ABSTRACT OF THE PROBLEM STATEMENT

URP Research Grant Scheme – Stage 1: Industry Problem Statement

Problem Title:	Design, Development, and Scaling Up of Advanced & Affordable Shuttle-Less Weaving Machine for the Indian Power Loom Sector
Submitted by:	Velmero Technologies Private Limited (CIN: U14101TZ2025PTC036864)
Sector:	Textile Technology / Manufacturing

1. Industry Context and Background

India's power loom sector is one of the largest in the world, comprising over 2.4 million looms and producing approximately 60% of the country's total cloth output. The sector is a critical pillar of the national textile industry, contributing approximately 2.3% to GDP and 12% to export earnings, while employing over 45 million people directly and indirectly. Major power loom clusters are concentrated in Tamil Nadu (Erode, Salem, Coimbatore, Tirupur), Maharashtra (Bhiwandi, Ichalkaranji, Malegaon), Gujarat (Surat, Ahmedabad), and Uttar Pradesh (Varanasi, Mau). The sector is overwhelmingly dominated by Micro, Small, and Medium Enterprises (MSMEs), with the typical weaving unit operating 4–10 looms and generating annual revenues of Rs.20–50 lakh.

2. The Problem: Technology Deficit in Indian Power Looms

Approximately 85% of India's 2.4 million power looms continue to rely on outdated shuttle-based weaving technology dating back several decades. This creates severe and compounding limitations across the value chain:

Low Productivity: Shuttle looms operate at 80–150 picks per minute (PPM), compared to 300–800+ PPM achievable with modern shuttle-less looms (rapier, air-jet, water-jet). This 3–6x productivity gap directly undermines unit economics and competitiveness against mechanised weaving operations in China, Turkey, and Vietnam.

Inferior Fabric Quality: Shuttle looms produce fabric with selvedge defects, inconsistent beat-up force, limited pattern complexity (typically 4–6 heald frames), and restricted fabric widths (up to 120 cm). As global brands demand higher-quality woven fabrics with diverse weave structures and wider widths, Indian weavers are losing market share in value-added segments.

Occupational Safety Hazards: Shuttle looms generate noise levels exceeding 95–100 dB, causing chronic occupational hearing loss among weavers. The high-speed flying shuttle also poses significant physical injury risks. Modern shuttle-less looms operate at 70–80 dB with substantially reduced mechanical hazards.

Energy Inefficiency: Shuttle looms consume 20–30% more energy per metre of fabric produced compared to equivalent shuttle-less machines, increasing operating costs and the carbon footprint of Indian textile manufacturing at a time when sustainability is becoming a market-access requirement.

3. The Core Barrier: Affordability

The core problem is the lack of an affordable, domestically manufactured shuttle-less weaving machine designed specifically for the Indian power loom sector's operational requirements and cost constraints. While the technological advantages of shuttle-less weaving are well-established globally, imported shuttle-less looms from manufacturers in Europe, Japan, and China are priced between

Rs.15–50 lakh per unit. For India's MSME power loom operators—with annual revenues of Rs.20–50 lakh—this capital expenditure is simply unviable. No indigenously developed alternative exists that delivers modern shuttle-less performance at an accessible price point.

Indian power loom weavers need a machine priced at Rs.3–5 lakh (compared to Rs.15–50 lakh for imports) that delivers higher weaving speeds (250–400 RPM), superior fabric quality, wider fabric widths (up to 190 cm), multi-fibre compatibility, reduced noise levels, and improved energy efficiency—while being serviceable with locally available skills and spare parts.

4. Impact if Unresolved

Without intervention, India's power loom weavers will continue losing competitiveness, facing declining margins, and remaining confined to low-value fabric segments. The Government of India's ambitious target of achieving USD 100 billion in textile exports by 2030 cannot be realised without modernising the power loom base. India risks falling further behind competing nations (China, Vietnam, Bangladesh, Turkey) that have already achieved high levels of shuttle-less loom adoption. The livelihoods of millions of weavers and ancillary workers depend on a technology intervention that makes shuttle-less weaving affordable and accessible to the Indian MSME sector.

5. Scope for Research-Led Resolution

This problem has a clear requirement for research-led resolution. The challenge is not merely one of manufacturing a cheaper version of existing imported machines, but of fundamentally re-engineering the shuttle-less weaving platform—through innovative material selection, simplified mechanical design, modular electronic controls, and cost-optimised component architecture—to achieve a 60–80% cost reduction while maintaining performance specifications suitable for the Indian market. This requires systematic research in weft insertion mechanics, shedding system optimisation, servo-driven tension control, and embedded IoT monitoring—areas where academic-industry collaboration can deliver breakthrough results. The addressable market for power loom modernisation in India is estimated at Rs.4,000–5,000 crore, with additional export potential across Southeast Asia and Sub-Saharan Africa for affordable shuttle-less weaving technology.

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