Shaping the Future of Production

Forum Members and Technology Pioneers CEO Workshop

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MIT, Boston

WORLD
ECONOMIC
FORUM

How will the technology transformation of production systems drive innovation, sustainability and employment?

We are at the threshold of a new industrial revolution, characterized by a confluence of emerging technology breakthroughs from **mobile connectivity, artificial intelligence, Internet of Things, next-generation robotics, 3D printing, wearables, genetic engineering to nanotechnology, advanced materials, biotechnology and others.**

These technologies, combined and connected, will transform manufacturing and production systems with unprecedented speed and scope, impacting business models, economic growth, employment and sustainability. Supply chains, businesses and policy-makers need new approaches and capabilities. They must work together to build truly innovative and sustainable production systems that benefit all people.
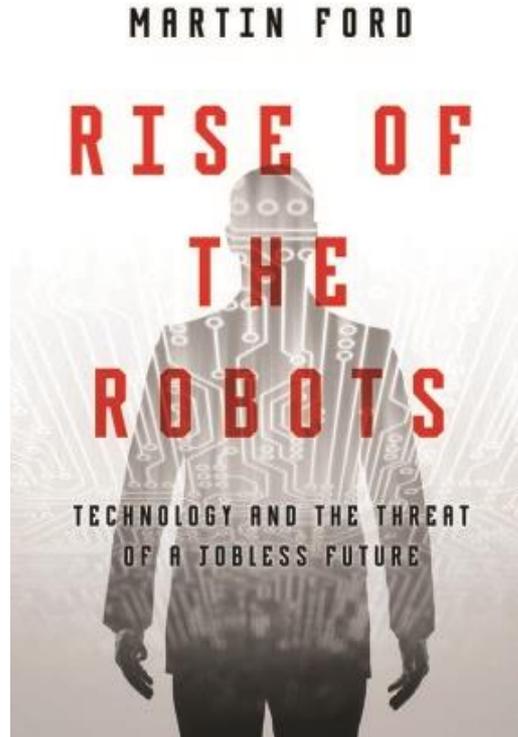
The impact of Technology Transformation on the Society is uncertain

"Computers Don't Kill Jobs but Do Increase Inequality"
Harvard Business Review, March 2016

"Technology has created more jobs than it has destroyed, says 140 years of data"
The Guardian, August 2015

MARTIN FORD

RISE OF THE ROBOTS

TECHNOLOGY AND THE THREAT OF A JOBLESS FUTURE

"Designing automation and control systems to conserve energy and reduce resource use results in "greener" manufacturing."
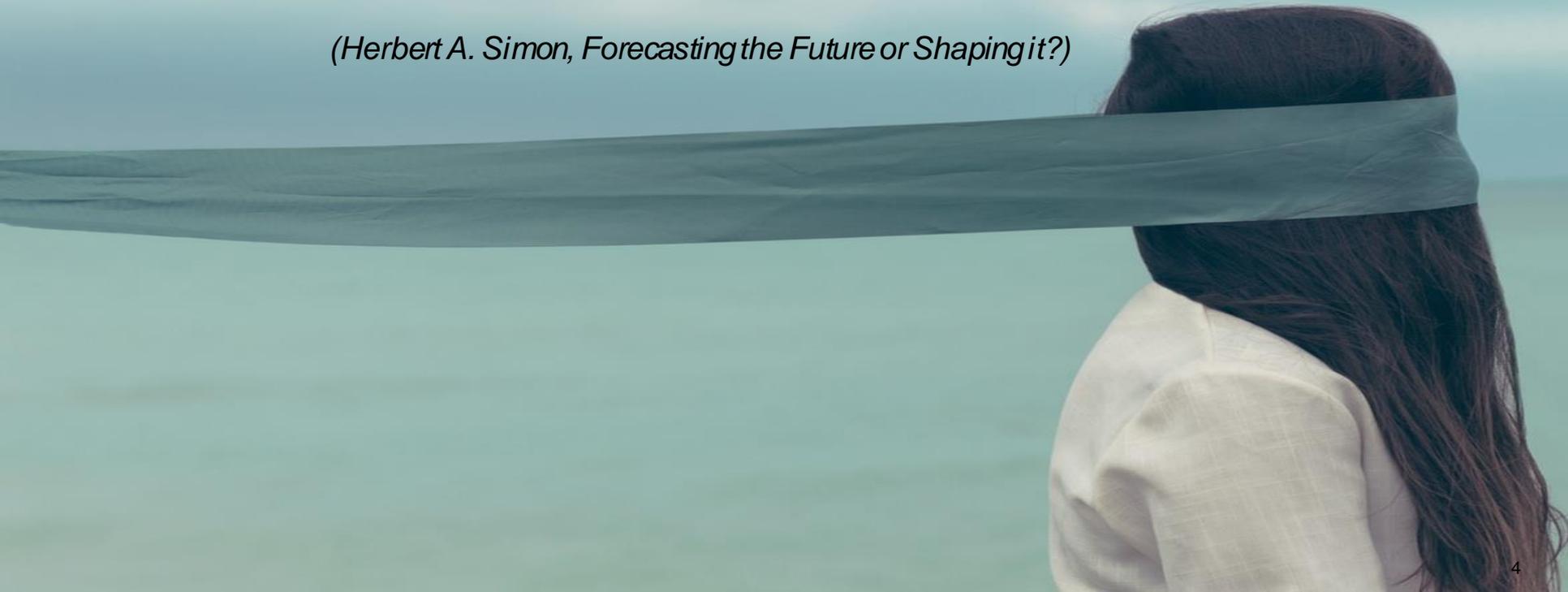Automationworld, March 2015

"A major Internet of Things hack has shown the importance of cybersecurity"
Businessinsider, October 2016

Our task is not to predict the future; our task is to design a future for a sustainable and acceptable world, and then to devote our efforts to bringing that future about.

(Herbert A. Simon, Forecasting the Future or Shaping it?)

Technology Foresight Series aims to map and understand the combined impact of disruptive technologies on production

Disruptive technologies

Connectivity & Computing Power	Internet of things
Analytics & Intelligence	Advanced analytics & AI
Human-Machine interface	Augmented / Virtual reality / Wearables
Digital – Physical transformation	Advanced robotics
	3D printing

What is the combined impact of these technologies?

Converging Impact & Recommendations

2030 Assumptions

	Readiness	Adoption

Product & Service Innovation *(Offering of the future)*

Individual *(Operator of the Future)*

Factory *(Factory of the Future)*

Firm *(Producer of the Future)*

Industry *(Value chain economics)*

Government *(Modern industrial development)*

Global *(Global value chains)*

We invite you to discuss converging impact of technologies that run along different broad themes

Key questions across technologies:
- What are the tipping points till mainstream adoption ?
- What trends have you observed on how individual technologies converge ?
- What are additional implications from converging technologies on production systems?

Main themes to be explored from converging technologies:

New production paradigm	Convergence	Value-creation	No-regret actions

- Design for performance
- Mass personalization
- Complexity decoupled from costs
- Regionalization
- Quality jobs

- Different stages of readiness and adoption
- Uncertainty about future direction
- Tipping points

- Super-convergence
- Competing and offsetting effects
- Value creation on factory floor, firm, industry, society, individual

- Investments
- Education and skills
- SME support

Technologies are dictating a new paradigm for global production systems, changing mechanisms for creating and distributing value

1. **Design for performance will replace design for manufacturing.** Flexible production methods will free designers to pursue unlimited possibilities for creating better-performing products.

2. **Mass personalization will replace mass production.** Production will shift from a mindset of mass production to one of mass customization and batches of one.

3. **Complexity will be decoupled from costs.** This will change the profitability equation and influence capital-investment decisions.

4. **Increased regionalization will supplant global supply chains.** Production clusters will form around demand centers.

5. **Better quality jobs will offer improved working conditions.** There will be a shift in the nature and conditions of work to cleaner, safer, and more connected workspaces

Technologies are at different stages of development and adoption, super converging or offsetting each other

1 **Technologies are at different stages of development and adoption, with varied levels of uncertainty about their future direction.**

2 **Technologies reinforce one another, super-converging to accelerate impact, but at times they also offset one another to solve similar problems.**

3 **Over shorter time horizons, new production technologies will work alongside more traditional ones, complementing and improving them.**

4 **Over longer time horizons, the wide-spread inclusive adoption of these technologies across geographies, industries and from large to small and medium-size firms, will largely depend on the interplay of several factors:**
- The speed and cost to overcome technical limitations.
- Availability of underlying infrastructure.
- Industry dynamics.

Converging technologies will create value across all elements but how that value will be redistributed is yet unclear

Value to the individual
How does it change my life?

- Self transcendence
- Fun
- Self actualization
- Provides hope
- Convenience
- Meets basic needs
- Motivate

Value to society
What value does it bring to society?

- Sustainability
- Economic growth
- Inclusiveness
- Wellness
- Job creation

Value to Industry
How does it change industry dynamics and supply networks?

- Improves access
- Integrates
- Enlarges the pie
- Connects
- Organizes

Value to the Firm
What does it do to production operations?

- Better offering
- Reduces risk
- Additional business
- Improves margins
- Innovation
- New business models

Value on the Factory Floor
What does it do to production operations?

- Safety
- Saves time
- Avoids hassles
- Health
- Simplifies
- Reduces cost
- Environment
- Reduces effort
- Quality

What are the "no-regret" actions for businesses and governments?

1 **The question is not if but where and when companies need to consider adopting these technologies in their operations toolkit.**

2 **While there is a wide array of uncertainties around the impact that technologies will have on individual nations, there are "no-regret" policies that governments should supported:**

- Education and curricula design to develop the technical skill base (e.g. design engineers, analytics and data scientists, etc.)

- Partnerships to upskill and reskill the workforce (e.g. industry apprenticeship programs, training schemes etc).

- Continue to explore new technologies and drive incentives for investment in innovation and sustainability through the development of partnerships that allows and encourages experimentation