ultimately it will be up to companies to capitalize on the IMIs' work. Manufacturers should therefore lead the development of IMI proposals, defining the scope and focus of the Institutes, and make significant investments in their operations, as discussed in more detail below. Many technical focus areas have been proposed by industry (as well as academia, government research agencies, and private research organizations) for the creation of potential Institutes for Manufacturing Innovation, as Box 2 shows.

"Focus" will differentiate the IMIs from typical academic or government research institutions. Rather than seeking to contribute to a global pool of scientific knowledge, the IMIs will build an interconnected web of skills, knowledge, and capabilities that support a large but nonetheless limited number of facilities and operations in the United States. Many IMIs are likely to focus on a particular type of manufacturing process, although some might focus on specific materials, supply chain integration methodologies, or enabling technologies. In addition, an IMI's area of focus should have applications in large, medium, and small establishments and where reasonable across more than one manufacturing industry.

Manufacturers should lead the development of IMI proposals, defining the scope and focus of the Institutes, and make significant investments in their operations.

Box 2: Focus Areas Proposed by Respondents to the Advanced Manufacturing National Program Office's "Request for Information" for NNMI[49]

- Advanced materials—lightweight materials
- Alternative energy development
- Amorphous metals manufacturing
- Autonomous robotics, autonomous systems manufacturing
- Batteries—energy storage
- Big data
- Bio-inspired electronics that reduce power requirements in servers, perform intelligent processing in robots, and do automatic testing of complex systems
- Biomanufacturing (including biomimicry), biotechnology, biomaterials and products, biomedical materials and device fabrication, tissue engineering, synthetic biology and customized or personal medicine, healthcare
- Castings—sand, die, investment, and permanent mold
- Carbon fiber components
- Carbon nanotubes
- Chemical coatings
- Complex systems that are intelligent, self-adaptive, self-tested, and self-repairable
- Composites materials manufacturing and coatings
- Control technologies
- Cyber infrastructure
- Design tools
- Diamond-based devices
- Digital manufacturing
- Energy—the reduction of energy use in energy-intensive processes and development of clean energy (photovoltaics, biofuels, offshore wind), increasing overall energy efficiency and sustainability
- Flexible electronics
- Flexible film and coating technology used for thermal, electronic, chromic, and optical applications