

ABSTRACT

This study aims to develop and evaluate a *push-pull stick* prototype made from Tohiti rattan (*Calamus inops*) as an alternative *hands-off tool* for lifting activities in the oil and gas industry. The research is motivated by the high risk of musculoskeletal injuries caused by direct worker contact with operational loads, as well as the limitations of conventional tools made from metal and fiber-reinforced composites, particularly in terms of weight, ergonomics, and material sustainability.

The study employs a *Research and Development* (R&D) approach, including field needs identification, prototype development, mechanical material testing, ergonomic evaluation, and assessment of user acceptance. Mechanical testing of Tohiti rattan was conducted through bending, compression, and tensile tests following ASTM D143 standards. The results indicate that Tohiti rattan exhibits bending strength of 68–79 MPa, compressive strength of 21–25 MPa, and tensile strength of 41–49 MPa, demonstrating sufficient mechanical performance as a lightweight structural material for a *push-pull stick* prototype.

Ergonomic evaluation was performed using the Rapid Entire Body Assessment (REBA) method involving nine respondents during pushing and pulling tubular handling tasks. The results show that the use of the Tohiti rattan *push-pull stick* prototype reduced REBA scores compared to fiber-composite tools, shifting ergonomic risk levels from moderate–high to low–moderate. These findings indicate improved working posture and reduced ergonomic risk.

User acceptance was evaluated through a five-point Likert-scale questionnaire and brief interviews. The prototype achieved average acceptance scores ranging from 3.6 to 4.7, reflecting positive perceptions of comfort, ease of use, and safety. Overall, the study demonstrates that Tohiti rattan has potential as an ergonomic, safe, and sustainable alternative material for the early-stage development of *hands-off tools* to support occupational safety in lifting activities.

Keywords: *push-pull stick*, ergonomics, Tohiti rattan, *hands-off tool*, occupational safety.

INTISARI

Penelitian ini bertujuan untuk mengembangkan dan mengevaluasi prototipe *push-pull stick* berbahan rotan Tohiti (*Calamus inops*) sebagai alternatif alat bantu *hands-off tool* pada aktivitas *lifting* di industri migas. Latar belakang penelitian didasarkan pada tingginya risiko cedera muskuloskeletal akibat kontak langsung pekerja dengan beban operasi serta keterbatasan alat bantu konvensional berbahan logam dan *fiber-composite* yang masih digunakan, terutama terkait bobot, ergonomi, dan aspek keberlanjutan material.

Penelitian ini menggunakan pendekatan *Research and Development* (R&D) yang meliputi tahapan identifikasi kebutuhan lapangan, pengembangan prototipe, pengujian mekanis material, evaluasi ergonomi penggunaan, serta pengukuran tingkat penerimaan pengguna. Pengujian mekanik rotan Tohiti dilakukan melalui uji kuat lentur, kuat tekan, dan kuat tarik mengacu pada standar ASTM D143. Hasil pengujian menunjukkan bahwa rotan Tohiti memiliki kuat lentur pada kisaran 68–79 MPa, kuat tekan 21–25 MPa, dan kuat tarik 41–49 MPa, yang menunjukkan kemampuan mekanis memadai sebagai material struktural ringan untuk prototipe *push-pull stick*.

Evaluasi ergonomi penggunaan prototipe dilakukan menggunakan metode Rapid Entire Body Assessment (REBA) terhadap sembilan responden pada aktivitas menarik dan mendorong tubular. Hasil evaluasi menunjukkan bahwa penggunaan prototipe *push-pull stick* berbahan rotan Tohiti menghasilkan penurunan skor REBA dibandingkan alat berbahan *fiber-composite*, dengan pergeseran tingkat risiko ergonomi dari kategori sedang–tinggi menjadi rendah–sedang. Hal ini mengindikasikan adanya perbaikan postur kerja dan penurunan risiko ergonomi.

Tingkat penerimaan pengguna dievaluasi menggunakan kuesioner skala Likert lima tingkat dan wawancara singkat. Hasil menunjukkan bahwa prototipe memperoleh nilai rata-rata penerimaan pada kisaran 3,6–4,7, yang mencerminkan persepsi positif terhadap aspek kenyamanan, kemudahan penggunaan, dan keamanan. Secara keseluruhan, penelitian ini menunjukkan bahwa rotan Tohiti berpotensi digunakan sebagai material alternatif yang ergonomis, aman, dan berkelanjutan untuk pengembangan awal alat bantu *hands-off tool* pada aktivitas *lifting*.

Kata kunci: *push-pull stick*, ergonomi, rotan Tohiti, *hands-off tool*, keselamatan kerja