Figure ES-2. Successful Outcomes

Greater Workplace Safety

The production and operational environment is made safer through modern, cost-effective training techniques and increased operator safety awareness.

Efficient Use of Energy Resources

Simulation and visualization methods enable better management and use of energy resources, as well as recovery and use of valuable waste heat.

Streamlined, Efficient Production

New technologies and simulation techniques lead to reduced cycle times, increased yields, and optimization of production efficiency.

Optimized Maintenance and Reliability

Greater confidence and reliability in equipment, processing, and product quality is achieved via enhanced training and early preventive maintenance tools.

Sustainable Production

New simulation tools allow for optimization of processes and identify opportunities for recycling, leading to fewer emissions and less landfilled or treated waste.

Economic, Reliable Raw Materials

Better materials utilization, yields, and recycling are made possible through advanced simulation methods, leading to fewer materials supply issues and lower costs, while optimizing product quality.

Agile, Smart Manufacturing Systems

Advanced computational methods for operations and enterprise management enable a smart, agile manufacturing environment and supply networks that are responsive to customer demands.

Next Generation Workforce

Greater awareness of opportunities in the steel industry and excellent educational and plant personnel training programs yield a highly trained, retained manufacturing workforce.

A number of **broad challenges** were identified that currently impede the use of modeling, simulation, and visualization for steel optimization. These challenges are economic, cultural, and technical, as illustrated in Figure ES-3.

Topic-specific challenges were also identified for the eight priority roadmap areas. Many of these are broad technical challenges and not necessarily specific to MSV, while others are directly related. In energy efficiency, for example, a significant challenge is the availability of cost-effective technology for capturing low-quality waste heat. Reducing heat losses (or increasing recovery) from mature processes is also challenging as it requires economically and technically feasible retrofits. In workplace safety, adverse operator perceptions of the utility and value of new MSV tools for safety and training can be an impediment to use. A complete set of challenges identified for each priority roadmap area is outlined in the respective chapters in this report.