A hypothetical scenario.

The core of the proposed cybermanufacturing approach is the development and deployment of a new “smart” machine that can carry out a variety of manufacturing operations based on the material and product required, and a manufacturing simulator (somewhat like a flight simulator for training pilots or a virtual surgery simulator for surgeons) with specialized apps for workforce training. These will be utilized in the following way:

**Infrastructure for workforce training:** TEES establishes the following five elements of the workforce training infrastructure:

- **Cybermanufacturing Training center** at San Antonio consists of 3D printers and CNC machines, computer workstations, a prototype of the cybermachine, and instructors/peer mentors.
- **Cybermanufacturing Development center** at College Station with software apps for design, the machine prototype for development and improvement of apps, a dedicated server to provide remote simulation (3D visualization) and control of the cybermachine.
- **Training modules** that leverage TAMU’s subscription to the edX platform ([https://www.edx.org/](https://www.edx.org/)) for online courses to deliver distance learning.
- **A certificate program** for industry professionals with various levels of experiences in manufacturing settings (e.g., advanced manufacturing training currently offered in San Antonio).
- **An undergraduate minor** with hands-on experiences in manufacturing decision making and manufacturing app development/usage.

**Workforce training:** The professional certificate program would consist of two levels of training at the Training center supported by the Development center. In the first level, the enrollees will use a computer workstation to learn manufacturing decision making by simulating the manufacturing process (like a flight simulator). The second level modules provide hands-on training in custom manufacture of parts using the apps and the machines available in the training center. On completion of the certificate program the professional would have acquired skills to develop a variety of custom high-end components that the industry currently procures at high prices, usually from other countries (e.g., Russia and Germany).

The undergraduate minor program would provide hands-on exposure to manufacturing decision making and custom manufacturing using the developed apps. The minor would build on the various STEM courses that the students would have already been exposed to as part of the undergraduate program at Texas A&M.

Taken together, the workforce training programs as well as the advanced technical features of edX and the apps offer Texas A&M with an exciting opportunity to form teams comprising members pursuing the undergraduate minor with those in the professional certificate program to address a capstone project. While the undergraduates learn the nuances of real world manufacturing from the trainees, the trainees will be exposed to STEM-based thinking from the undergraduates.
Partner companies would enroll their members into the professional certificate program. The program would receive significant publicity, thus creating a steady stream of large learning cohorts.

These efforts lead to the following developments in the subsequent phases.

- Software upgrades are launched
- Gen 2 of the cybermachine commissioned (to include broader and improved functionality and performance)
- 100+ professionals and students receive training
- Infrastructure capacity upgraded to train 100 professionals every weekend
- Propagation of the successful San Antonio Training center to other regional sites.

**Outcome:** Among the graduates from the program at the end a cohort (annual average of 500): (a) 85% gainfully employed to address urgent custom manufacturing needs of the regional industry, (b) 5% become entrepreneurs and develop startups/small businesses to create a manufacturing ecosystem, and (c) 10% pursue advanced studies to push technology forefront in manufacturing

In five years, the impact in terms of direct earnings (based on a five year average revenue for successful startups ($1M), rate of success of a manufacturing startup (5%), salaries for skilled engineer ($62k)) and multiplicative effect of investment in manufacturing is **roughly $0.7B**.