاية البحر الأحمر السودانية، وتستكشف العوامل التي تؤثر على التزامهم بالممارسات الآمنة. وأجري استبيان شامل، باستخدام مقياس ليكرات المكون من ثلاث نقاط، على ٥٠ من مديري المشاريع من شركات البناء الحكومية والقطاع الخاص على السواء. تكشف الدراسة أن البيئات الداعمة والممارسات الإشرافية القوية وقنوات الاتصال الواضحة والتركيز القوي على تقييم المخاطر ضرورية لتعزيز ثقافة السلامة الإيجابية بين مديري المشاريع في السودان.

الكلمات المفتاحية: ثقافة السلامة، البناء، مديرو المشاريع، السودان، ولاية البحر الأحمر، تقييم المخاطر، الاتصال، الإشراف.

Introduction

Construction remains a high-risk industry with a concerning rate of accidents and fatalities. This necessitates a strong focus on safety culture – the shared values, beliefs, and behaviors that guide safety practices within an organization (Antonsen, 2017). A positive safety culture is characterized by open communication, strong leadership, employee engagement, and a commitment to continuous improvement (Goetsch & Tolson, 2009).

This study delves into the safety culture of project managers in Sudan, focusing on the Red Sea State. It aims to identify key factors affecting their safety practices and provide insights for enhancing safety culture within the region's construction sector. This research builds upon previous studies that have explored various facets of safety culture in construction, including the role of management (Masood et al., 2012), the influence of behavioral factors (Ismail et al., 2011), and the importance of an industrial framework (Al-Bayati et al., 2019).

Methodology

This study employed a descriptive approach using a structured questionnaire to gather data from project managers in the Red Sea State. The questionnaire was developed based on a comprehensive review of established safety culture assessment frameworks, such as the Safety Culture Assessment Tool (SCAT) and the Safety Performance Measurement System (SPMS). It incorporated nine key factors identified as critical to safety culture:

- 1. Communication:** Open communication channels, effective dissemination of safety information, and a culture of reporting safety concerns.
- 2. Safety Rules & Procedures:** Clarity and consistency in safety rules, procedures, and enforcement.

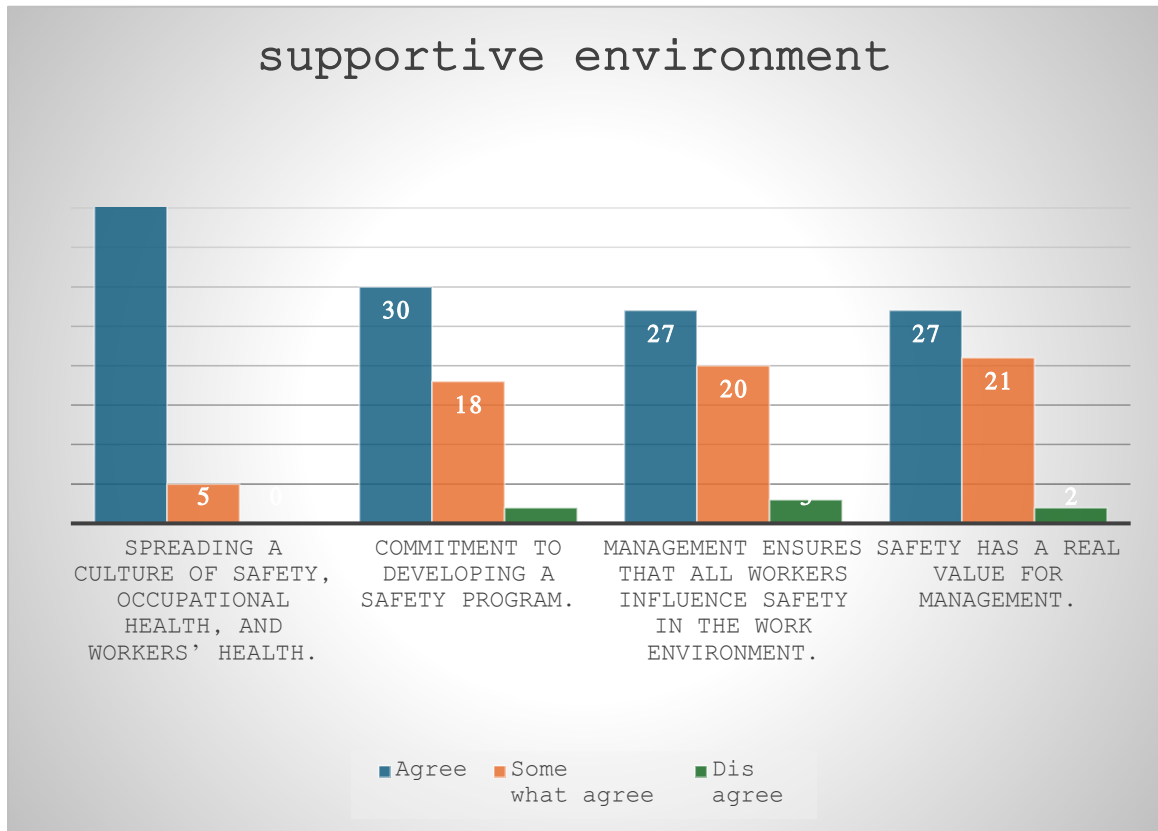
3. **Supportive Environment:** Strong organizational commitment to safety, encouragement of worker involvement, and a culture of valuing safety.
4. **Supervisory Environment:** Active role of safety representatives, effective supervision, and accountability for subcontractors.
5. **Worker Involvement:** Employee engagement in safety decision-making, reporting, and collaboration.
6. **Assessment of Physical Work Environment & Work Hazards:** Thorough risk assessment, worker training, and proactive hazard mitigation.
7. **Personal Appreciation of Risk:** Regular safety meetings, toolbox talks, and incident investigations.
8. **Work Pressure:** Prioritization of safety over production deadlines, provision of a safe work environment, and appropriate occupational protection.
9. **Competence & Training:** Comprehensive safety training programs and strong safety leadership.

A three-point Likert scale was used to measure the degree of agreement with each statement in the questionnaire. The data was analyzed using statistical software, and the findings are presented in tabular and narrative formats.

Results and Discussion

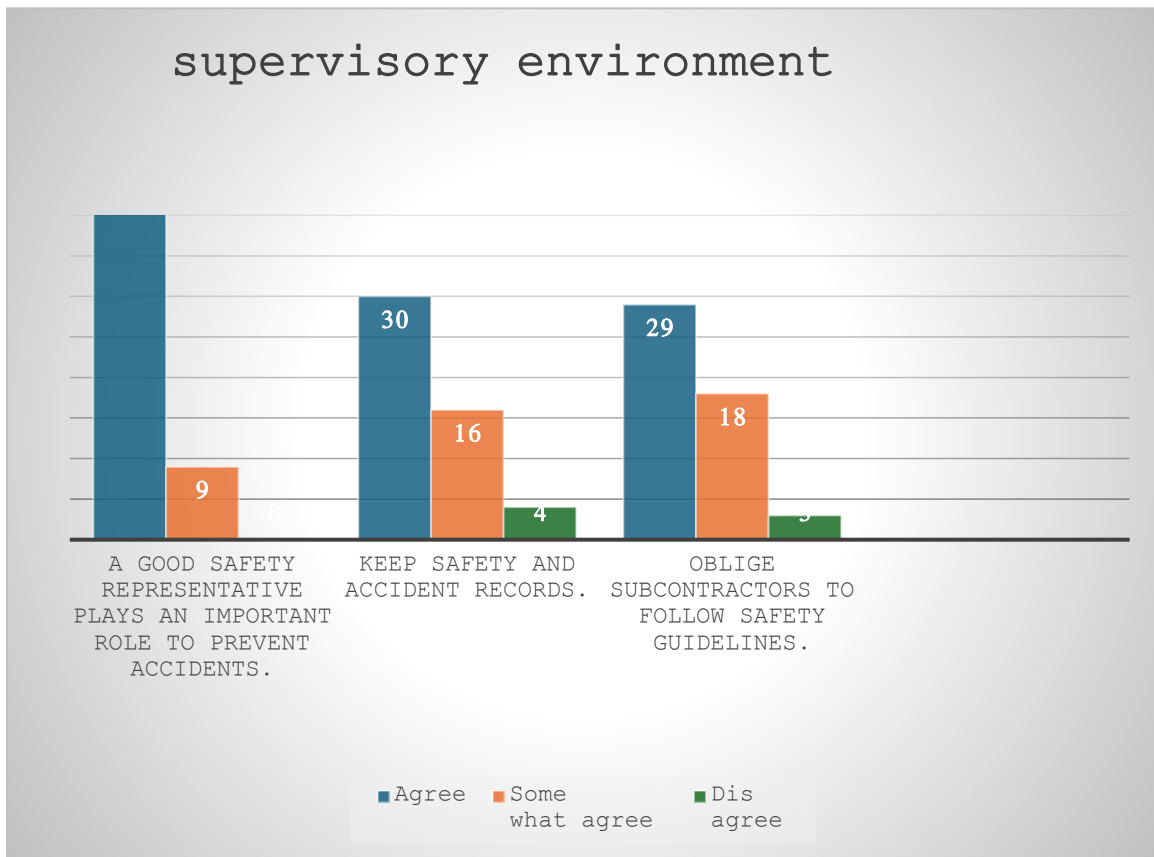
The analysis revealed that project managers in the Red Sea State generally perceive a positive safety culture within their organizations. However, significant variations were observed across different factors. The most influential factors promoting a positive safety culture were:

1. **Supportive Environment:** Project managers strongly agreed that their organizations value safety and actively promote a culture of safety, health, and worker well-being.



The chart shows high agreement levels for most aspects of the supportive environment, particularly in management's commitment to safety and health.

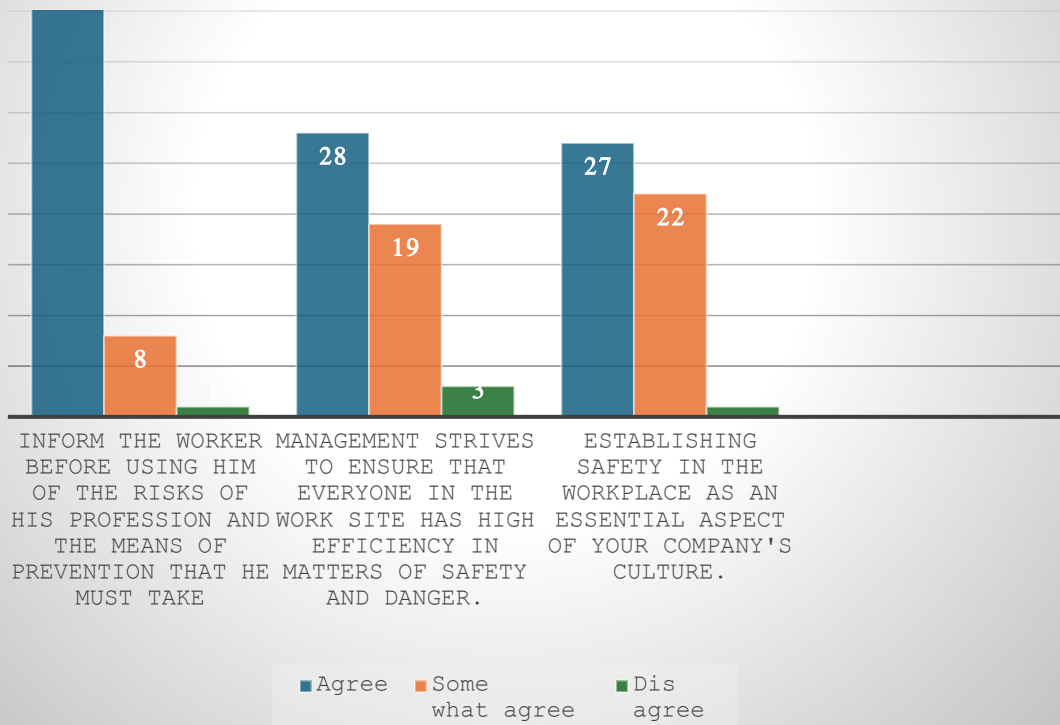
2. **Supervisory Environment:** Project managers highly valued the role of safety representatives and expressed confidence in the supervisory practices employed within their organizations.



The chart indicates strong agreement on the accountability of supervisors and their active role in enforcing safety practices.

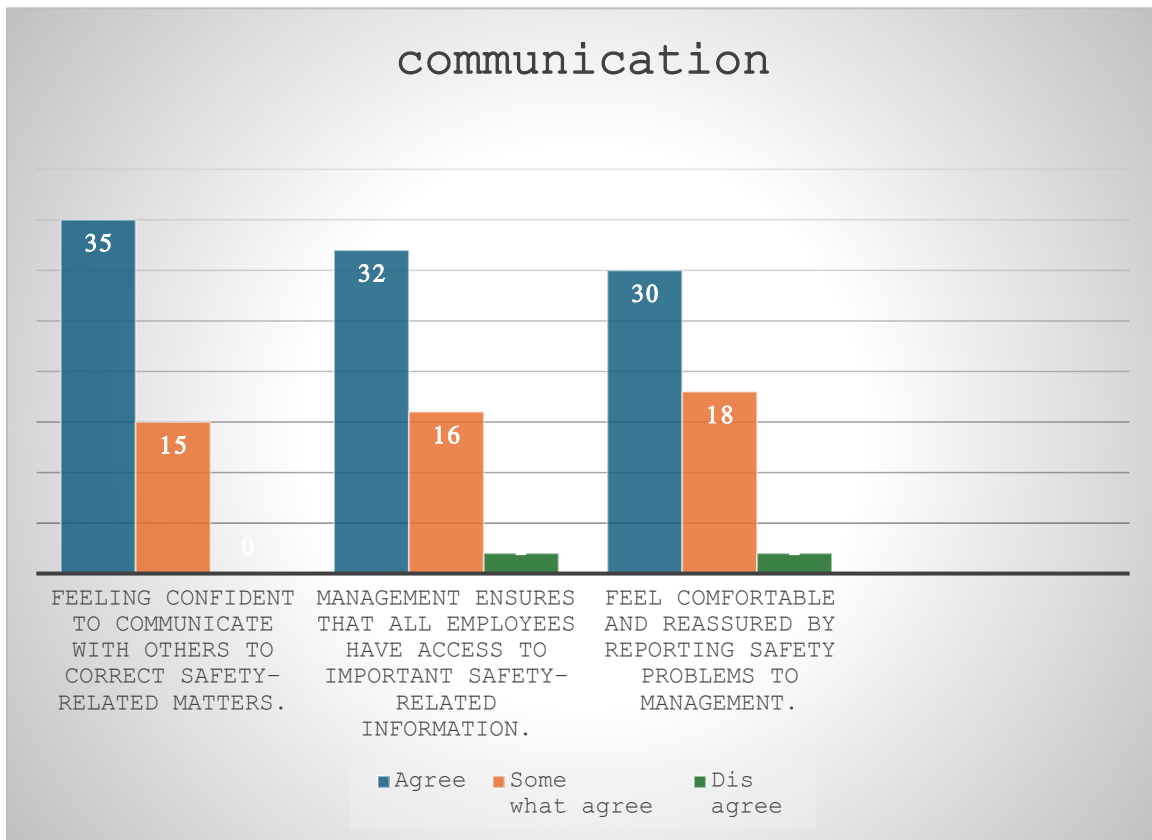
- 3. Assessment of Physical Work Environment & Work Hazards:** Project managers indicated a strong focus on assessing risks, training workers, and mitigating hazards.

Appraisal of Physical Work Environment and Work hazards



The chart demonstrates high levels of agreement on risk assessment and hazard mitigation practices.

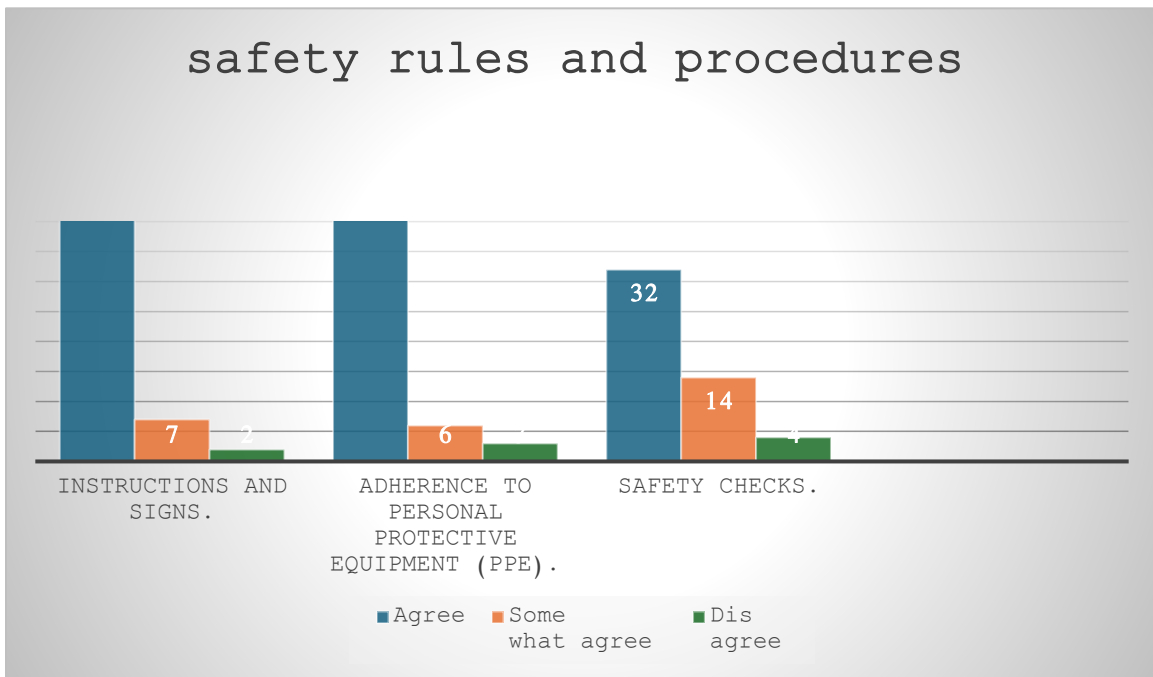
4. **Communication:** Project managers reported feeling comfortable and confident in communicating safety concerns and accessing important safety information.



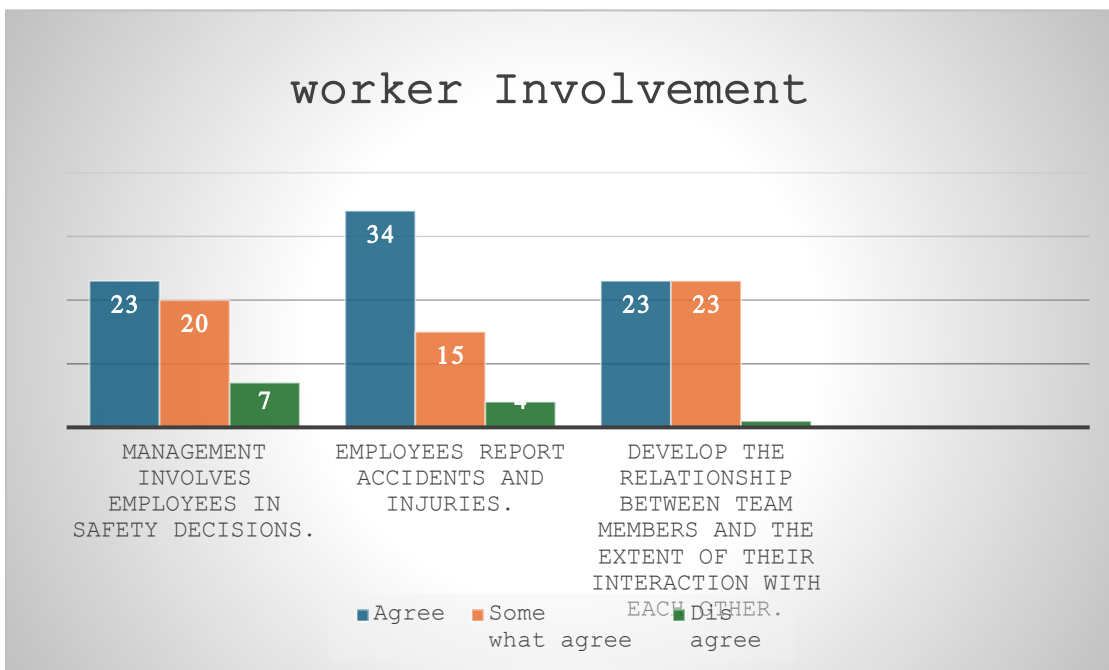
The chart shows generally positive responses to communication practices, with room for improvement in some areas.

Other significant findings include:

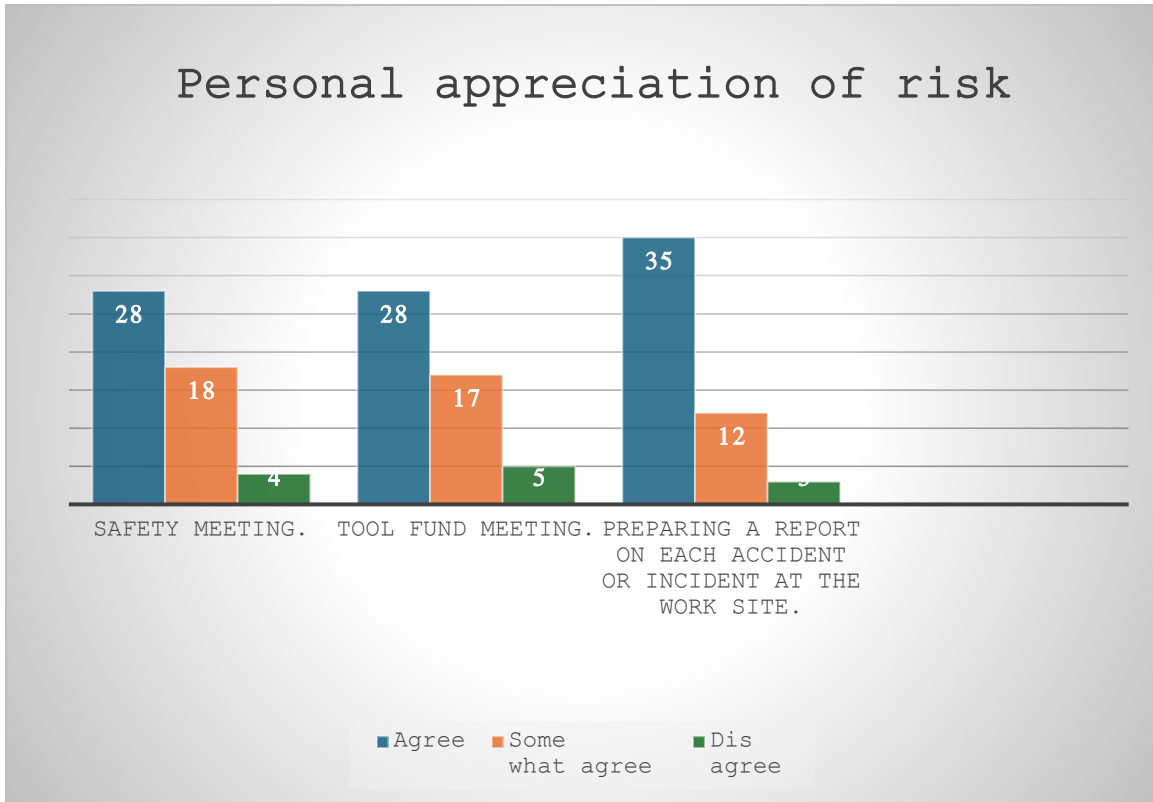
1. **Safety Rules and Procedures:** There is strong agreement on the existence of clear safety rules, but less certainty about their consistent application.



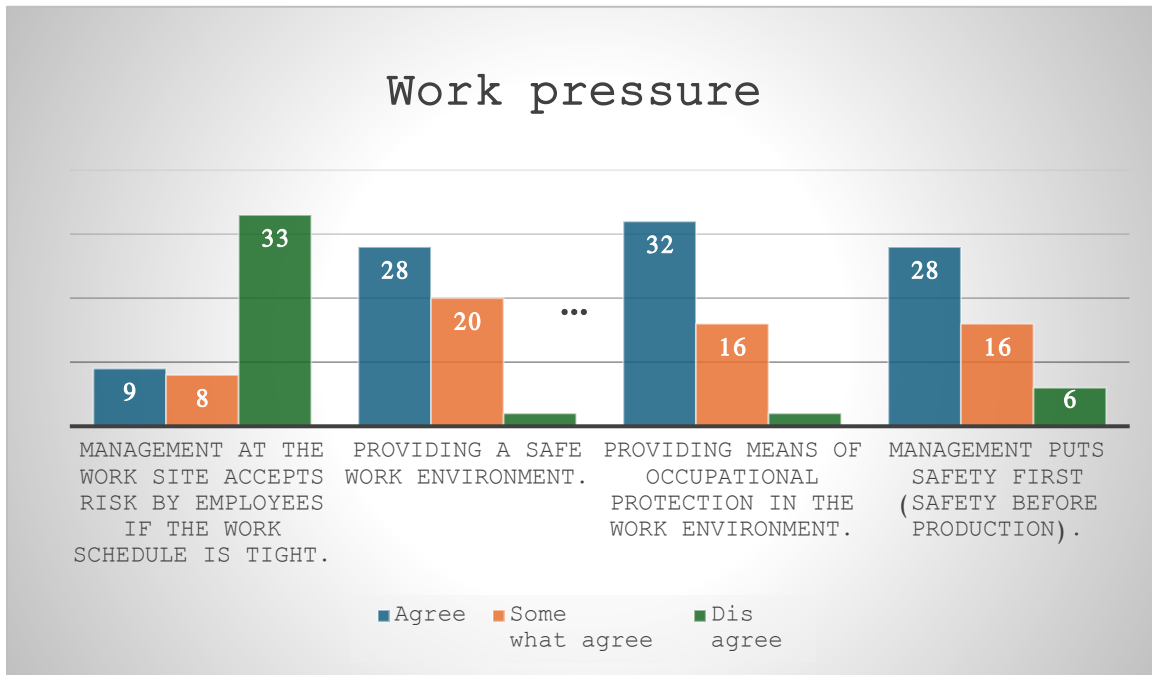
2. **Worker Involvement:** While there is agreement on worker involvement in safety practices, there is room for improvement in encouraging workers to voice concerns.



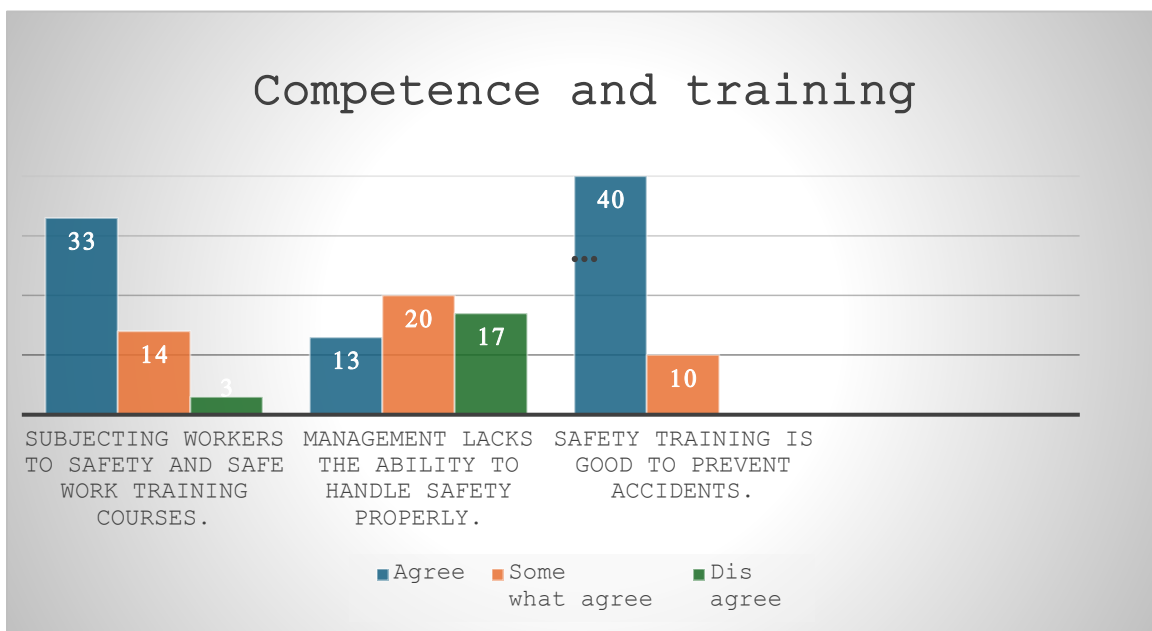
3. **Personal Appreciation of Risk:** Regular safety meetings and incident investigations are common, but there is a need for more frequent toolbox talks.



4. **Work Pressure:** This chart reveals an area of concern, with many project



5. **Competence and Training:** While safety training is generally provided, there is a need for more comprehensive programs and leadership development.



Conversely, factors related to work pressure and the management's ability to handle safety effectively showed lower levels of agreement. Project managers acknowledged a need for improvement in these areas, highlighting the importance of striking a balance between safety and production deadlines and ensuring that management consistently demonstrates strong safety leadership.

These results provide a comprehensive picture of the safety culture among project managers in Sudan's Red Sea State construction sector. While there are many positive aspects, particularly in supportive environments and risk assessment, there are clear areas for improvement, especially in managing work pressure and enhancing safety-training programs.

Analysis of the results of the arithmetic mean, standard deviation, percentage, and value (T. Test) of factors affecting the safety culture:

(Table 1: Factors affecting Safety Culture - Descriptive Statistics)

set of factors	Question	Mean	Deviation	percentage	T. Test	Ranking	Sample orientation
communication	1. Feeling confident to communicate with others to correct safety-related matters.	2.7	0.84	90.00	5.91	7	Agree
	2. Management ensures that all employees have access to important safety-related information.	2.6	0.84	86.67	5.03	10	Agree
	3. Feel comfortable and reassured by reporting safety problems to management	2.56	0.85	85.33	4.68	13	Agree
safety rules and procedures	4. Instructions and signs.	2.78	0.83	92.67	6.62	5	Agree
	5. Adherence to personal protective equipment (PPE).	2.76	0.83	92.00	6.44	6	Agree
	6. Safety checks.	2.56	0.85	85.33	4.68	14	Agree
supportive environment	7. Spreading a culture of safety, occupational health, and workers' health.	2.9	0.83	96.67	7.70	1	Agree
	8. Commitment to developing a safety program.	2.56	0.85	85.33	4.68	15	Agree
	9. Management ensures that all workers influence safety in the work environment.	2.48	0.85	82.67	3.99	22	Agree
	10. Safety has a real value for management.	2.5	0.85	83.33	4.16	20	Agree

supervisory environment	11. A good safety representative plays an important role to prevent accidents.	2.82	0.83	94.00	6.98	2	Agree
	Keep safety and accident records.	2.52	0.85	84.00	4.33	17	Agree
	Oblige subcontractors to follow safety guidelines.	2.52	0.85	84.00	4.33	16	Agree
worker Involvement	4. Management involves employees in safety decisions.	2.32	0.86	77.33	2.63	27	Somewhat agree
	Worker report accidents and injuries.	2.66	0.84	88.67	5.55	8	Agree
	Develop the relationship between team members and the extent of their interaction with each other.	2.38	0.86	79.33	3.13	26	Agree
Appraisal of Physical Work Environment and Work hazards	Inform the worker before using him of the risks of his profession and the means of prevention that he must take	2.8	0.83	93.33	6.80	3	Agree
	8. Management strives to ensure that everyone in the work site has high efficiency in matters of safety and danger.	2.5	0.85	83.33	4.16	21	Agree
	Establishing safety in the workplace as an essential aspect of your company's culture.	2.52	0.85	84.00	4.33	18	Agree
Personal appreciation of risk	20. Safety Meeting.	2.48	0.85	82.67	3.99	23	Agree
	21. Tool Fund Meeting.	2.46	0.85	82.00	3.82	24	Agree

	2. Preparing a report on each accident or incident at the work site.	2.64	0.84	88.00	5.38	9	Agree
Work pressure	Management at the work site accepts risk by employees if the work schedule is tight.	1.52	0.91	50.67	-3.73	29	Dis agree
	4. Providing a safe work environment.	2.52	0.85	84.00	4.33	19	Agree
	25. Providing means of occupational protection in the work environment.	2.6	0.84	86.67	5.03	11	Agree
	Management puts safety first (safety before production).	2.44	0.85	81.33	3.64	25	Agree
Competence and training	7. Subjecting workers to safety and safe work training courses.	2.6	0.84	86.67	5.03	12	Agree
	8. Management lacks the ability to handle safety properly.	1.92	0.88	64.00	-0.64	28	Agree
	Safety training is good to prevent accidents.	2.8	0.83	93.33	6.80	4	Somewhat agree

Conclusion

This study provides valuable insights into the safety culture of project managers in Sudan's Red Sea State. While the region's construction sector shows positive signs in fostering a strong safety culture, further emphasis should be placed on addressing areas requiring improvement, such as work pressure management and leadership development.

The findings highlight the importance of a supportive environment, effective supervision, clear communication channels, and robust risk assessment procedures in shaping a positive safety culture. By prioritizing these key factors, the construction sector in Sudan

can create a safer work environment for all stakeholders and ensure the sustainable success of future projects.

Recommendations

1. Develop comprehensive safety training programs for all levels of project management, focusing on risk assessment, communication, and leadership skills.
2. Implement robust safety management systems that emphasize regular audits, performance reviews, and continuous improvement.
3. Establish clear communication channels that encourage open dialogue, feedback, and the reporting of safety concerns without fear of reprisal.
4. Promote a culture of safety leadership, where managers at all levels champion safe practices and hold themselves accountable for fostering a positive safety culture.
5. Provide adequate resources and support for safety representatives to ensure their effectiveness in promoting safe working conditions.
6. Conduct further research into the specific challenges faced by project managers in Sudan, particularly in relation to work pressure and safety leadership.

Limitations

This study has several limitations that should be acknowledged. The sample size was limited to 50 construction project managers, which may not be representative of the entire population of project managers in Sudan's Red Sea State. Additionally, the study relied on self-reported data, which may be subject to biases and inaccuracies.

Future Research Directions

Future research should focus on exploring effective strategies that require a comprehensive approach that includes several aspects, from awareness and education to

the application of laws and the use of technology to improve safety culture in construction projects in Sudan. Longitudinal studies can be conducted to study the impact of driving methods for project managers, safety knowledge, and communication skills on safety culture over time. In addition, studies can be conducted to investigate the role of other stakeholders, such as customers, architects, and engineers, in forming a culture of safety in construction projects.

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Appendix I: Questionnaire

We ask you to answer all questions related to the factors affecting safety culture

	set of factors	Factors	Agree	Some what agree	Dis agree
1	communication	Feeling confident to communicate with others to correct safety-related matters.			
		Management ensures that all employees have access to important safety-related information.			
		Feel comfortable and reassured by reporting safety problems to management.			
2	safety rules and procedures	Instructions and signs.			
		Adherence to personal protective equipment (PPE).			
		Safety checks.			
3	supportive environment	Spreading a culture of safety, occupational health, and workers' health.			
		Commitment to developing a safety program.			
		Management ensures that all workers influence safety in the work environment.			
		Safety has a real value for management.			
4	supervisory environment	A good safety representative plays an important role to prevent accidents.			
		Keep safety and accident records.			
		Oblige subcontractors to follow safety guidelines.			

5	worker Involvement	Management involves employees in safety decisions.			
		Employees report accidents and injuries.			
		Develop the relationship between team members and the extent of their interaction with each other.			
6	Appraisal of Physical Work Environment and Work hazards	Inform the worker before using him of the risks of his profession and the means of prevention that he must take			
		Management strives to ensure that everyone in the work site has high efficiency in matters of safety and danger.			
		Establishing safety in the workplace as an essential aspect of your company's culture.			
7	Personal appreciation of risk	Safety Meeting.			
		Tool Fund Meeting.			
		Preparing a report on each accident or incident at the work site.			
8	Work pressure	Management at the work site accepts risk by employees if the work schedule is tight.			
		Providing a safe work environment.			
		Providing means of occupational protection in the work environment.			
9	Competence and training	Subjecting workers to safety and safe work training courses.			
		Management lacks the ability to handle safety properly.			
		Safety training is good to prevent accidents.			