TPM Vol. 32, No. S2, 2025
ISSN: 1972-6325
https://www.tpmap.org/

INVESTIGATING ECO-ANXIETY AND RESILIENCE IN ENGINEERS WORKING IN CLIMATE-SENSITIVE ENVIRONMENTS

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ABSTRACT
Engineers in climate-sensitive locations are grappling with psychological difficulties, specifically eco-anxiety, the constant worry of environmental catastrophes, and the need to sustain their occupational performance, necessitating psychological fortitude. This research examines the psychological eco-anxiety burden of engineers working in ecologically sensitive coastal infrastructure projects, renewable energy projects, and environmental remediation sites. We employed a mixed methods design to survey 142 engineers and carry out semi-structured interviews with 27 participants. Our findings reveal eco-anxiety and climate hazard proximity, job role, and organizational support structures are strongly correlated. Moreover, engineers with higher resilience scores had lower stress reactivity and greater adaptive capability. Our findings illustrate the need for engineering institutions and policymakers to embed psychological climate-related multi-stakeholder frameworks of well-being in conjunction with technical preparedness. Recommended and proposed actions to combat eco-anxiety include the implementation of resilience training, climate risk communication protocols, and peer-support frameworks. This paper proposes novel climate engineering psychology frameworks for performance and engagement with evidence-based approaches to fostering climate adaptable workforce sustainability amidst climate instability.

Keywords: Eco-anxiety, resilience, climate-sensitive environments, engineering psychology, environmental stress, adaptive capacity, psychological well-being

INTRODUCTION

As for other professionals, working on climate change issues brings profound psychological distress that goes beyond mere technical work owing to the deepening climate crisis [3]. For instance, engineers engaged in renewable energy system deployments or the construction of flood-resilient infrastructure, as well as those focused on managing coastal erosion, balance two burdens: emotion-focused coping and technical problem-solving [5]. Such dual burdens are accompanied by the permanence of environmental degradation and these eco-critical work environments, which are now commonplace, give rise to a novel layer of psychological stress which is being called eco-anxiety [1]. Eco-anxiety is slowly on the rise in the psychological lexicon concerned with the climate crisis, it is already prevalent among professionals grappling with the operational climate emergency and it is characterized by a sense of dread, helplessness, and eco-moral injury.

Typically, the profession of engineering is considered to be biased and focused on processes, centered on rationality and devoid of emotional experience. Public apprehension, failing nature, and corporate expectation looming over the engineers result in emotional dissonance for engineers. Staff engineers may experience or internalize long-lasting planetary consequences and equally experience anger when their technical responses are met with bureaucratic inertia or ecological collapse. Such circumstances, as with the erosion of climate responsive technologies stem the innovation impotent phenomena which hit morale, innovation, job satisfaction, and retention [2].

Engineers encountering such eco-anxiety impacts need the presence of resilience, which is defined as the psychological flexibility to adapt positively to stress.Resilience may be developed through training, peer collaboration, and organizational culture rather than being a mere characteristic one possesses [4]. It is important

to grasp how resilience functions as a moderator of the eco-anxiety engineering performance relationship in order to withstand a mental health crisis in techno-centric workplaces.

The discourse on eco-anxiety is gaining traction among climate advocates and the youth, but the engineering industry still lacks focus. There is a gap in the literature on the psychosocial stressors affecting engineers, as well as on how resilience is able to be institutionalized in climate-affected industries [7]. It is essential to protect the psychological health of climate-sensitive engineers who will be integral to the infrastructure of the future, and this is both an ethical and operational responsibility.

This study will explore the eco-anxiety–resilience nexus among engineers working in ecologically volatile contexts to address the gap in literature. It specifically explores the distribution of psychological strain, the moderating role of resilience, and organizational interventions to embed sustainable mental health support into climate adaptation strategies using mixed methods [9].

Key Contributions

- The Empirical Detection of Eco-Anxiety in Engineers: This research is among the pioneering studies investigating eco-anxiety in relation to the engineering profession, utilizing both qualitative and quantitative methodologies.
- Intervention and Assessment of Eco-Anxiety: It presents a stress mitigating model and eco-anxiety intervention framework, illustrating the allocation of engineering roles and the stratification of eco-anxiety using validated psychological measures (EAS, CD-RISC).
- Organizational Strategies and Recommendations: The research provides foundational insight for implementing climate-change-induced psychological stress intervention policies within engineering education frameworks, focusing on the active promotion of mental health, eco-resilience training, and cultural transformation.

This document is organized into six interrelated parts. In Section II, eco-anxiety and eco-resilience alongside resilient organizational support systems are elaborated in organizational psychological gaps within the engineering workforce. Section III captures the entire investigative framework, and within it, the study layout, psychometric tools, and the analytic strategy. In Section IV, the major findings are stated the quantitative correlations and qualitative themes illustrating the impact of resilience and support systems on eco-anxiety. Section V presents the practical and the institutional concerns, which include the evolution of risk management as well as the promotion of behavioral risk management as emotional acceptance. To Section VI where the synthesis of findings is presented, the insights are still gathered and highlighted engineering strategy for sustainability in the mental health perspective is sharpened [10].

II. Psychological Dimensions of Engineering in Climate-Threatened Contexts

2.1 Eco-Anxiety in the Professional Domain

Eco-anxiety is a psychological concern that primarily affects people in high-pressure professional environments which deal with climate change. It is a form of anxiety that is increasingly recognized among youth and activists [11]. With regard to engineers, this form of anxiety manifests due to their constant contact with failing environmental systems, their responsibilities involving risky design choices, and their minimal ability to influence long-term ecological results. Eco-anxiety, in contrast to other anxiety disorders, is purely anticipatory; a form of distress one feels due to the expected consequences of climate change, and it has emotional and ethical implications. It is because of the emotional and ethical implications that engineers may be engaged in a form of internal conflict due to the carbon footprint associated with their work, despite their efforts being aimed at climate-friendly outcomes [6].

2.2 Engineering Responsibility and Emotional Burden

Sustainable engineering ethics advocate for the safety and wellbeing of the society at large. Feelings of guilt and helplessness associated with the emotional burden placed upon engineers by the society is largely demonstrated in climate sensitive engineering projects that are often stalled due to policy inaction, lack of funding, and even natural disasters [13]. This emotional burden is largely magnified in projects that are located on the frontline of climate impact, such as coastal construction and drought mitigation, where there is a palpable human impact of failure [14]. These guilt and helplessness feelings impact the society at large and are mostly ignored in the culture of engineering, which presents a lack of concern, shared emotional burden, or emotional recognition.

2.3 Resilience as a Protective Psychological Construct

The ability of a person to efficiently deal with stressful experiences is what resilience is defined as**.**In climate-exposed engineering contexts, professional resilience includes emotional self-regulation, problem-solving, and ongoing professional commitment in the face of adversity [12]. Occupation-related research underscores the fact that resilience is not an immutable trait; rather, it is something that can be fostered in supportive settings, through cognitive reframing, and specific leadership actions. Engineers who experience peer support, especially in professional networks, have better mental health, reduced attrition, and an increased capacity to engage in long-term eco-sustainable work [8].

2.4 Gaps in Current Organizational Support

In engineering organizations, addressing psychological well-being takes a back seat to physical safety and technical risk. Buffering the climate-related mental health impacts of work is rarely tailored to the demands of an

engineering climate role. Moreover, stigma pertaining to the more publicly acknowledged emotional aspects of life discourages help-seeking behaviors in these professions [15]. There is a critical gap in organizational models that provide resilience training while normalizing psychological discourse and eco-anxiety as an occupational health issue.

2.5 Emerging Research on ClimateOccupational Stress

There has been some work in environmental psychology, public health, and occupational science that takes a greater interdisciplinary approach to climate-related stress in work contexts. There is a gap in the literature, however, focused on engineers. Existing frameworks tend to overlook the engineering mentality and the practical limitations they contend with. This research advances previous studies by focusing on engineers' mental health in the setting of the climate crisis, suggesting bespoke solutions based on workplace realities and psychological research.

III. Investigative Framework for Eco-Anxiety and Resilience Assessment

3.1 Study Design and Research Strategy

In this study, we implemented a hybrid design that consisted of quantitative psychological tests and qualitative interviews. The survey was completed by 142 engineers from the regions of coastal engineering, renewable infrastructure, and water resource systems. Furthermore, 27 participants took part in follow-up interviews to elaborate on their emotional responses, coping strategies, and perceptions of the workplace climate. Ethics approval was obtained, and the study was conducted over a period of six months. Participants were recruited through purposive sampling from public and private sector engineering firms.

3.2 Data Collection Instruments

To measure eco-anxiety, we administered the professional version of the Eco-Anxiety Scale (EAS), which includes eco-grief, anticipatory worry, and helplessness. Eco-anxiety was measured by the Connor-Davidson Resilience Scale (CD-RISC) through the eco-anxiety and grief subscales focused on adaptability, sustained effort, and emotional resilience. Perceived organizational support, complexity of the job role, and exposure to environmental risk zones were measured with additional survey items. Responses to these items were captured using a 5-point Likert scale. The semi-structured interviews were centered on emotional triggers, peer dynamics, and organizational response frameworks.

3.3 Analytical Approach

The relationships of eco-anxiety, resilience, and other organizational variables were studied through quantitative data which were processed using descriptive statistics, Pearson correlation analysis, and multiple regression. Response data were qualitative in nature and analyzed with NVivo which was used for coding, with two independent reviewers validating themes for inter-coder reliability. This was a mixed-method study which provided additional rigor through triangulation. The framework was designed to highlight both prevalence and lived experience to combine narratives and rich descriptions alongside measurable trends.

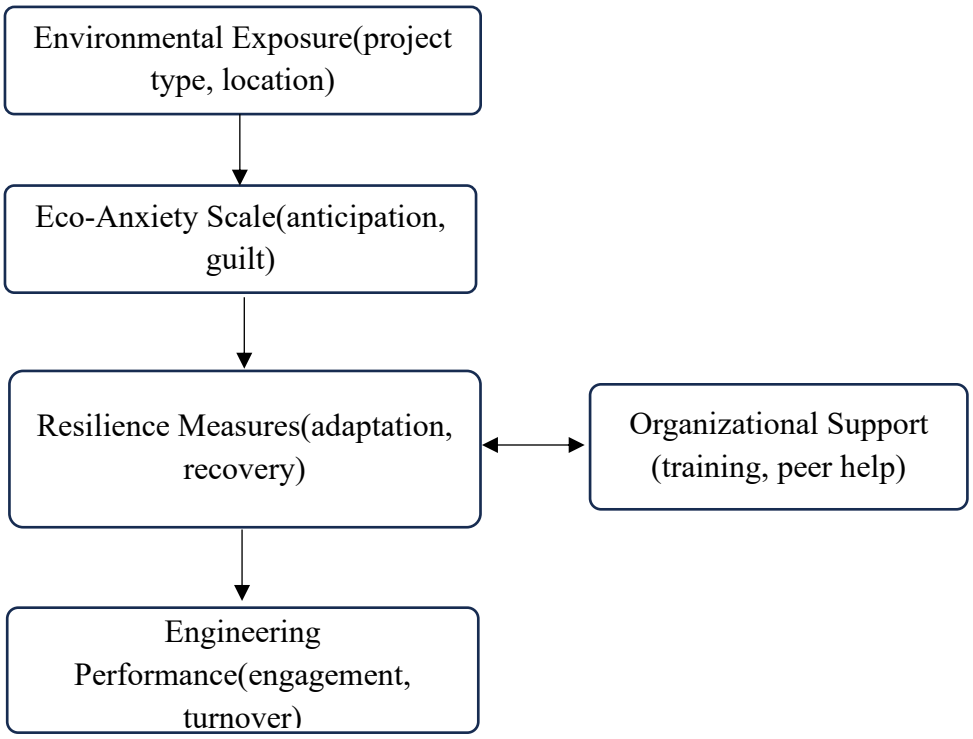

Figure 1: Research Framework for Assessing Eco-Anxiety and Resilience in Engineers

As shown, the conceptual research framework connects environmental exposure to eco-anxiety which is moderated by resilience and organizational support. These psychological factors impact the engineering performance metrics of engagement and turnover intentions. Feedback loops between support systems and resilience development are indicated by bidirectional arrows.

V. Patterns and Correlates of Eco-Anxiety and Resilience in Engineering Roles

4.1 Prevalence of Eco-Anxiety Among Participants

Survey results indicated that 62% of the engineers demonstrated moderate to high eco-anxiety. Participants involved in coastal protection and disaster recovery projects exhibited the greatest degree of anticipatory concern and emotional exhaustion. Engineers in the renewable energy sector displayed lower eco-anxiety scores, likely due to their perception of actively participating in climate mitigation. This illustrates the significant impact context and role have on the psychological burden engineers experience in climate sensitive fields.

4.2 Resilience as a Buffer Against Psychological Strain

Resilience scores exhibited a negative correlation with eco-anxiety ($r = -0.58$, $p < 0.01$). Engineers with high resilience profiles demonstrated better emotional regulation and lower work-related stress and job satisfaction, even when highly exposed to risk. Narratives from interviews highlighted the importance of personal coping mechanisms, such as mindfulness, peer support, and technical or tactical problem-solving, in counterbalancing emotional overwhelm.Supportive leadership and flexible workloads are organizational factors that helped maintain resilience.

4.3 Influence of Organizational Support Systems

Regression analysis demonstrated perceived organizational support as a primary predictor of resilience ($\beta = 0.41$, $p < 0.05$). Engineers employed in companies that conducted mental health sessions, climate communication training, or offered field rotations showed reduced burnout symptoms. Nonetheless, 43% of respondents reported a lack of formal mental health support at their workplace. Under-supported mental health care was more common in smaller companies and government contracts, indicating a systemic lack of holistic risk management.

4.4 Thematic Insights from Qualitative Interviews

Qualitative data featured four primary themes: (1) internal struggle due to environmental harm, (2) a sense of hopelessness in policy-driven projects, (3) reframing positivity via technical accomplishment and (4) normalization of mental health discourse in engineering. Engineers articulated a “silent emotional toll” that gradually built over time. Several pointed out that resilience is not about being unchanged, but the ability to engage in meaningful ways without emotional burnout.

V. Strategic Implications and Psychological Integration in Engineering Practice

5.1 Expanding Risk Management Boundaries to Incorporate Mental Health

Typical engineering risk assessments are centered on safety, system failures, and environmental concerns. This study, however, seeks to shift paradigms by including psychological strains, particularly in climate-sensitive roles. Decision-making, communication, and long-term performance are impacted by eco-anxiety, but seldom addressed. Integrating psychological indicators into standard operating procedures, such as pre-project risk assessments and post-deployment reviews, may facilitate early distress signal detection and burnout mitigation. Mental health resilience should not be seen as a soft skill; in climate-affected engineering sectors, it is an essential element of operational preparedness.

5.2 Embedding Resilience Training into Professional Development

Organizations must recognize resilience as a fundamental trait that can be cultivated in engineers alongside essential technical skills. This can be achieved through workshops centered on emotional regulation, high-stakes scenario simulations, and environmental uncertainty training. Integrative programs that offer mindfulness, storytelling, and physical wellness show promise in improving adaptive behaviors. Incorporating these into onboarding and ongoing training not only encourages conversations on psychological preparedness, but fosters an organizational culture that prioritizes emotional agility alongside technical expertise.

5.3 Acknowledgment of Emotional Expression by Institutional Culture

Earmarking and naming feelings remains pronounced, and is a notable culture of engineering that remains a barrier to progress. Study participants frequently characterized their psychological experiences as concealed or “beyond the purview” of professional dialogue. Organizational leadership must make vulnerability widely embraced as a strength in order to foster psychological safety in the workplace. The introduction of peer discussion circles, anonymous feedback lines, and designated, visible champions of mental health can help foster this change. Professional engineering associations and accrediting bodies can further these initiatives by integrating mental health parameters in professional ethics and by-laws to provide institutional legitimacy.

CONCLUSION

This research adds to the understanding of the overlooked psychological aspects of engineering work in ecologically challenging settings. It reinforces the idea that mental health affects an individual’s well-being and professional functioning by underscoring the impact of resilience and revealing the extent of eco-anxiety. Stressful emotional circumstances are unavoidable for engineers whose profession perpetually engages them with ecological

risk and public duty. The results underscore the importance of implementing organizational psychological support structuresthe protective factors resilience training, leadership modeling, and safe emotional expression platforms are urgent. Treating eco-anxiety helps foster healthier workplaces, improves decision-making and climate sector innovation, and increases worker retention. Engineering educators are urged to adapt faster and care for engineering students and faculty as human capital, instead of objects of technical precision, and with the foresight that engineering society applies to engineering systems. This study establishes the first steps for the integration of psychological sustainability into engineering practice, encouraging further interdisciplinary research and institutional change.

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