Making Value For America

GUIRR Webinar

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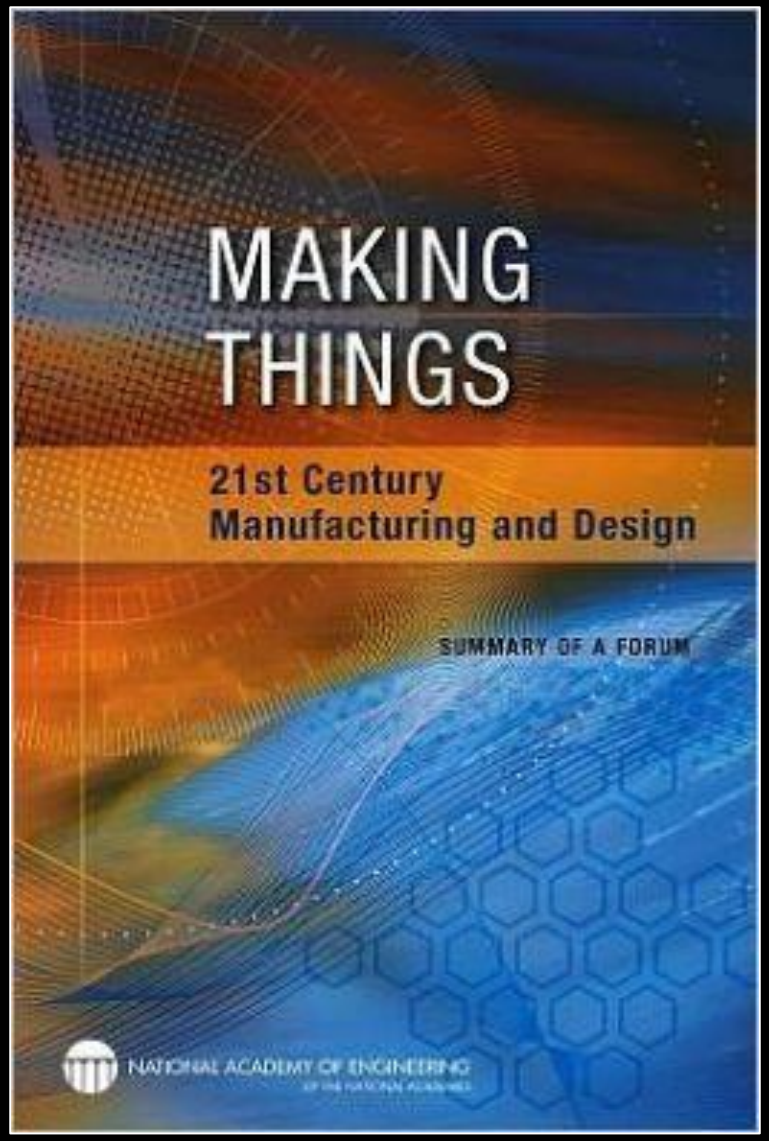
January 19, 2016

National Academy of Engineering



Making Things: General Motors

- 1992-2007
  - GM transformed how it made cars & trucks
    - Design for Manufacturability
    - Lean Manufacturing
    - Global Sourcing
    - Supply Chain Management
    - Quality/Reliability/Durability Processes
    - Product Portfolio Planning
    - Product Development Process
    - Math-Based Design and Engineering
    - Throughput Improvement
    - Compelling Design
  - Market Cap
    - $66 B 2000
- 2008
  - GM could not get ahead of its legacy costs
- 2009
  - GM bankruptcy

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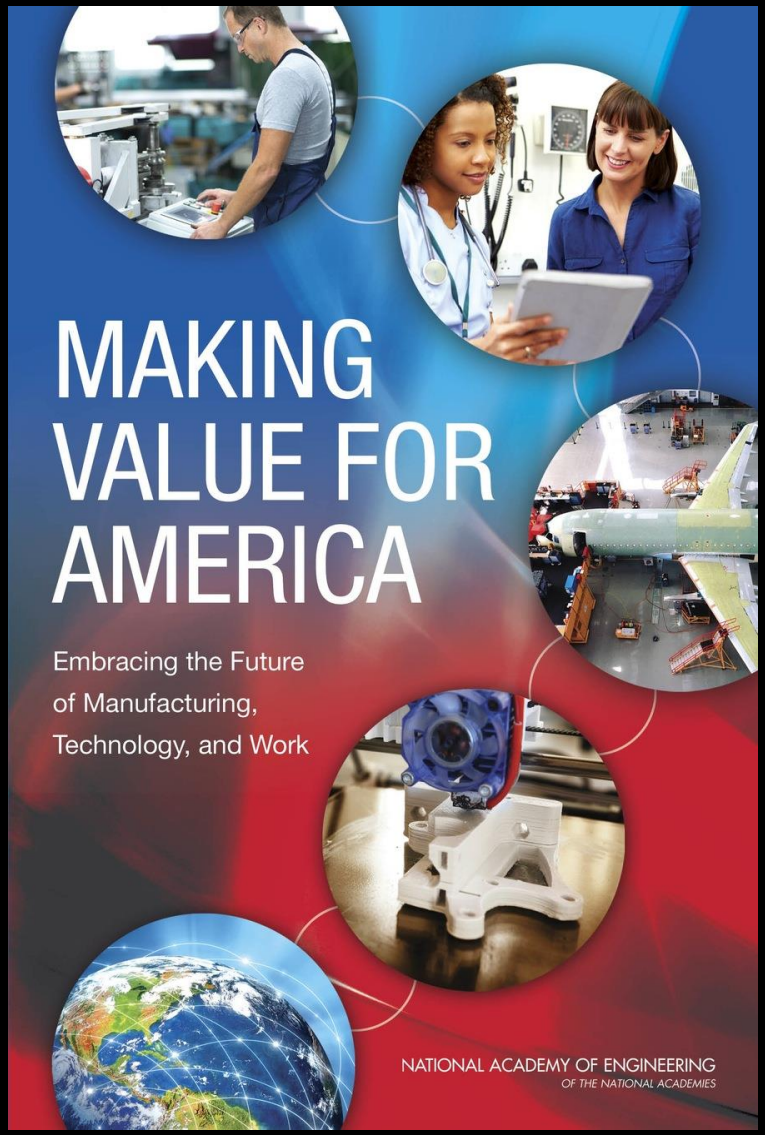


Making Value: Apple

- 1997
  - Apple lost $1.6 B
  - 6 months away from bankruptcy
  - Steve Jobs named interim CEO
  - $2 B market cap
- 1998-2000
  - iMac sales success
  - Return to profitability
  - Steve Jobs named permanent CEO
  - $16 B market cap
- 2001-2015
  - Apple Retail Stores
  - iPod
  - iTunes
  - iTunes Store
  - MacBook Pro
  - iPhone
  - Apple TV
  - Apps
  - iPad
  - Apple WATCH
  - >$700 B market cap

Making Value

Builds Strong Brand Equity

Leads To Superior Financial Returns

Making Value

The process of using ingenuity to create value for people and society

Value Network

The interdependent activities performed to make value

- Spans many locations and economic sectors
- Involves work by multiple companies and workers
- Is driven by the desires of the end customer

Making Value: Keys to Success

Integrated System

Maximize value over the entire global value network

Design Innovation

Focus on the total customer experience

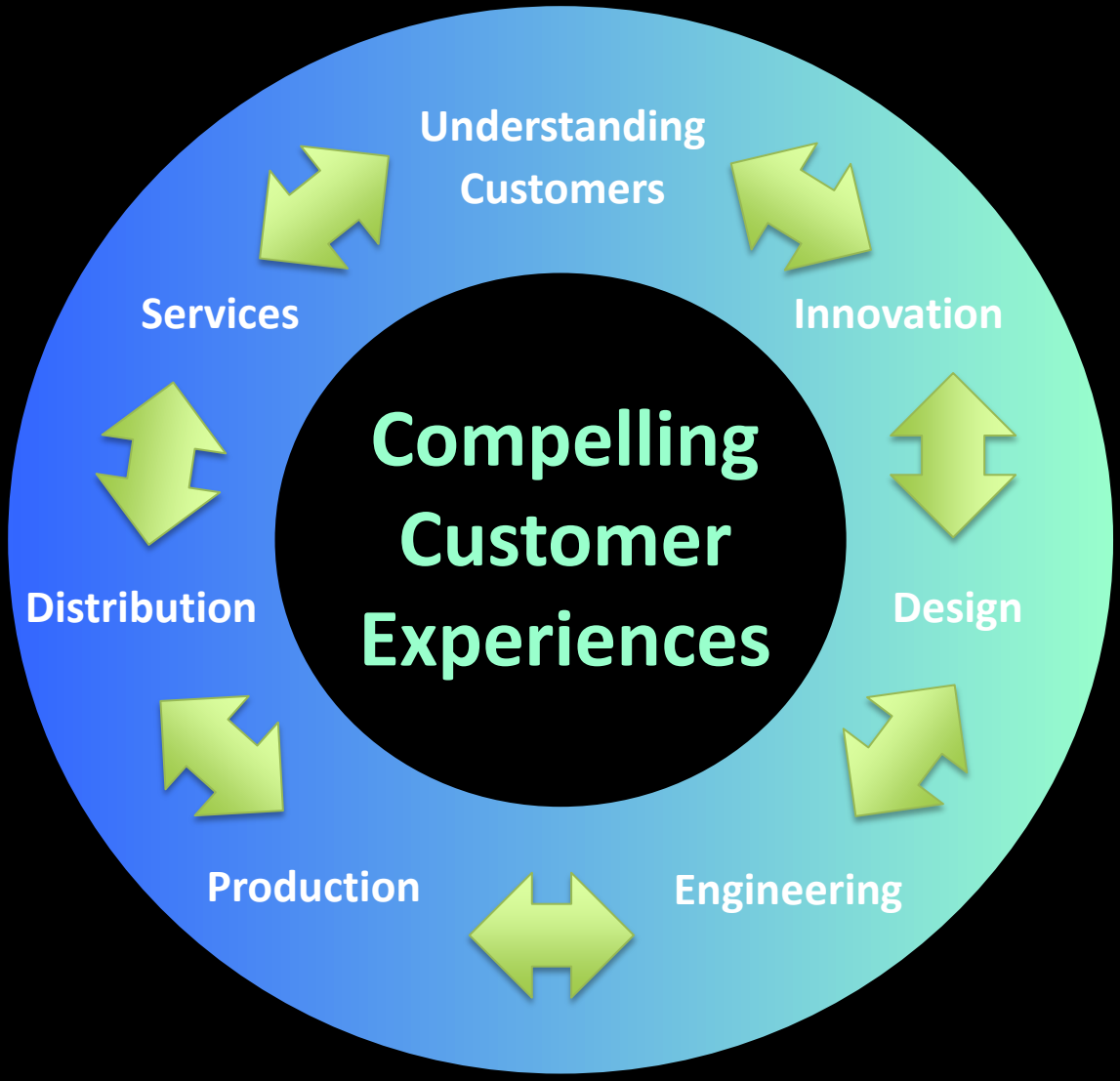
Technology Innovation

Create compelling customer experiences

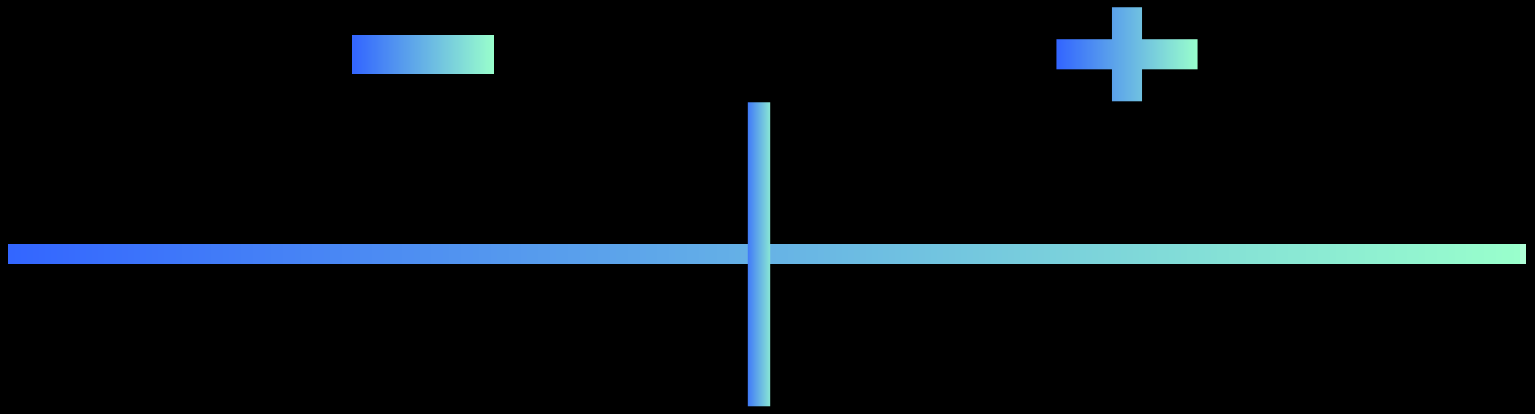
Operational Excellence

Ensure consistently positive customer experiences

Making Value: Integrated System



Design Innovation Focused on the Total Customer Experience



The Ultimate Sustainable Advantage

- Compelling ***and*** Low Cost Products and Services
- Premium Prices
- Superior Returns

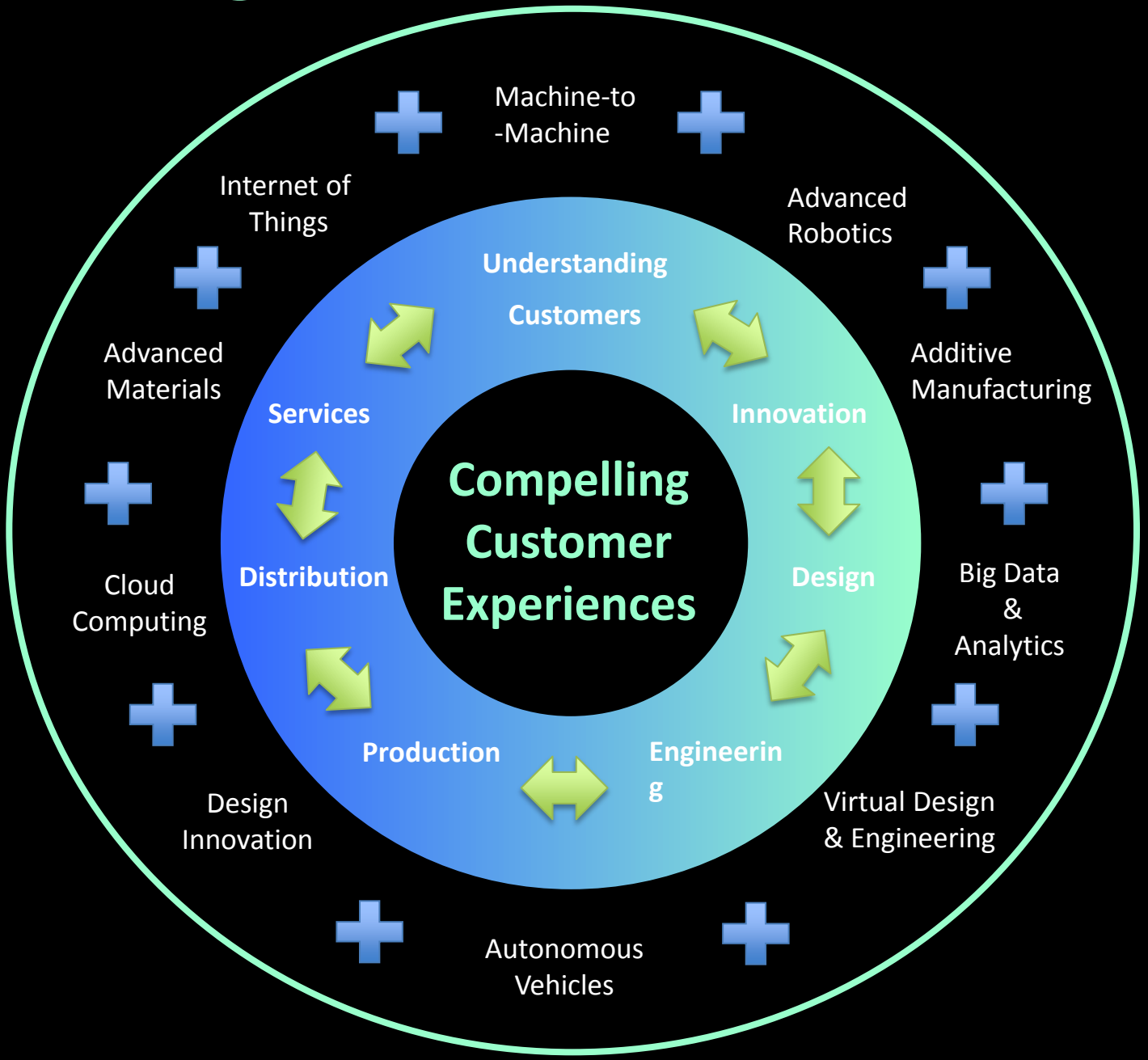
Technology Innovation

+ Information
+ Communications
+ Robotics
+ Processes
+ Materials
+ Work Systems
+ Analytics
+ Energy

Operational Excellence

- Fundamental to making value
  - "Brands are all about trust that is built in drops and lost in buckets"
    - Kevin Plank, Under Armour CEO
- Numerous proven best practices
  - Design for Manufacturability
  - Lean Manufacturing
  - Global Sourcing
  - Supply Chain Management
  - Quality/Reliability/Durability Processes
  - Customer Relationship Management
  - ….
- New opportunities
  - "Big data" and advanced analytics
  - Advanced robotics
  - Virtual design and engineering
  - Low-Cost Sensors and Actuators
  - Remote Diagnostics & Prognostics
  - ….

Making Value: Transformation



Examples

Jeans

Running Shoes

Mobility

Automotive “DNA”

Historical “DNA”

- Mechanical Drive
- Combustion Engines
- Oil-based Fuels
- Mechanical & Hydraulic
- Stand-alone
- Personally Owned
- Human Operated
- General Purpose

New “DNA”

- Electrical Drive
- Electric Motors
- Diverse Energy Sources
- Electronic & Digital
- Connected and Coordinated
- Shared
- Driverless
- Tailored

Transformational Opportunity

Connected

+

Coordinated

+

Shared

+

Driverless

+

Tailored

Better <u>Mobility Experiences</u>
at Radically Lower Societal and Consumer Cost

Better Mobility Experiences

- Safer
- More Convenient
- More Productive
- More Personalized
- More Affordable

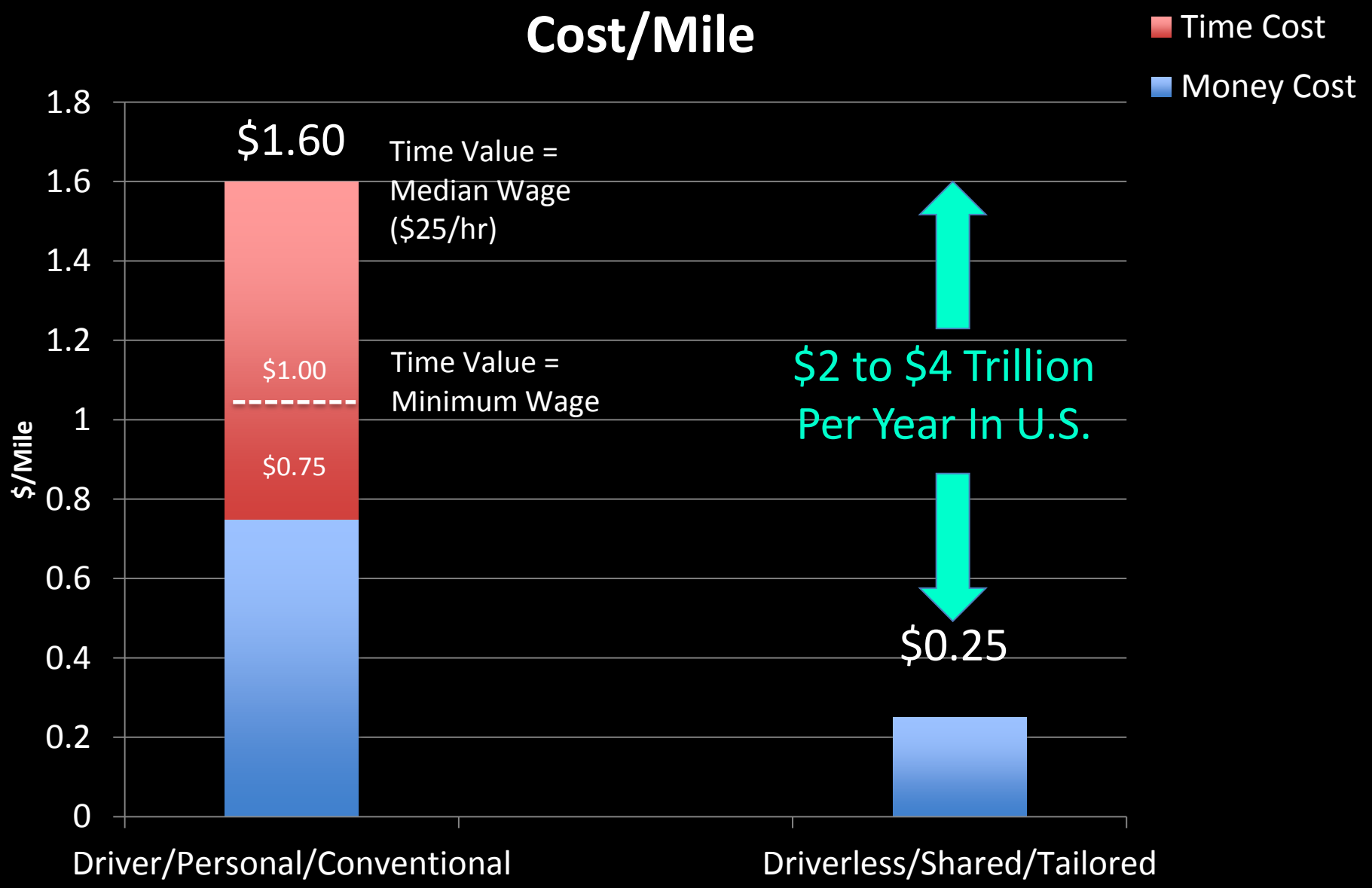
Improving All Attributes Simultaneously!

Lower Societal Cost

- Fewer Fatalities
- Fewer Injuries
- Less Energy Use
- Less CO_2 Emissions
- Less Congestion
- Better Land Use
- More Equitable Access

Reducing All Side Effects Simultaneously!

Lower Consumer Cost



Government-University-Industry Research Opportunities

- Codify the Fundamentals of Making Value in the 21st Century
- Define 21st Century Work Systems and Jobs
- Define 21st Century Education
  - In All Fields (Especially Business, Design and Engineering)
  - At All Levels
- Define 21st Century Economics
- Define 21st Century Policies for Making Value
  - Education
  - Immigration
  - Investment
  - Equality of Opportunity
- Define 21st Century Infrastructure Required for Making Value

Government-University-Industry Research Opportunities

- Deeply understand the future of work and the knowledge and know-how required to prosper in this future
  - Define standards for “employment fitness” for people of all ages
  - Comprehend how technology will continue to shape the future
  - Define and quantify the future of “middle class” jobs
  - Assess what factories might look like in 20 years and the types of jobs/skills required for these factories
- Understand how sustainability, economic growth, productivity, technology and jobs interrelate
- Understand why small business start-ups are declining

THE FUTURE OF

INNOVATION, TECHNOLOGY AND WORK

COULD BE THE DEFINING

OPPORTUNITY & CHALLENGE OF OUR TIME

Back-ups

Technology Innovation

- Information
  - Internet of “Things”
  - Cloud Computing
  - More “Moore’s Law”
- Communications
  - Mobility Internet
  - Machine-to-Machine (M2M)
- Robotics
  - Autonomous Vehicles
  - Enhanced Sensors, Dexterity and Intelligence
  - Automate Tasks and Augment Humans

Technology Innovation

- Processes
  - Additive Manufacturing (3D-Printing)
  - Advanced Machining, Forming and Joining
  - Sustainable Manufacturing
  - Low-Cost Sensors and Actuators
  - Remote Diagnostics & Prognostics
- Materials
  - Nano-technology
  - Designed for Superior Strength, Mass, Conductivity, Functionality and Sustainability

Technology Innovation

- Work Systems
  - Advanced Systems Design and Engineering
  - Intelligent Software for Knowledge Work
  - Virtual/Math-Based Design, Engineering and Manufacturing
  - Design Innovation Focused on Customer Experiences
- Analytics
  - “Big Data”
  - Speed to Insight
- Energy
  - Enhanced Oil and Gas Exploration and Recovery
  - Renewables
  - Storage

New Technology "Improves" Existing Technology

- Aluminum has driven improvements in steel auto bodies
- Electric vehicles are driving improvements in internal combustion engines
- Plentiful natural gas will drive improvements in coal and renewables