

Mid-Atlantic Technology, Research & Innovation Center

MATRIC

Market-Driven Innovation



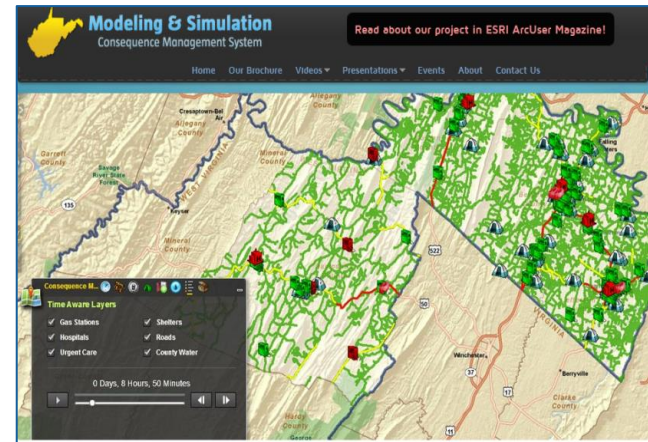
Managing Technology Commercialization Risk



**CHEMICAL, ENERGY &
ENVIRONMENTAL
TECHNOLOGIES**



TECHNICAL ENGINEERING



ADVANCED SOFTWARE TECHNOLOGIES

Technology Commercialization Challenges in the Chemical Industry

Technology Development Pathway

- Duration of development cycle
 - Missed opportunity
 - Increased development costs
- Technology does not scale up directly
 - Additional delays to implementation
 - Costs for equipment modification
 - Lost sales

Capital Intensity

- Rate of Return
- Capital demand

Societal Impact

- Safety
- Environmental

Business Culture

- Communications
- Ownership

Successful Commercialization

 **Salable product delivered safely, on-time and on-budget**

Challenges Associated with On-Time Delivery

Technology Development

- “Known” Unknowns
 - Addressed throughout the planned technology period
- “Unknown” Unknowns
 - Discovered later than “known” unknowns, therefore add time to development
 - Same solutions – Invention, Engineered Solution
- Process Scale-up
 - Pilot Scale? Demonstration Scale?

Process Design

- Process Definition of Technology completeness
- Equipment Uniqueness – long lead delivery potential

Process Commercialization

- Separate normal start-up from new technology-related challenges
- Resource availability (Using plant labs rather than R&D laboratories.)

Challenges Associated with On-Budget

Technology Development Budget

- Keeping technology development on-time (see previous)

Process Design Budget

- Experience of EPC working with new technology
- Completeness of technology definition package
- Novelty of equipment requirements

Process Commercialization

- Experience of Manufacturing team in implementing new technologies
- Delayed start-up
 - Commissioning/start-up issues
 - New Technology issues
- Reduced capacity at start-up
 - Lower sales
 - Purchases on spot market

Cultural Requirements for Successful Technology Commercialization

Communications are timely and complete

- Good news and bad news travel up and down the organization equally quickly
- Project documentation is complete at all phases
 - Project team membership continuity
 - Sponsor's Objectives are published and shared
 - Definition of Technology is complete
- Project learnings are shared
 - Successes and failures are equally embraced

Business Leadership establishes supportive culture

- Project champions exist at all levels of the organization
- Prudent risk taking is rewarded
 - All team members are recognized (fairly) for prudent risk taking
- Stretch goals are defined
 - Contingency plans in place
- Understanding and focus on the technology features that provide the greatest value

Technology Commercialization Standards

- **The biggest technical/economic hurdles are identified, and addressed first!**
- **Safety and environmental considerations are included in the earliest stages of the technology development!**
- **Multi-functional teams are involved in the project from conception to completion!**
 - Include R&D personnel throughout the EPC design and construction.
 - Include R&D and process engineering experts in the commercial start-up and operations.
 - Subject Matter Experts are included in discussions!
- **Technology is developed at the smallest scale that can be accurately scaled to the next development stage!**
 - The number of development stages will be determined by the scaling difficulties.
- **Troubleshooting time is included in the plant start-up schedule!**

Technology Commercialization Standards (cont'd.)

- Troubleshooting contingencies are included as a line item in the project budget for commercial start-up!
- Supply contingencies are developed in the event of delays or issues in the start-up!
- Organizational alignment is managed, including a robust Change Management process!
- There is a supportive culture in the organization for prudent risk taking!
- Project communications of good and bad news are equally shared and embraced!
- Project documentation is clear and complete at all levels!