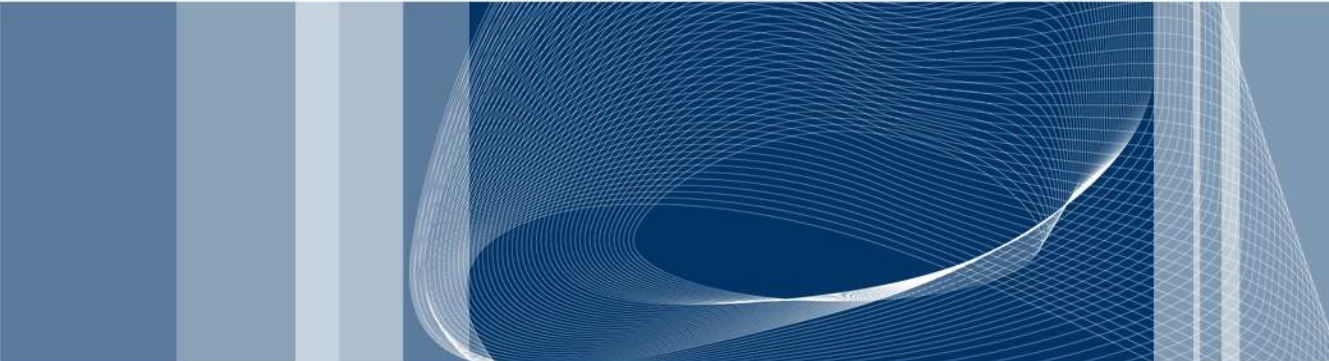




 POLITECNICO DI MILANO



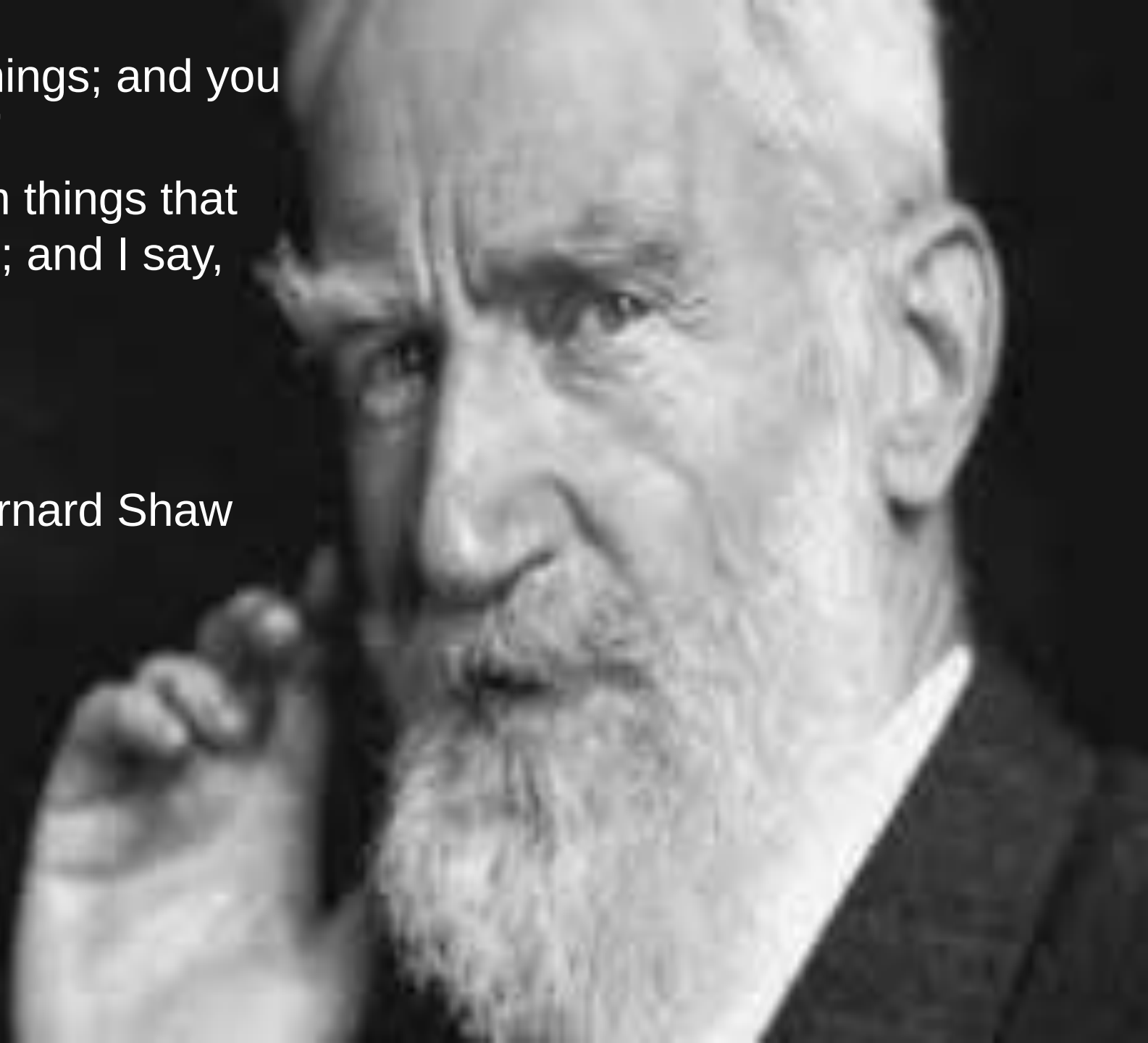
I trend innovativi per il Manufacturing del futuro The New Industrial Revolution

Prof. Marco Taisch
Politecnico di Milano
Manufacturing Group

"You see things; and you
say, 'Why?'"

But I dream things that
never were; and I say,
"Why not?"

George Bernard Shaw



Product volumes



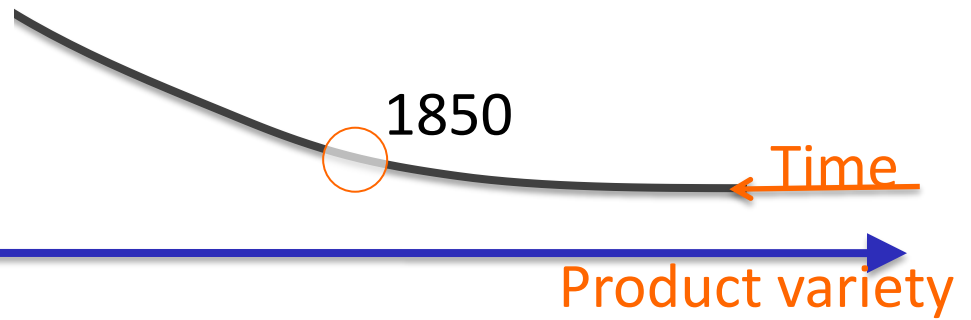
Evoluzione della produzione

Product variety

Product volumes



ARTIGIANATO



Product volumes

1950

1908

1850

Time

Product variety



MASS PRODUCTION



Product volumes

1950



1980



globalization

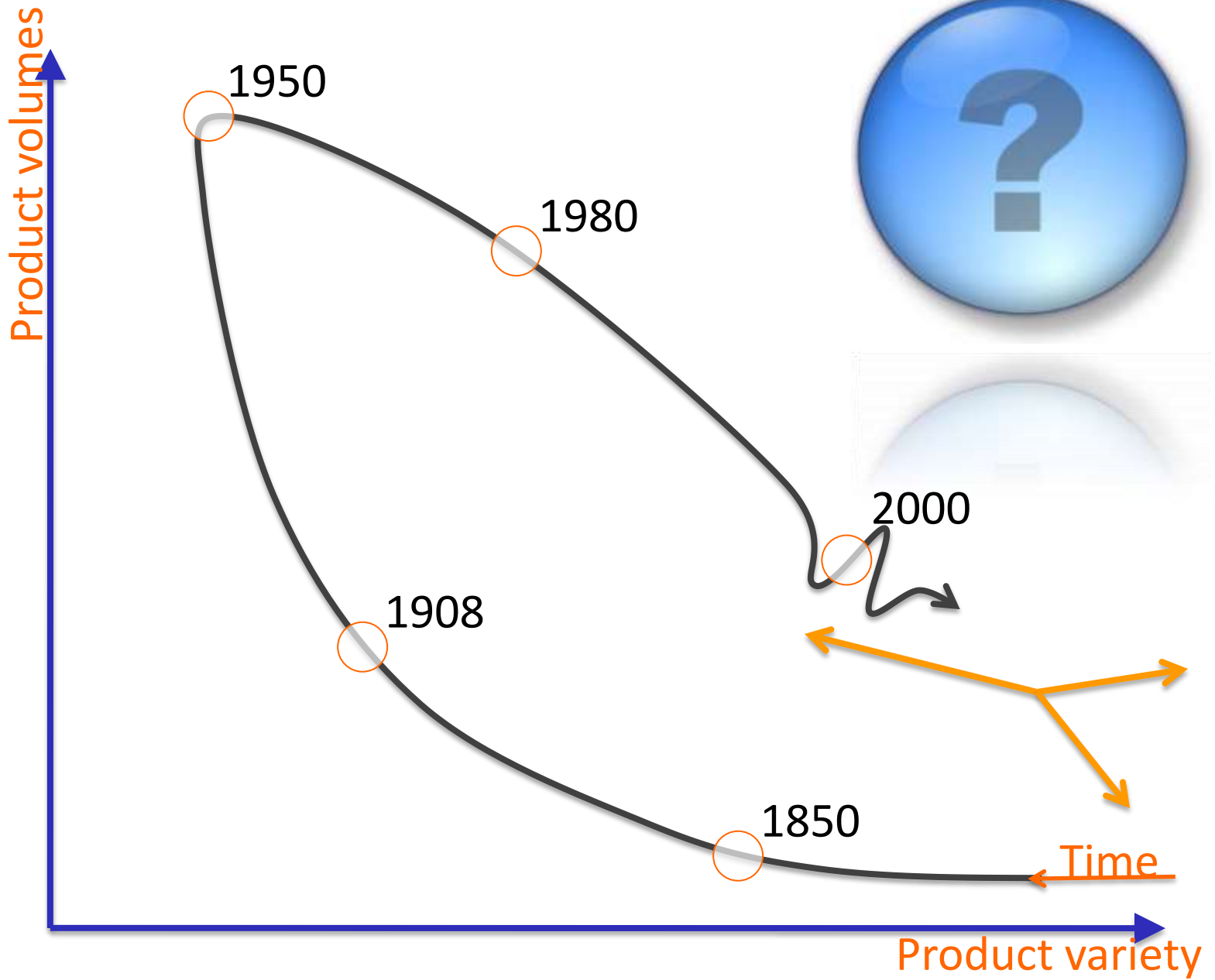
2000

1908

1850

Time

Product variety





VALORE AGGIUNTO DEL MANUFACTURING PER PAESE

Large developing economies are moving up in global manufacturing

Top 15 manufacturers by share of global nominal manufacturing gross value added

Rank	1980	1990	2000	2010
1	United States	United States	United States	United States
2	Germany	Japan	Japan	China
3	Japan	Germany	Germany	Japan
4	United Kingdom	Italy	China	Germany
5	France	United Kingdom	United Kingdom	Italy
6	Italy	France	Italy	Brazil
7	China	China	France	South Korea
8	Brazil	Brazil	South Korea	France
9	Spain	Spain	Canada	United Kingdom
10	Canada	Canada	Mexico	India
11	Mexico	South Korea ¹	Spain	Russia ²
12	Australia	Mexico	Brazil	Mexico
13	Netherlands	Turkey	Taiwan	Indonesia ²
14	Argentina	India	India	Spain
15	India	Taiwan	Turkey	Canada

1 South Korea ranked 25 in 1980.

2 In 2000, Indonesia ranked 20 and Russia ranked 21.

NOTE: Based on IHS Global Insight database sample of 75 economies, of which 28 are developed and 47 are developing.

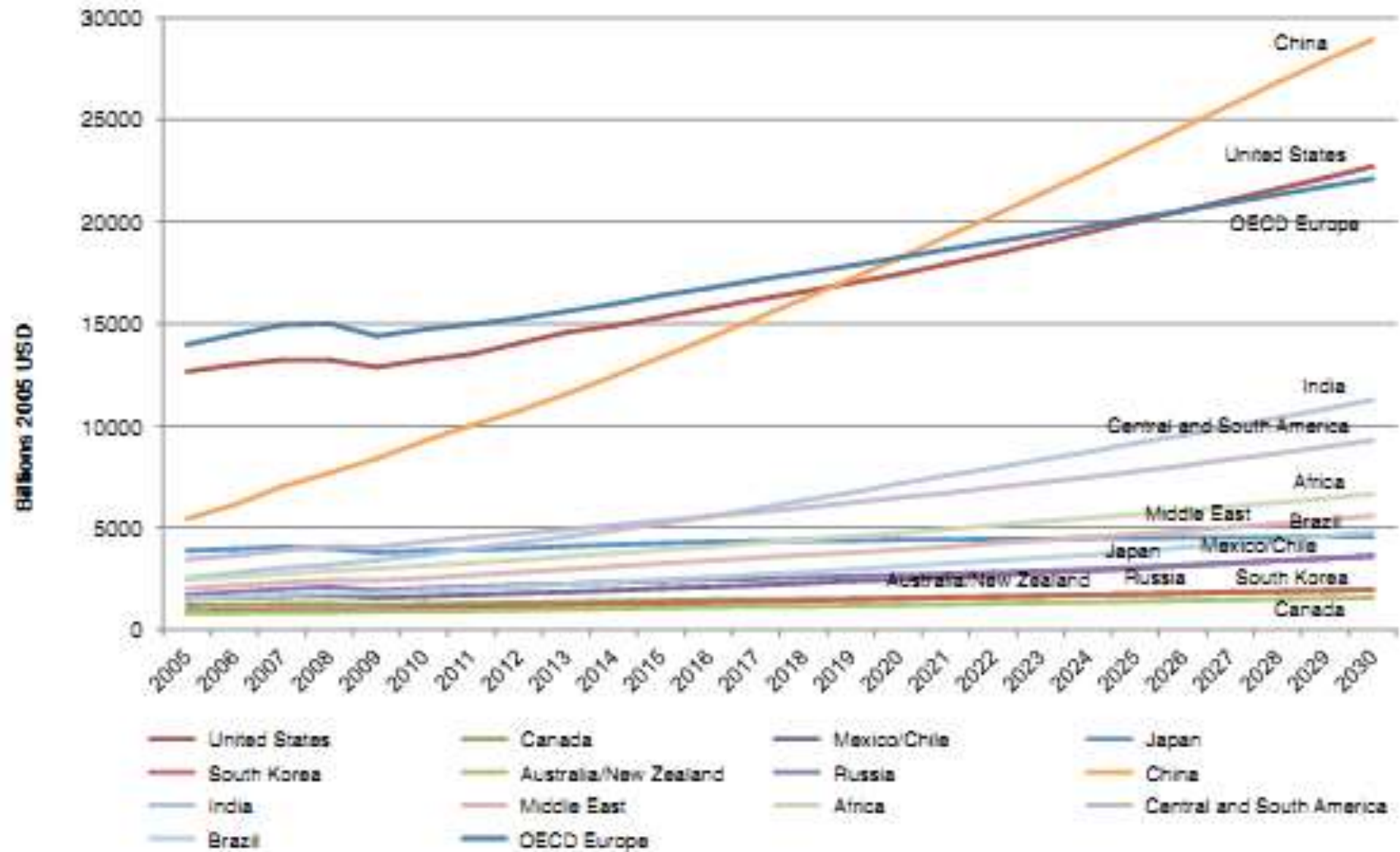
Manufacturing here is calculated top down from the IHS Global Insight aggregate; there might be discrepancy with bottom-up calculations elsewhere.

SOURCE: IHS Global Insight; McKinsey Global Institute analysis



PIL per nazione

Figure 9: GDP by Region, 1990-2030, Expressed in Purchasing Power Parity, Reference Case



Source: United States Energy Information Administration, (2011) Annual Energy Outlook 2011. Available at: www.eia.gov/forecasts/aeo/tables/2011/

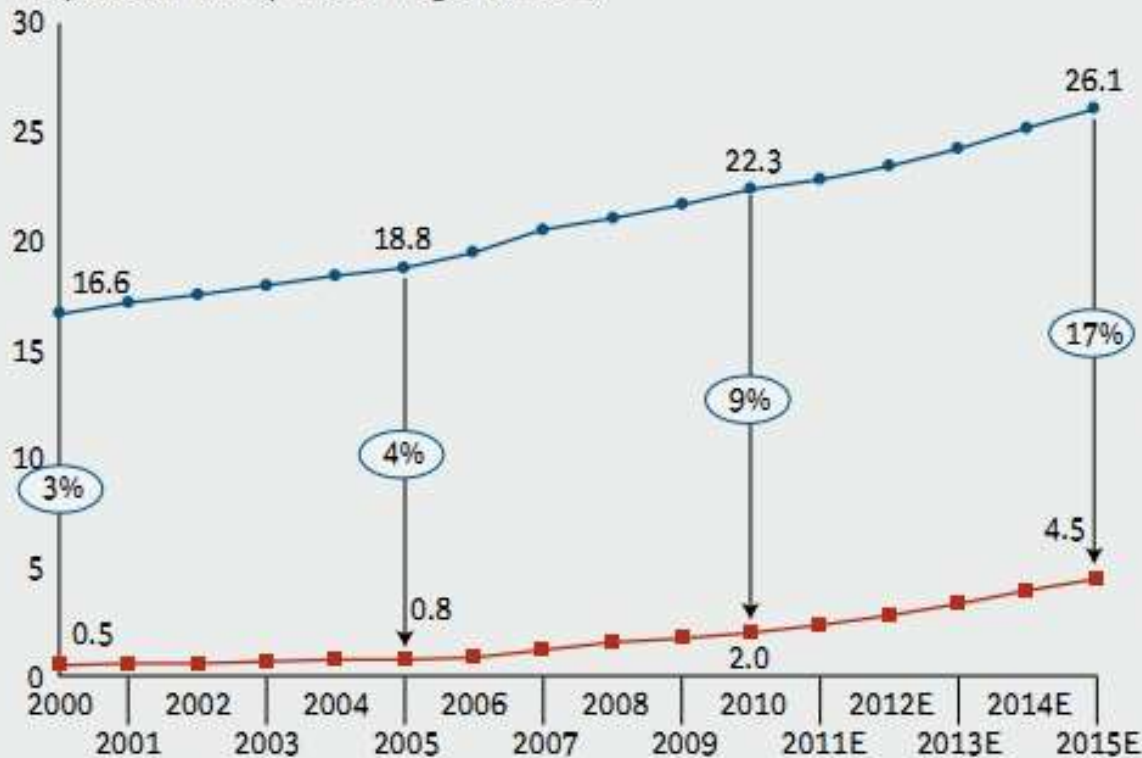
Forlino, 10 Giugno 2014, Prof. Marco Taisch - copyright

POTENZIALITÀ DI MERCATO

EXHIBIT 1 | China's Wage Rates Are Growing Rapidly

Average wages could approach 17 percent of those in the U.S. by 2015, up from 3 percent in 2000

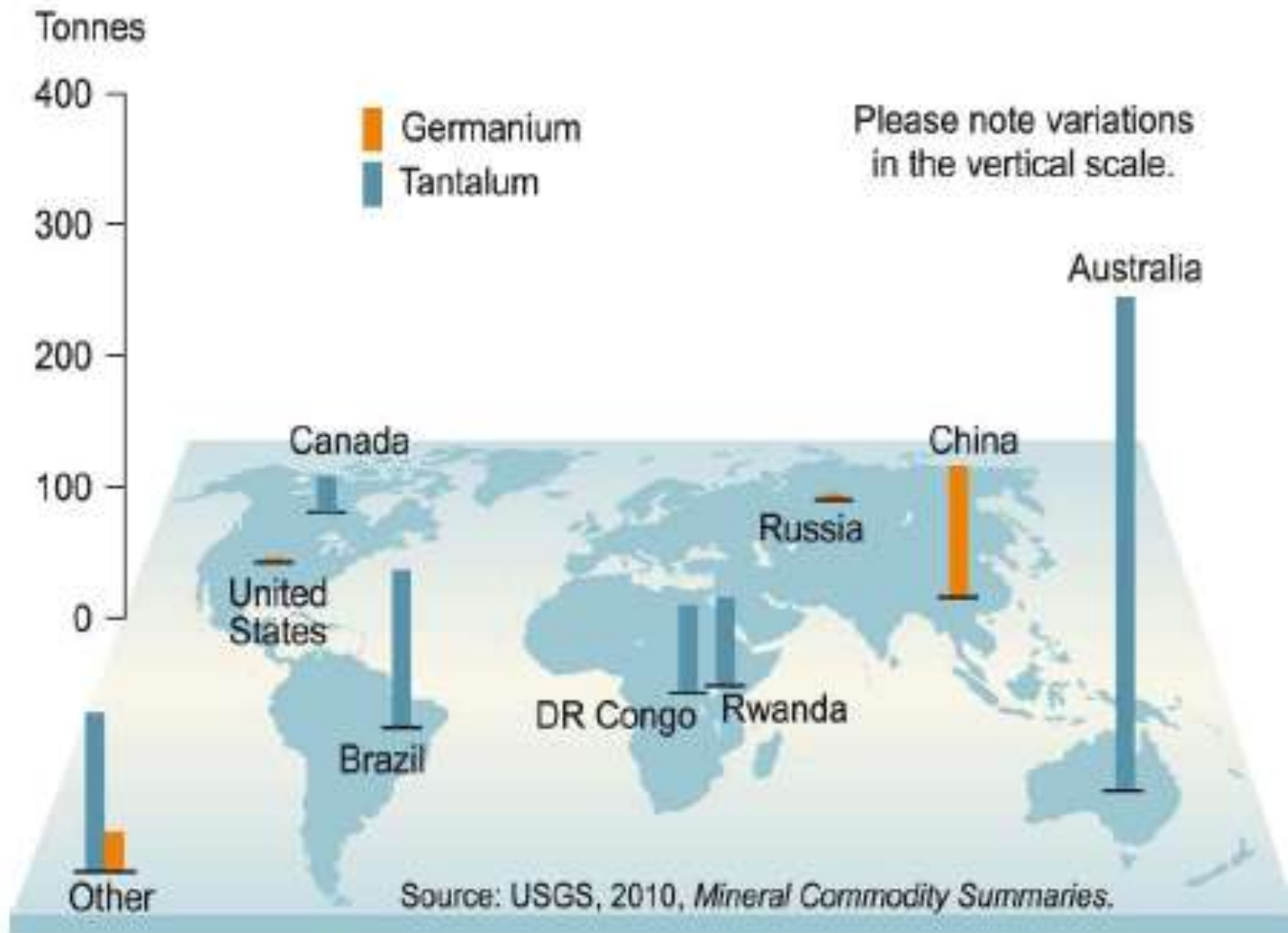
Fully loaded factory-worker wages (\$/hour)



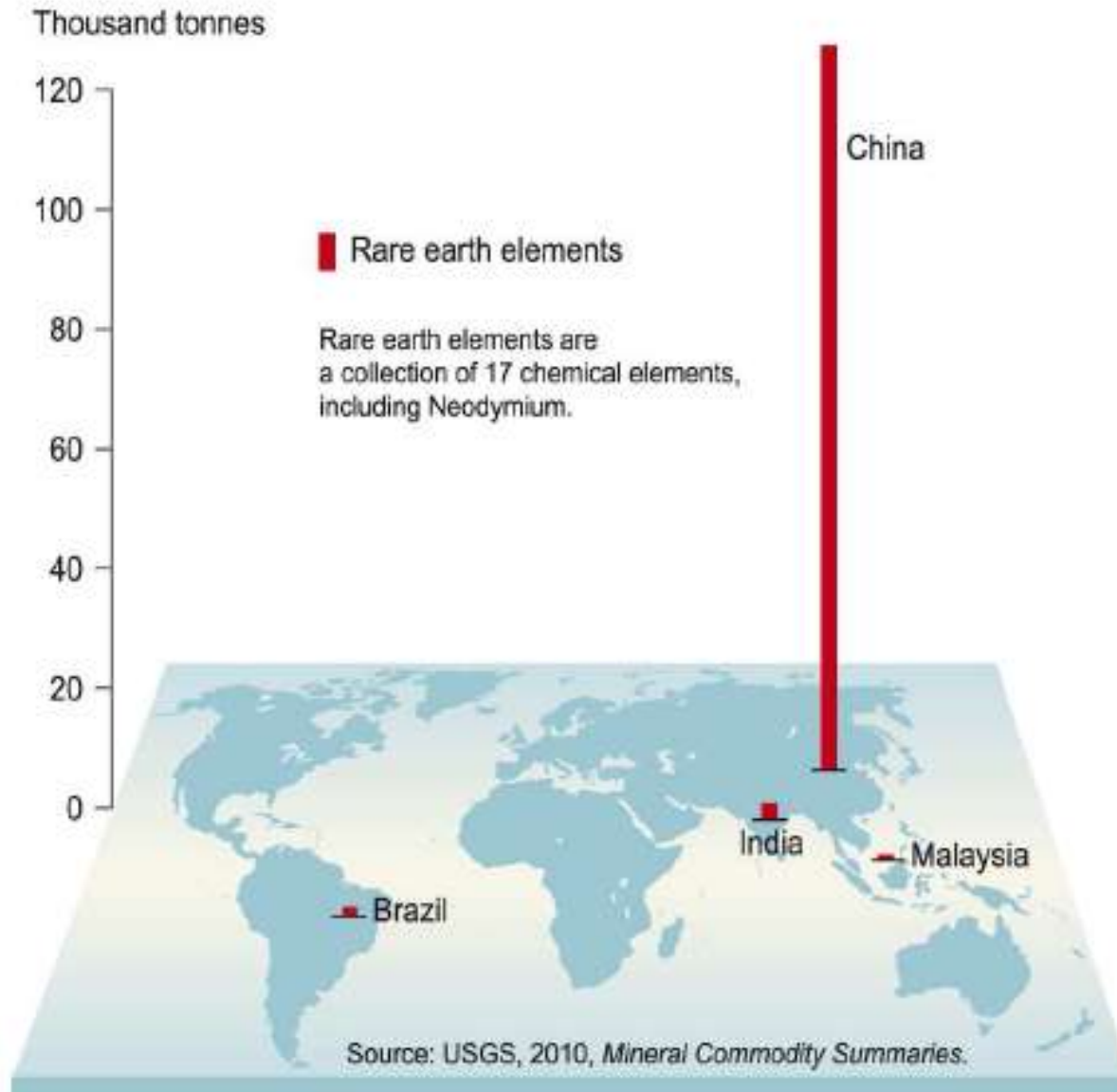
	CAGR		
	2000–2005 (%)	2005–2010 (%)	2010–2015 (%)
U.S.	2	4	3
China	10	19	17

Sources: Economist Intelligence Unit; U.S. Bureau of Labor Statistics; selected company data; BCG analysis.

Terre rare



Terre rare





Cosa vogliono dire questi simboli?

危机

Pericolo Opportunità

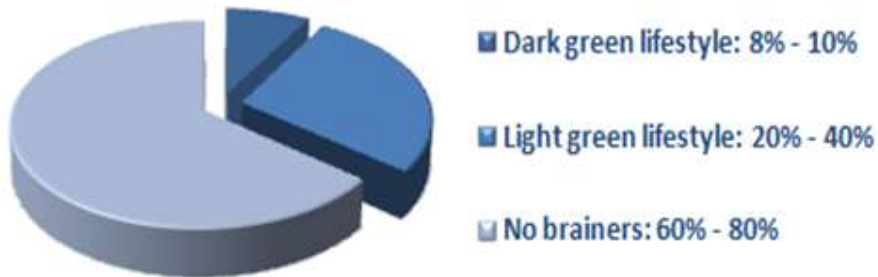
CRISI IN LINGUA CINESE



Quale futuro?



Il consumatore Verde: mito o realtà?

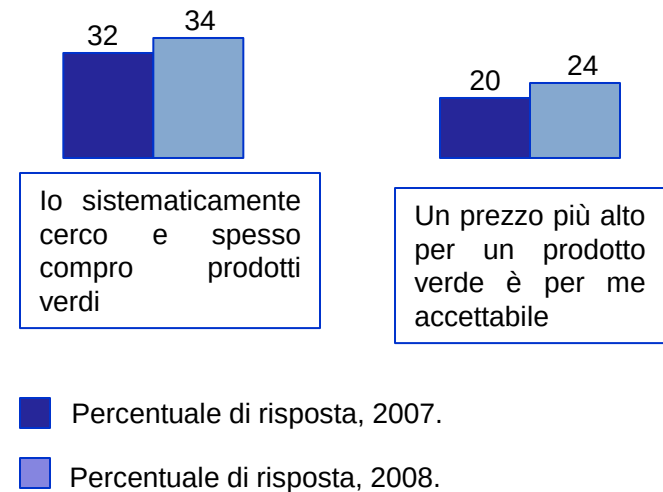


L'interesse verso il Green sta crescendo, nonostante la crisi.

I driver verso il green non sono cambiati

- 1 Prezzi dell'energia alti e volatili
- 2 Pressione dei governi verso le tematiche green
- 3 Interesse verso la sicurezza alimentare e di prodotto
- 4 Pulsione a ridurre i costi a causa dell'elevata concorrenza
- 5 L'ambiente non si pulisce da solo e l'impatto antropico è sempre più evidente

...la domanda di prodotti verdi continua a crescere.



Source : BCG/Lightspeed Research Survey of more than 2,000 European adults.

From Mass to Personalised Production

Complete Ford F-150 program		
Trim Line	6	6
Cab	3	18
Drive	2	36
Box	4	144
Engines	3	432
Transmission	3	1,296
Rear Axle Ratio	7	9,072
Wheel	9	81,648
Tires	8	653,184
Seats	18	11,757,312
Power Seats	2	23,514,624
Radios	5	117,573,120
Running Boards	4	470,292,480
Rear Window	3	1,410,877,440
Colors	12	16,930,529,280
Trim Colors	3	50,791,587,840
16 Individual Options	12,870	653,687,735,500,800



- **Thousands** of marketable combinations
- **Millions** of buildable combinations
- **Trillions** of theoretically possible combinations





Quale è più *Sostenibile*?



Toyota Prius

104 gCO₂/Km

4,7L/100Km



Seat Leon

100 gCO₂/Km

6,2L/100Km



VW Polo

108 gCO₂/Km

4,0 L/100Km

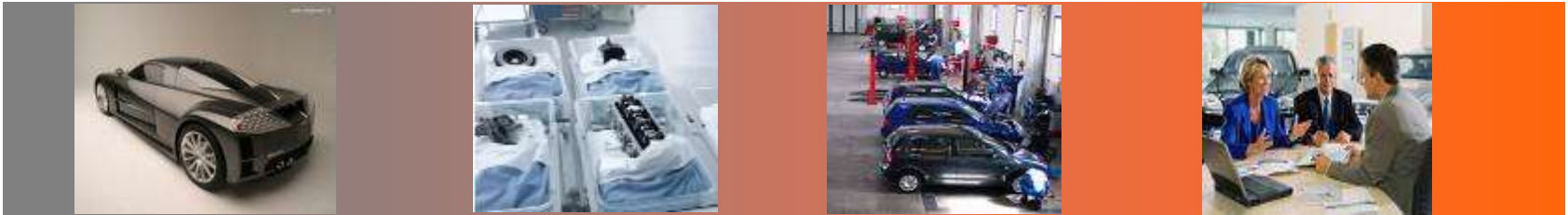
All 1400 cm³ engines

Qual'è la più sostenibile?

E il processo
produttivo?

E oltre
all'impatto
ambientale?

Dal prodotto al servizio



Servizio per il
prodotto

Servizio
per i clienti



Riduzione del time-to-market

La competizione verte sempre più attorno al tempo necessario per presentare al mercato un nuovo prodotto (dunque includendo progettazione, produzione e distribuzione). Infatti riducendo il time-to-market si:

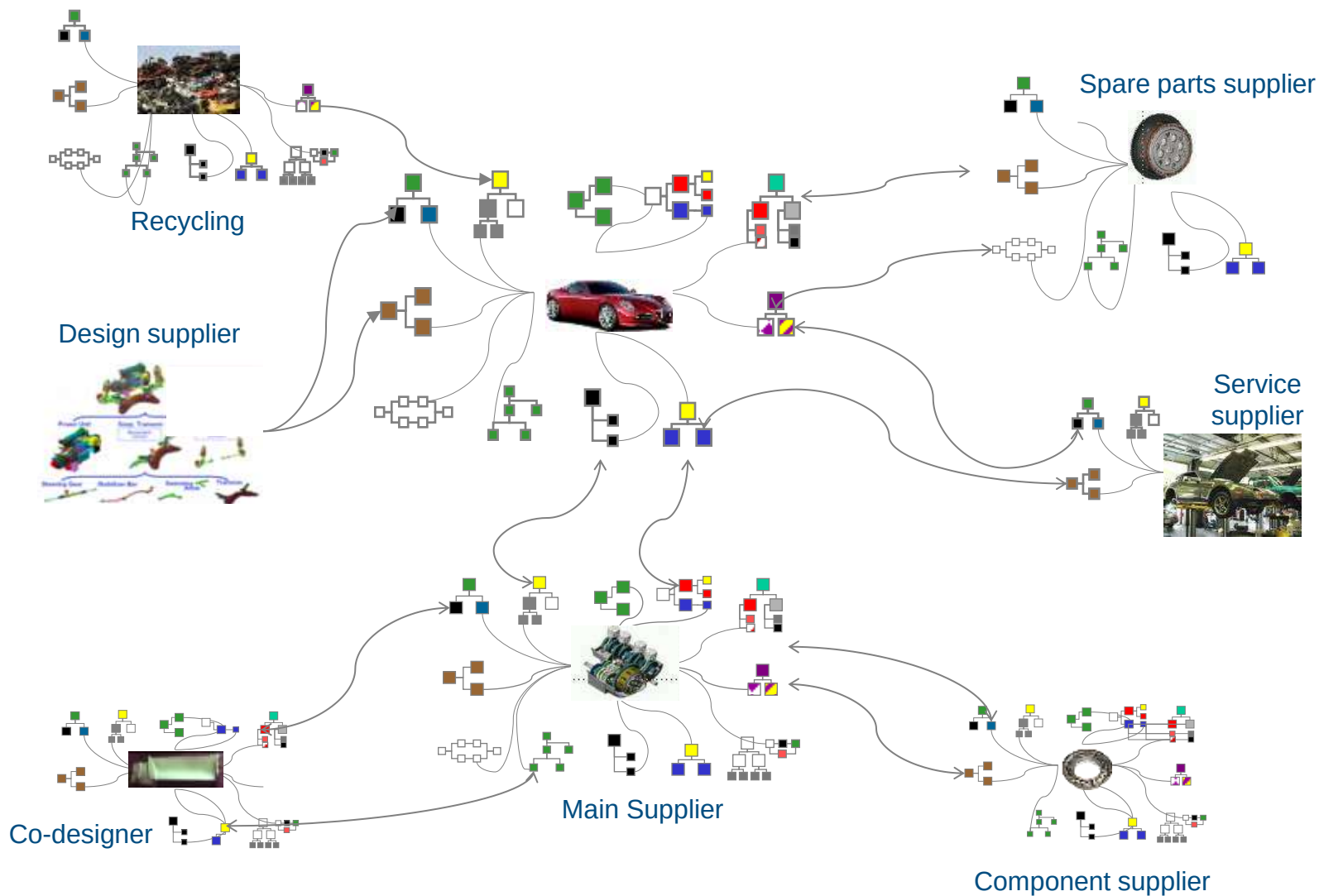
- Aumenta l'affidabilità delle previsioni di vendita iniziali (riducendo il time-frame)
- Riduce il rischio della messa in produzione di un nuovo prodotto

*As a result, Fiat was able to cut the time from “design freeze” to production on the Bravo and the 500 to just **18 months**, from **26 months** on the Stilo. Mr Marchionne says that cutting time to market is a critical source of competitive advantage for “the guys running the brand who are mostly not engineers, but are people with a very strong consumer product bias”.*

“Rebirth of a carmaker” - The Economist - April 24th 2008



Internet of Things





Come affrontare il futuro?

Table 3b: Global CEO Survey: Global drivers of manufacturing competitiveness index ranking

Executives rank key drivers that impact a country's ability to compete in manufacturing

Overall rank (1-10)	Overall index score	Main driver	Most important sub-components	Sub-component rank (1-40)
1	10.00	Talent-driven innovation	Quality and availability of researchers, scientists, and engineers Quality and availability of skilled labor	1 2
2	8.42	Economic, trade, financial and tax system	Tax rate burden and system complexity Clarity and stability of regulatory, tax and economic policies	3 5
3	8.07	Cost and availability of labor and materials	Cost competitiveness of materials Availability of raw materials	11 21
4	7.76	Supplier network	Cost competitiveness of local suppliers Ability of supply base to innovate in products and processes	8 9
5	7.60	Legal and regulatory system	Stability and clarity in legal and regulatory policies Labor laws and regulations	7 13
6	6.47	Physical infrastructure	Quality and efficiency of electricity grid, IT and telecommunications network Quality and efficiency of roads, airports, ports, and railroad networks	4 16
7	6.25	Energy cost & policies	Cost competitiveness of energy Ongoing investments to improve and modernize energy infrastructure	14 20
8	3.99	Local market attractiveness	Size and access of the local market Intensity of local competition	27 36
9	2.48	Healthcare system	Cost of quality healthcare for employee and society Regulatory policies (e.g., pollution, food safety, etc.) that are enforced to protect public health	26 33
10	1.00	Government investments in manufacturing and innovation	Government investments in R&D: science, technology, engineering and manufacturing Private and public sector collaboration for long-term investments in R&D: science, technology, engineering and manufacturing	29 30

Source: Deloitte Touche Tohmatsu Limited and U.S. Council on Competitiveness, 2013 Global Manufacturing Competitiveness Index

Note: See Appendix B1 for full list of 40 sub-components and associated ranking

Table 4: China's transformation reveals itself through key competitiveness drivers

Country level ratings for key drivers of competitiveness

Selected Country/Manufacturing Competitiveness Drivers

	Germany	U.S.	Japan	China	Brazil	India
Talent-driven innovation	9.47	8.94	8.14	5.89	4.28	5.82
Economic trade, financial and tax system	7.12	6.83	6.19	5.87	4.84	4.01
Cost of labor and materials	3.29	3.97	2.59	10.00	6.70	9.41
Supplier network	8.96	8.64	8.03	8.25	4.95	4.82
Legal and regulatory system	9.06	8.46	7.93	3.09	3.80	2.75
Physical infrastructure	9.82	9.15	9.07	6.47	4.23	1.78
Energy cost and policies	4.81	6.03	4.21	7.16	5.88	5.31
Local market attractiveness	7.26	7.60	5.72	8.16	6.28	5.90
Healthcare system	9.28	7.07	8.56	2.18	3.33	1.00
Government investments in manufacturing and innovation	7.57	6.34	6.80	8.42	4.93	5.09



Scores on a 10 point scale, where 1 being "Least competitive" and 10 being "Most competitive" — adjusted for country, size, and industry

Source: Deloitte Touche Tohmatsu Limited and U.S. Council on Competitiveness, 2013 Global Manufacturing Competitiveness Index

Advanced manufacturing processes that will be focused on by the 'Factories of the Future' partnership are:

- Additive manufacturing (i.e. 3D Printing)
- Photonics-based materials processing tech
- Shaping technology
- High productivity & 'self-assembly' technologies
- Methods for the handling parts, metrology & inspection
- Flexible sheet-to-sheet & roll-to-roll
- Innovative physical, chemical & physiochemical processes
- Replication equipment for flexible, scalable production
- Integration of non-convention tech



FACTORIES OF THE FUTURE Multi-annual roadmap for the contractual FFP under Horizon 2020

Prepared by  EFFRA



Collaboration

- OEM – subcontractor collaboration through cloud paradigm
- Trends of contract manufacturing and 'product as a service'
- Customer involvement in product design



Mobility

- Proliferation of mobile devices
- 'On-the-go' and 'Always-on' users
- New businesses (manufacturing apps & manufacturing app store)



Connectivity

- Sensors, controllers, embedded devices a commonplace
- 'Intranet of Things' to 'Internet of Things'
- Bidirectional interaction with real-world objects



Intelligence

- Data analytics and forecasting on-the-fly
- Leveraging cheaper storage and low cost processors
- Better visualization & intelligence on manufacturing data

Human-centric Manufacturing

Knowledge Workers

Factories of the future are expected to create a large amount of employment opportunities for citizens. Factory workers are key to competitiveness but challenges such as changing demographics & new skills must be addressed.

Companies should address the following items:

- New approaches to accommodate different demographics
- New technical, educational & organisational ways to increase attractiveness of factory work
- New approaches to development of skills & competences
- New ways to organise factories: Human-centred work environments
- Ways to integrate future factory work into social patterns



They are coming!





World Manufacturing Forum (WMF2014)

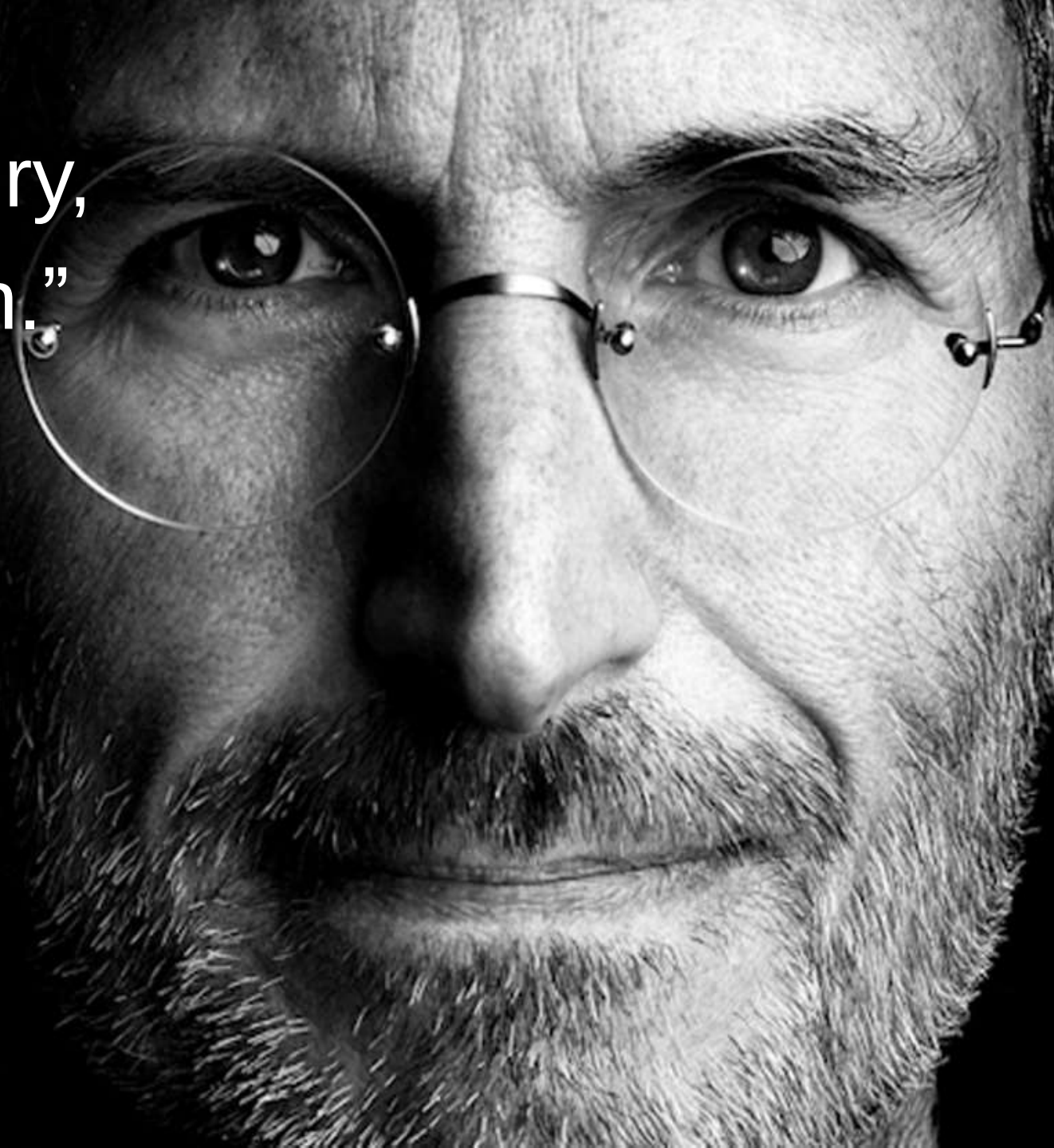
The Way Forward to Global Prosperity
Through Manufacturing Collaboration

Milano, 1-2 July 2014, 440 partecipanti

- *Direction of Manufacturing Policy*
- *Policies, Challenges, and Opportunities in Next-Generation of Manufacturing*
- *Workforce, Education and Human centered Manufacturing*
- *Venture Capital/Ecosystem for Manufacturing Start-ups*
- *Robotics for SMEs*
- *Global standards for products and manufacturing*
- *Cyber security Issues for Manufacturing*
- *Game Changing Technologies for Manufacturing*



"Stay hungry,
stay foolish."





Who I am

- Professor of Advanced and Sustainable Manufacturing @ Politecnico di Milano
- Leader of a 40-people group on Manufacturing Engineering and Management
- Member of the European Factory of the Future Research Association
- Technology Foresight expert
 - Coordination of 3 Technological Foresight Roadmaps on Manufacturing over the last 10 years
- 22 EU Funded projects for a total amount of 10,9M€ funding since Jan 2009
- Scientific Chairman of the World Manufacturing Forum
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 POLITECNICO DI MILANO



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