

Creativity and Innovation for Sustainable Development in Saudi Architectural and Engineering Firms

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Abstract: This study aims to validate the climate for creativity in Saudi Arabian architectural and engineering (A&E) firms using factors of climate by Ekvall, Amabile, and Woodman's theories of creativity climate. According to Saudi Vision 2030, A&E companies' creative thinking and innovation are important for achieving sustainable development since they encourage resource conservation, resilient urban growth, and green design. Promoting innovation results in socially, economically, and environmentally sound practices. The study methodology used a quantitative survey approach to analyse the data. Fourteen hypotheses were tested, and the study sample included 460 participants from different categories of owners, managers, and employees from Saudi and international firms. The findings of the investigation on A&E firms operating in Saudi Arabia showed that Debate (80%) and Challenges (80%) are the most significant factors that serve creativity and innovation in A&E firms. While (79%) is recorded for technological knowledge, freedom recorded (76%), management strategies (76%), and organizational culture (68%). Conflict resolution (59%) ranked lowest, indicating a need for improvement in this area. The findings align with global creativity models adapting them to Saudi Arabia's context. This study presents the Innovation in Saudi A&E Firms (CISAEF) model, a measurable framework that helps to improve innovation environment. The practical implications introduce the importance of improving the culture of debate and employee empowerment in the light of Saudi Vision 2030.

Keywords: Creativity Climate; Innovation Management; Architectural and Engineering Firms; Saudi Arabia; Quantitative Survey; Organizational Culture.

1. Introduction

Creativity and innovation are critical for Saudi Architecture and Engineering (A&E) firms, which function as creative problem solvers for society (Alexander, 1993). Managers must have an organizational vision and possess the necessary skills to engender a creative environment, guaranteeing high-quality creative outcomes. Despite the extensive research on organizational creativity, empirical studies specifically examining creativity climate in A&E firms within the Saudi Arabian context remain limited. Salvatierra et al. (2019) discuss that, unlike those of other actors, the performance and practices of architects' offices are difficult to characterize, and there have been few studies on these issues. While Saudi firms strive to meet Vision 2030 goals, many lack the internal creative consultancy needed to overcome existing challenges. The innovation climate is important in determining innovation-related outcomes (Steele and Murray, 2004). Improving creativity in A&E firms is a major factor in bringing professional practices into line with the sustainability goals of Vision 2030, which specifically highlights sustainability in urban and architectural development. This research project aims to find the necessary professional working suitable climate or environment for A&E firms, especially in Saudi, for them to achieve a conducive environment for innovation and creativity when working. Even though sustainability is receiving more attention globally, little is known about how Saudi A&E companies' creativity and innovation can support sustainable development. The study primarily aims to measure the creative climate of A&E firms' performance in the Kingdom of Saudi Arabia that guides employees to be more creative and enhances their creative outputs. The findings should help the managers of these firms initiate a suitable creative climate. The study was conducted during the global pandemic (Covid-19), which affected the objectives, continuity, and performance of Architecture and Engineering offices and firms in Saudi Arabia (Al-Youbi et al., 2020, Crosbie, 2020). The pandemic increased the need to search for innovative and creative ways to keep A&E firms continuing their work.

2. Theoretical Framework

The research hypotheses are reflected in the study model based on the theories of Amabile, Woodman, and Ekvall, figure 1. The study uses Ekvall's theory, Amabile (Amabile, 1988), and Woodman's model of the creativity climate as tools to optimize of A&E firms in Saudi. Integrating these three frameworks enables a multi-level

analysis: Ekvall's dimensions capture the organizational climate, Amabile's componential model addresses individual and managerial factors, and Woodman's interactionist perspective accounts for group-level dynamics. Together, they provide a more comprehensive lens than any single framework alone. Some of these authors emphasize that architects should have these behaviours when they manage these firms (MAASHER, 2013). Ekvall's creativity climate theory relies on three aspects: resources, climate, and their effect on various elements. Resources include the people, buildings, machinery, etc., that must be present to encourage people's creativity (Ekvall, 1996). Creating a creative climate requires understanding challenges, freedom, liveliness, and conflicts in the working environment. Risk-taking, leadership, and communication are also essential factors influencing creativity (Ekvall, 1996). Furthermore, the framework of Ekvall's creative climate can be applied to sustainability-oriented innovation since elements like challenge, debate, and freedom foster an atmosphere in which businesses not only produce original ideas but also incorporate sustainability concerns into their architectural design. According to Ekvall, there are ten dimensions to evaluate and measure creativity within an organization, including freedom, openness and trust, conflicts, debates and discussions, absurdity and humour, risk-taking factors, supportive ideas, dynamism, challenges, and ideological state (Afsar and Badir, 2017). Amabile's componential theory proposes that organizational motivation to innovate, management practices, and resources are essential in supporting creativity (Amabile, 1988). The model underlying Amabile KEYS articulates these factors in detail. Since intrinsic motivation and creativity-relevant skills are essential for creating environmentally conscious designs and solutions within A&E firms, Amabile's model also serves as a foundation for sustainability-oriented innovation. Woodman et al. (1993) suggested an interactionist model of creativity as the result of a person's actions in a specific situation shaped by contextual and social forces. According to Woodman's model, group dynamics and organizational culture can have an impact on creative outputs. When these dynamics are focused on sustainability, they can encourage shared accountability for environmentally friendly building and design methods. The conceptual model in figure 2 shows a fundamental link between the criteria that provide an environment for creativity and the firm's strategic management, and how these strategies affect personal competencies. The research's outcomes and findings concerning creativity and innovation in A&E firms are affected by various elements, including the internal work environment, leadership, individual motivation, rewards, internal relations, management education, and organizational culture to adopt new ideas and practices (Alsharef et al., 2021, Isaksen, 2017).



Figure 1: Study Hypothesis concept, Diagram showing the research hypothesis linking creative climate factors to innovation outcomes in Saudi A&E firms, with implications for sustainability.

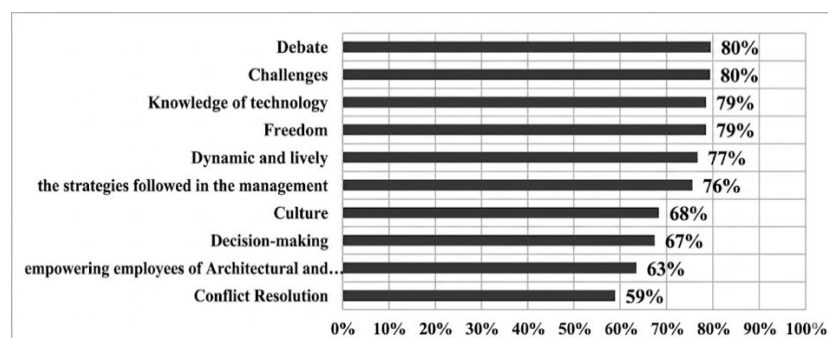


Figure 2: Conceptual model illustrating the relationship between creative climate dimensions and firm performance, supporting sustainable practices in A&E firms.

3. Materials and Methods

According to Engineers (2018), the number of registered engineers was approximately 186,630, with 2,856 offices, table 1. In 2021, the number of registered engineers rose to approximately 192,809, with 3,280 offices excluding expired licenses (Engineers, 2021), table 2. The planning stages included formulating the general objective of the questionnaire to measure factors necessary for developing A&E firms in Saudi Arabia and creating a creative and innovative environment. The distribution of A&E firms in the kingdom focused on the data received from the Directory of Engineering and Consulting Firm and Offices 2019 (Sauding, 2019), indicating that the total number of A&E firms in Saudi Arabia was 2345 principal consultant A&E firms and 514 engineering subsidiary offices. The sample included 460 participants selected from managers, specialized staff (designers), and firm owners. A non-probability convenience sampling approach was adopted. The questionnaire was distributed to as many firms as possible using the official directory, and participation was entirely voluntary. Initial deductive research involving a literature review generated questionnaire questions addressing employees' opinions on factors affecting creativity. The survey used a 5-point Likert scale. The questions were also judged and drafted by several experts, academics, and practitioners in architecture and engineering. They were tested, developed and subsequently published (Kangari, 1995, Creswell and Creswell, 2017). Data were collected from 27 January 2021 to 8 March 2021, and 2,859 questionnaires were distributed by email with a cover letter explaining the survey purpose. Among the 935 questionnaires collected, 475 were incomplete. Accordingly, 460 questionnaires were valid for this study, and others were discarded. The response rate of approximately 16% ($460/2,859$) is acknowledged as a limitation; Although the response rate may increase the possibility of self-selection bias, the inclusion of respondents from different organizational roles and firms across Saudi Arabia provides a reasonably broad representation of the target population. a non-response bias check was conducted by comparing early versus late respondents on key demographic variables, revealing no significant differences. Efficiency, adaptability, and management strategies are just a few of the factors that have obvious sustainability implications, even though the questionnaire did not measure sustainability directly. In line with the objectives of sustainable development, these dimensions demonstrate long-term viability and ethical management techniques. It follows that encouraging a creative environment in A&E companies not only boosts innovation but also subtly promotes sustainable results.

Table 1: Number of engineering consultants and classifications in the Saudi Council 2018 (Engineers, 2018)

Licenses by Category (Classification)	Number	Licenses by Category (Classification)	Number
Engineering Consulting Office	1,489	Soil and Concrete Laboratory	37
Specialized Engineer's Office	485	Soil and Foundation Laboratory	22
Engineer's Support Office	298	Architectural Drawing Office	7
Professional Engineering Firm	156	Facility Control Office	3
Foreign Firms	140	Interior Design Office	17
Mixed Professional Firms	99	Concrete and Materials Inspection Office	6
Office of Engineering Safety	95	Architectural Monitoring Office	2
Total			2,856

Table 2: Number of engineering consultants and classifications in the Saudi Council (Engineers, 2021)

Licenses by Category (Classification)	Valid License	License Almost Expired	Initial License	Expired License	Total
Engineering office	2186	84	701	2519	5490
Engineering Consulting Office	1708	59	409	1807	3983
Specialized Engineer's Office	252	8	235	556	1051
Engineer's Support Office	159	8	47	116	330
Office of Engineering Safety	67	9	10	40	126
Engineering Firm	243	10	56	227	536
Professional Engineering firm	214	10	42	227	493
Foreign firm	29		14		43

4. Results

4.1 Characterization of the Primary Data

The survey had 460 respondents, most of whom were young professionals with an average age of 42.64 years. The gender distribution was 93% male and 7% female. Participants represented 23 nationalities, with the largest group being Saudi (58%), followed by Egyptian (20%) and Sudanese (4%). The sample also showed high educational diversity. In job roles, 35% were employees, 38% were firm owners/partners, and 27% were executive directors or department heads. Average experience was 13.5 years (SD = 10.5). Firm nationality was predominantly Saudi (87%). Most A&E firms were headquartered in Riyadh, Makkah, and Jeddah, with 96% based in Saudi Arabia. 98% of participants worked within the Kingdom. A detailed demographic breakdown of the participants is presented in Table 3.

Table 3: Biography characterization

Age	20–25	6%	Experience Years	0–5	23%	Education	Secondary / Diploma	3%	Firm Nationality	Saudi	87%
	26–30	11%		6–10	28%		Bachelor	59%		Egyptian	2.90%
	31–35	17%		11–15	17%		Master	31%		American	1.90%
	36–40	16%		16–20	11%		PhD	7%		Other	8.20%
	41–45	14%		21–24	6%						
	46–50	7%		25–30	5%						
	51–55	9%		30+	10%						
	56–60	9%									
	60+	11%									
Job Title	Firm Owner	35%	Gender	Male	93%	Workplace	Makkah	28%	HQ Location	Inside KSA	95%
	Employer/ Partner	28%		Female	7%		Riyadh	21.70%		Outside KSA	5%
	Executive Director	10%	Nationality	Saudi	58%		Jeddah	20.20%			
	Department Head	12%		Non-Saudi	42%		Other	26.50%			
	Other	15%					Outside KSA	3.50%			

4.2 Measures and Scale Validation

To evaluate internal consistency (reliability), Cronbach's alpha was used (Cronbach, 1951). All questionnaire axes showed acceptable reliability levels, mostly above 0.70, except the 6th and 7th axes. Deleting Item 3 in axis 6 improved reliability from 0.449 to 0.709. Axis 7 was better when split into culture and freedom components, table 4. Construct validity was ensured through literature review and factor analysis. Items were developed based on Amabile, Woodman, and other foundational studies. Content and construct validity were confirmed. Future revisions should supplement Cronbach's alpha with Composite Reliability (CR) and Average Variance Extracted (AVE) to establish convergent validity, and report a Confirmatory Factor Analysis (CFA) for each construct.

Table 4: The Values of the 'Alpha–Cronbach' Parameter for Each Main Study Axis, Included in the Study Questionnaire

The axis	Number of Questions	Cronbach's Alpha	Cronbach's Alpha if Item Deleted	Cronbach's Alpha if Item Divided	The Number of Questions for the Divided Axis
The second axis	5	0.733			
The third axis	4	0.861			

The axis	Number of Questions	Cronbach's Alpha	Cronbach's Alpha if Item Deleted	Cronbach's Alpha if Item Divided	The Number of Questions for the Divided Axis
The fourth axis	6	0.867			
The fifth axis	6	0.880			
The sixth axis	3	0.449	0.709		
The seventh axis	5	0.580		2	0.838
				3	0.656
The eighth axis	4	0.766	0.782		
The ninth axis	2	0.815			
The tenth axis	5	0.819			

4.3 Descriptive Analysis of Questionnaire Axes

Descriptive statistics (frequency, percentage, mode, median) were analysed. The average importance score across the 10 axes was 72%. The most important axes were Debate (80%), Challenge (80%), Knowledge of Technology (79%), Freedom (79%), Strategies for Management (76%), and so on, with Conflict Resolution (59%) being the lowest, figure 3.

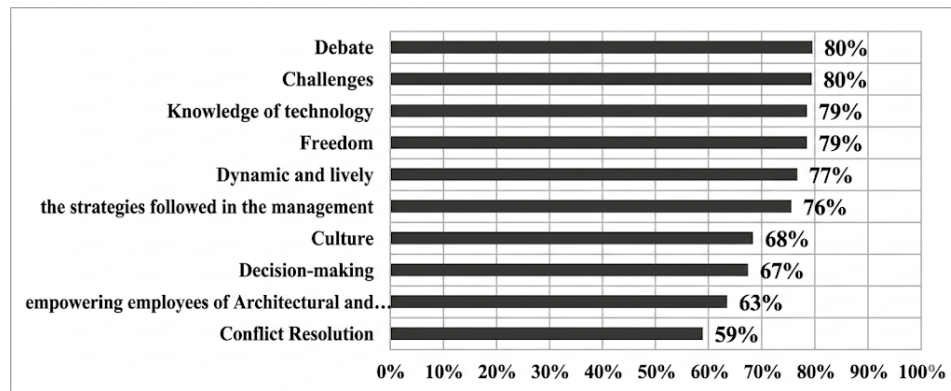


Figure 3: Bar chart showing the general importance of the study axes in shaping creative climate, highlighting their relevance for innovation and sustainability.

The graphical columns showing the relative importance of the major dimensions evaluated in this study are shown in Figures 4 through 13. The respondents' assessments of the different elements influencing the creative environment in A&E firms are shown in these figures. Figure 4 highlights the significance of the tactics used by businesses, while Figure 5 emphasizes the role of debate. The significance of challenges and dynamism are illustrated in Figures 6 and 7, respectively. Figure 8 presents conflict resolution, while Figures 9 and 10 present culture and freedom. Figure 13 demonstrates the value of motivating and empowering staff members, while Figures 11 and 12 highlight the importance of technological expertise and decision-making, respectively.

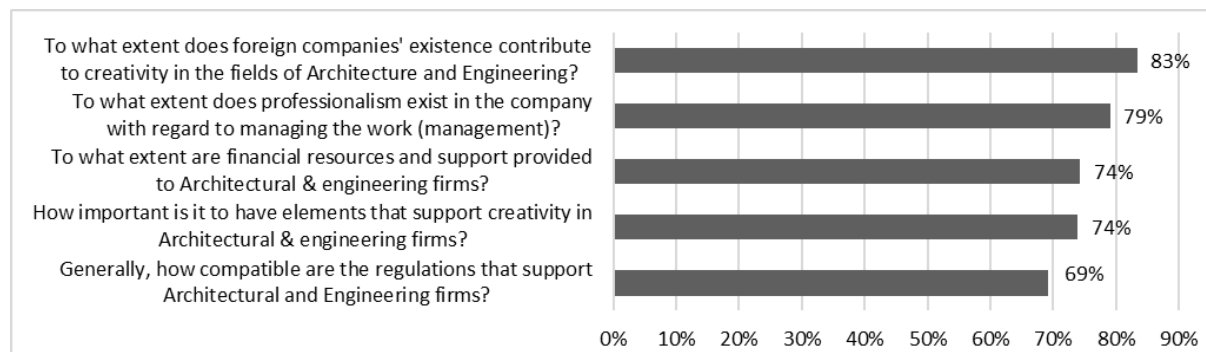


Figure 4: Strategies Followed Graphical columns showing the importance of the elements of the second axis, with implications for sustainability.

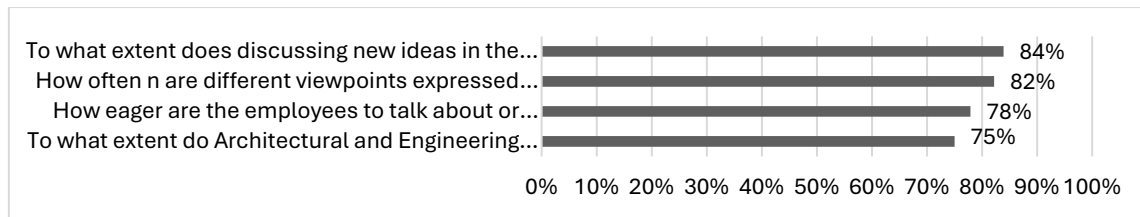


Figure 5: Debate Graphical columns showing the importance of the elements of the third axis, contributing to sustainable decision-making.

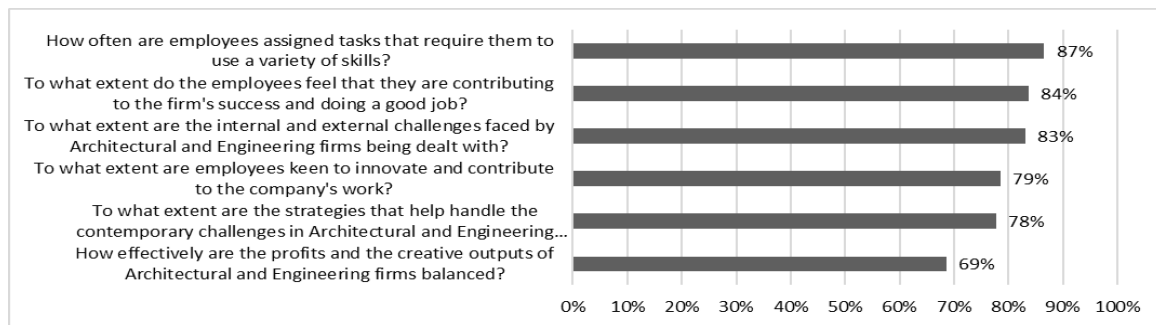


Figure 6: Challenges Graphical columns showing the importance of the elements of the fourth axis, which drive innovation and sustainability adaptation.

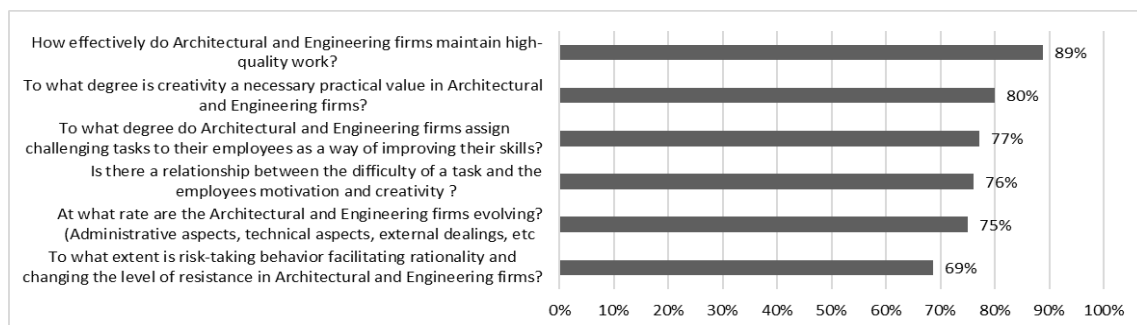


Figure 7: Dynamic and lively Graphical columns showing the importance of the elements of the fifth axis, which foster adaptability and sustainable growth.

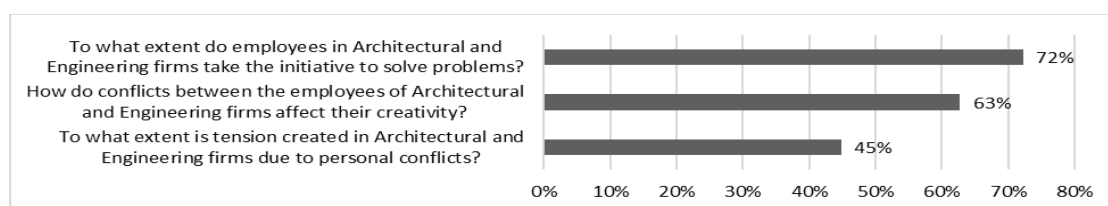


Figure 8: Conflict Resolution Graphical columns showing the importance of the elements of the Sixth axis, supporting collaboration and sustainable organizational practices.

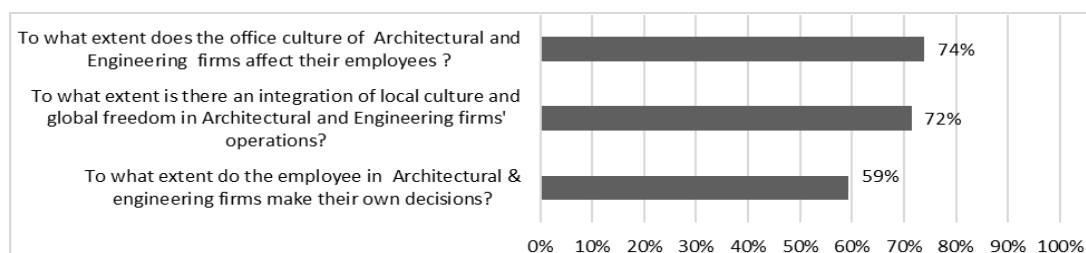


Figure 9: Culture Graphical columns showing the importance of the elements of the Seventh axis, embedding creativity and sustainability values in A&E firms.

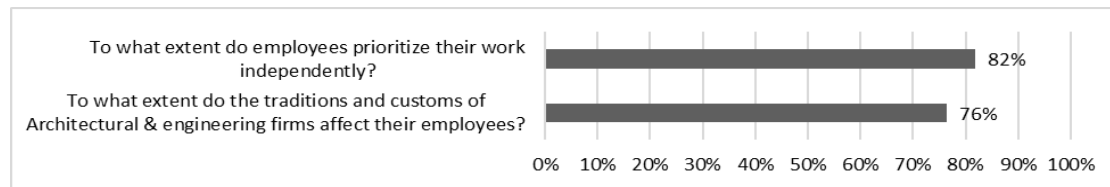


Figure 10: Freedom Graphical columns showing the importance of the elements of the eighth axis, enabling innovation and sustainable problem-solving.

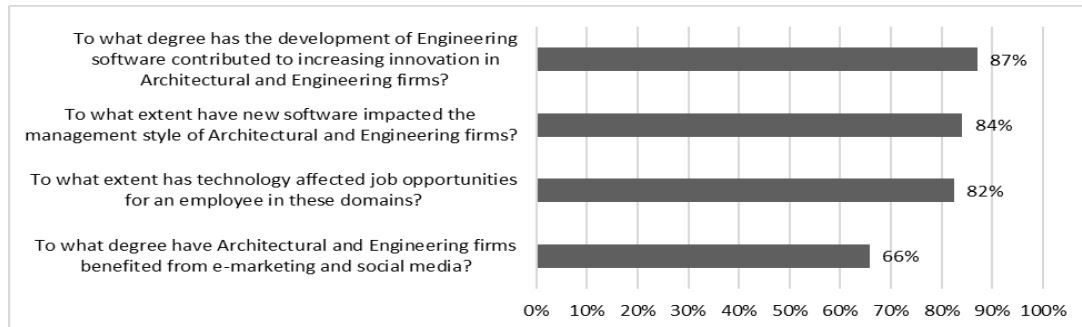


Figure 11: Knowledge of technology Graphical columns showing the importance of the elements of the ninth axis, essential for developing sustainable design and engineering solutions.

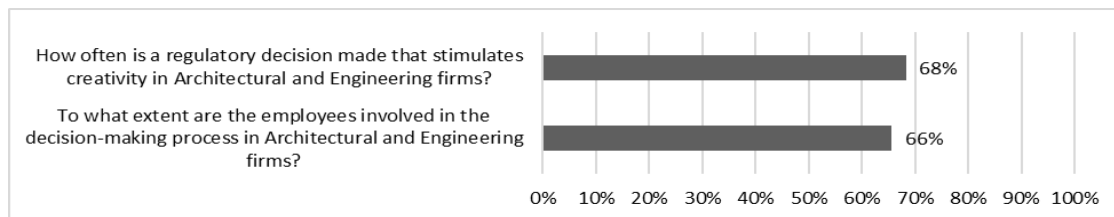


Figure 12: Decision-making Graphical columns showing the importance of the elements of the tenth axis, contributing to responsible and sustainable management practices.

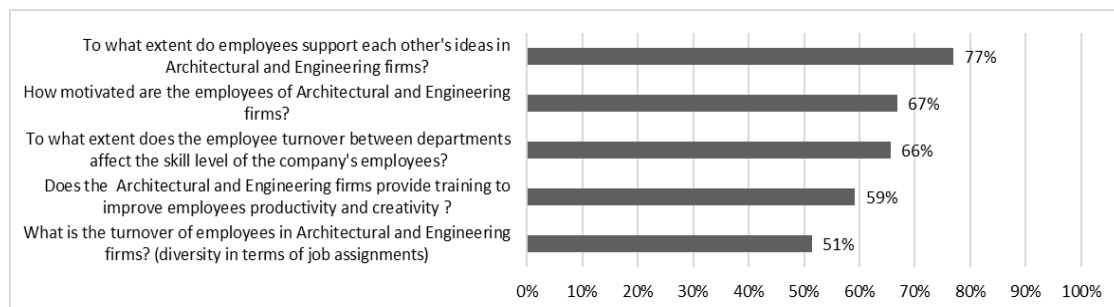


Figure 13: Energizing or empowering Graphical columns showing the importance of the elements of the eleventh axis, which strengthens creativity and promotes sustainable practices.

5. Discussion and Conclusion

The literature strongly supports the role of creativity and innovation in A&E firms (Cropley, 2016; Emmitt, 1999). This study confirms those findings in the Saudi context. Participants showed strong awareness of creativity's importance in performance, problem-solving, and strategic innovation. In addition to showing the innovative environment of Saudi A&E companies, the ranked factors also suggest possible directions for sustainable practices. For instance, technological expertise can encourage the use of eco-friendly solutions, and organizational culture may promote sustainability principles. In the same way, freedom and decision-making allow businesses to implement long-term plans that strike a balance between creativity and effective utilization of resources. These results imply that in A&E firms, a creative environment can promote sustainability and innovation at the same time. The discussion should be reorganized to systematically address each of the 14

stated hypotheses, specifying which were supported and which were not, and grounding each finding in prior literature. Currently the discussion presents general observations rather than hypothesis-specific analysis. The analysis showed that Debate, Challenge, and Technological Knowledge are the most valued factors. Interestingly, Conflict Resolution ranked lowest, suggesting a gap in this area that firms may need to address. These findings align with the studies of Steele & Murray (2004) on innovation climates. The developed model, CISAEF, illustrates how creative climate factors (as proposed by Ekvall, Amabile, and Woodman) relate directly to strategic management and personal competencies in Saudi firms. This model helps Saudi A&E firms assess their own creativity levels and highlights areas for improvement. The developed CISAEF conceptual model, illustrated in Figure 14, integrates the creative climate factors with strategic management and personal competencies in Saudi A&E firms. The overall ranking and interpretation of the creativity climate factors are summarised in Table 5.

Table 5: A creative environment and innovations in A&E professional firms ordered according to importance

No.	Climate Factors	Interpretation	Importance
1	Debate	Encouraging diverse viewpoints and idea-sharing to foster competitiveness.	80%
2	Challenges	Utilizing skills to overcome internal and external risks successfully.	80%
3	Knowledge of Technology	Adoption of software that evolves management styles and innovation.	79%
4	Freedom	The level of employee autonomy in decision-making and task prioritization.	79%
5	Dynamic And Lively	An eventful environment that reduces resistance and evolves technical aspects.	77%
6	The strategies Followed for the management	Strategic support for financial and professional creativity standards.	76%
7	Culture	Social perceptions and habits influencing independent employee action.	68%
8	Decision-Making	Regulatory processes that include and stimulate employee creativity.	67%
9	Energizing or Empowering Employees.	Motivating staff through diverse assignments and targeted training.	63%
10	Conflict Resolution	Eliminating personal tensions to protect and maintain creative output.	59%

Flexibility, remote work, and international collaboration (especially post-COVID) also emerged as relevant factors. Firms embracing joint ventures (JVs) and digital platforms demonstrated more resilience. Finally, this study calls for leadership in fostering a creative professional culture aligned with Islamic values and Vision 2030 (Iqbal, 2020). Future studies could compare local and global A&E firm practices and apply this model in longitudinal or case-based settings.



Figure 14: Author's elaboration- develop conceptual model

Ethics Declaration

This study used an anonymous, voluntary questionnaire with no collection of private or sensitive data. The affiliated organization does not have a formal IRB; ethical oversight is provided through its internal research

framework, publicly available online (Omraniioun, 2025). Given the non-clinical, low-risk nature of the study, formal ethical approval was not required. The research followed internationally accepted ethical principles, including confidentiality, voluntary participation, and participant wellbeing. Participants were informed of the study purpose, their right to withdraw, and data confidentiality. Completion of the questionnaire was considered as informed consent.

AI Declaration

The authors confirm that the research, analysis, and writing of this manuscript were carried out independently by the authors without the use of Ai tools.

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