Vision and Way-forward for Scaling Graphene Commercialization

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Abstract

Graphene promises to redefine advanced manufacturing and applications delivering sustainable value through lighter structures, longer-lasting energy systems, high-performance coatings, and next-generation conductive materials, few among many potential values. The opportunity is transformative—but commercialization at scale remains the critical hurdle.

Success depends on shifting from laboratory breakthroughs to application-driven industrial integration. Scalable production must ensure consistent quality, standardized characterization, and compatibility with existing manufacturing processes. Performance improvements, a critical delivered value must be measurable at the system level to justify cost and adoption.

Key challenges include material variability, lack of unified standards, integration and dispersion complexities, long-term reliability validation, and funding gaps across mid-to-late Technology Readiness Levels (TRL 4–8). Immersive translational and distributed development eco-system to proliferate graphene into everyday life still remains unexplored. Best of academic, research minds, collaborating in area of their passion and frugally translating graphene infused product with startups/ SMEs for then large industrial house to absorb/adopt is next best revolution on the anvil.

Bridging these barriers through coordinated industry- research collaboration, pilot-scale validation, standards development, and sustained translational risk capital funding the value stream can unlock graphene's transition from promise to scalable industrial impact. Government and Industry both play an anchor role to commercialize Graphene.

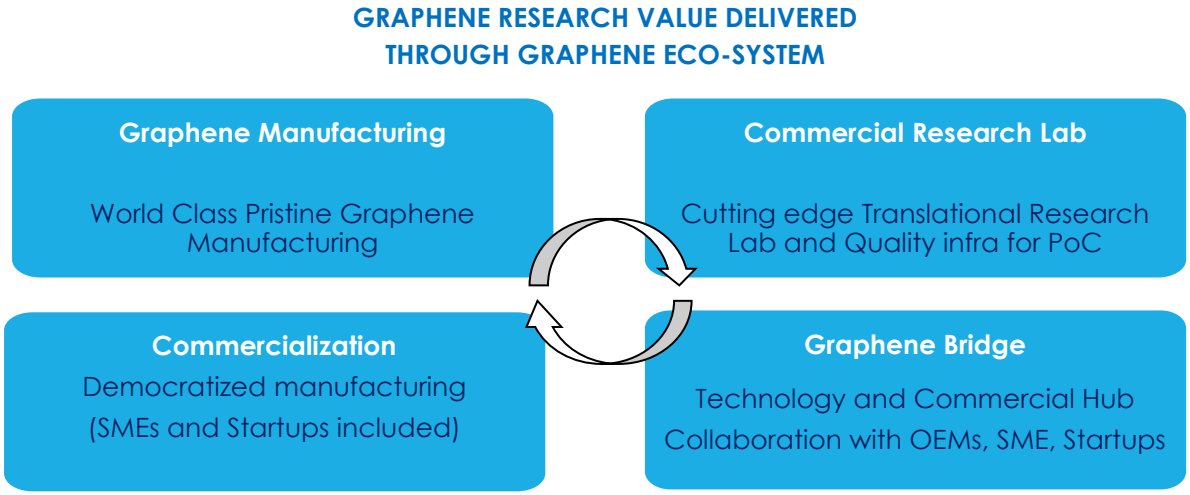

Figure 1: Graphene Eco-system for commercialization at scale