CEI / IFCI

Implementation Framework for Chemical Innovation

Creative Engineers Inc.

	Stage 1 Bench Scale	Stage 2 Pilot Scale	Stage 3 Commercial Scale
Characteristics	• One or more experiment stations • Bench or glove-box size • One or two experimenters • Investment up to $100K • Focus on confirming technology or process	• Includes build, operate, revise • Owned, leased, or host space • Small team of technology specialists • Investment $100K to $2M • Focus on safe + economical scale up	• Includes build and early production • Permanent space or long term lease • Full staffing plan • Investment of $1M and up • Focus on construction and production
Prerequisites	• Project Charter and success criteria • Prelim. R&D done and shared with team • Investment plan for all Stages • Identify IP protection needs • Resources are aligned	• Bench Scale success proven • Bench Scale issues addressed • Investment Plan has continued support • Goals and success criteria defined • Resources ready for extended operations	• Bench Scale success achieved • Complete data package ready • Investment plan supported • Commercial Scale reporting plan done • All material logistics in place
Activities and Goals	• PDCA methodology of experiments • Stakeholder Communication Plan • Focus activities to support Project Charter • Gather evidence of success • Complete Lessons Learned	• Design, build, operate new pilot system • Nurture new and existing stakeholders • ID early adopters for Commercial Scale • Begin Product Marketing Plan • Complete Lessons Learned	• Design, build, operate production system • Production plan closely monitored • Cater to early adopters to gather feedback • Gather production and Q/C feedback • Monitor and report on production costs
Resources	• Main innovator very involved • “All Hands on Deck” attitude • Identify/Secure 3rd party resources • Bench Scale facility requirements	• Funding for operating, decommissioning, and disposition of waste • Resources for extended operations/activities • Confirm 3rd party resources and raw materials • Pilot Scale facility requirements	• Secure competent resources • ID org. resources including production and maintenance • Secure funding for all facets of this stage • Commercial Scale facility requirements
Risks	• Establish and use Risk Register • Monitor expenses vs. budget • Evaluate safety risks for novel processing • Stick to Stakeholder Communication Plan • Have reserves for cleanup or deviations	• Use proper Hazard Assessment Techniques • Secure good documentation in all areas • Use Change Management Process • Protect IP with procedures and documents • Agree on production limits of this scale	• Use proven methods for Project Approach • Risk identification expands to supply chain, competition, early adopters • Start maintenance and sustaining plans • Invest in sales, marketing, early adopters
Stakeholder Needs	• Well documented success criteria • Convey risks and mitigation plans • Utilize Project Charter for alignment • Report frequently on expenses and results • Educate on CEI/IFCI process	• Well documented success criteria • Continue risk awareness activities • Report frequently on schedule, expenses, results both positive and negative	• Well documented success criteria • Utilize expanded Stakeholder Communication Plan • Report according to Commercial Scale Reporting Plan