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FROM VALLETTA TO DELPHI, FROM EUROPE TO CHINA, AN INSIGHT IN FORESIGHT

Ο κόσμος είναι αεικίνητος



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- Delphi Understanding Change
- ► Some Megatrends
- Europe & China: cooperation perspectives
- Valetta: Trends Spotting for Research Managers

DELPHI



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DELPHI

"No man ever steps in the same river twice, for it's not the same river and he's not the same man."

Heraclitus of Ephesus (c. 535 – c. 475 BC)





LONDON: 1894, THE GREAT MANURE CRISIS







LONDON: 1894, THE GREAT MANURE CRISIS

Imagine London in 1894:

- World's largest city and commercial center.
- Ten of Thousands of horses in the streets transporting goods and people.
- Each horse produces 7-16 kgrs of manure per day.
- The Times of London dared to predict that by 1950 every street in London will be 2,5 meters deep in horse manure.
- Crisis: Scientists and Politicians were struggling to address the problem.
- An urban planning conference broke up prematurely when no solution was found.



MORTON STREET, CORNER OF BEDFORD, LOOKING TOWARD BLEECKER STREET, MARCH 17, 1893.

LONDON: 1894, THE GREAT MANURE CRISIS



But Prediction is very difficult!

Usually we focus on one single trend and extrapolate, jumping to the wrong conclusion.

Usually we dont question the Status Quo.

The internal combustion had been in existence for 30 years and asphalt had been already used to create smooth roads in USA.

IMAGINE A FUTURE

- Al and Robots have replaced the majority of current jobs.
- ► There is unlimited energy due to renewable sources and nuclear fusion.
- Death and age related diseases are cured



LOOKS UNREAL?

30 years ago:

- ► We didnt have internet, PCs and mobile phones.
- ► All Eastern Europe was not part of the EU, the WTO, and NATO.
- We didnt have AIDS, discussion about globalization, cloned mammals, GMOs or stem cells repairing body organs.
- ► Many believed that a WW3 to destroy the world was near.

SUCCESSFUL ORGANISATIONS



resources and competencies

Future Demands from contextual environment

VIABLE AND ROBUST STRATEGIES



surrounding world

THE CHALLENGE

F

To question "official future"



THE ENVIRONMENT

- Contextual environment outer world, the world we cannot control
- Business arena Near world, the world we can control indirectly
- Inner world the world we control (=own organisation)



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- Contextual environment outer world, the world we cannot control
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${\bf 3}_{\rm TYPES}$ of changes affecting future





TRENDS



MEGATRENDS

The Three Dimensions of a Megatrend



TREND1 RICHER & OLDER [DEMOGRAPHICS]

MEGATREND 1: RICHER & OLDER

8.3 billion people on earth by 2030 (from 6.9 billion today); 33.2 years the median age;

- ► 59% the global urbanization rate;
- China's infertility rate rose to around 12.5% of people of childbearing age, more than four times higher than it was 20 years ago.

Middle Class 2009->2030 (Source:OECD)

MEGATREND 1: RICHER & OLDER

2030 Projections

 Ageing will be global. The world population growth will slow and peak, possibly within 20 years, at around 8.3 billion people;

 A new global 'middle class' in the emerging countries will expand rapidly, mainly in cities, and particularly in Asia;

 Dynamic and technologically empowered, this new group will be especially vulnerable, subject to increasing inequalities and unprecedented ageing;

Inequalities within countries will widen worldwide;

 Migration may well further increase, in particular along South-South routes.

Uncertainties

 Ageing in the emerging economies may affect their economic growth and domestic stability;

 Growing inequalities in access to resources (education, health services) may trigger serious social discontent.

TREND2 GLOBALIZATION 2.0

MEGATREND 2: GLOBALIZATION 2.0

- The world exports as share of GDP will raise from 26% (2010) to 33% (2030).
- GDP growth will continue at a rate of 1.8% p.a. in Developed countries, 7.9% in BRICs, and 5.9% in the Next Eleven.
- The middle class in the BRIC countries will grow by 150% to 2.0 billion people, and by 116% to 730 million people in the N-11 countries.

MEGATREND 2: GLOBALIZATION 2.0

By 2025, consumption in emerging economies will reach \$30 trillion, the biggest development opportunity in the history of capitalism

2030 Projections

The middle class in the BRIC countries will grow 150%, from 0.8 billion people today to 2.0 billion in 2030, raising enormously the purchasing power of these countries.

The emerging equity markets will grow significantly by 9.3% p.a. to USD 80 trillion by 2030, while global equity market capitalization (in fixed 2010 USD) will increase by 6.2% p.a. from USD 43 trillion to USD 145 trillion in 2030.

By 2030, the combined real GDP of the N-11 will equal 30% of the BRIC's GDP and 11% of the world's GDP.

The ASEAN-5 GDP will equal 4.0% of global GDP in 2030 (almost as today).

Uncertainties

- The political and financial role of Europe, and USA
- The political stability of BRIC, and ASEAN-5 countries.

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TREND 3 TECHNOLOGICAL REVOLUTION

MEGATREND 3: TECHNOLOGICAL

REVOLUTION

Technological Breakthroughs

Intelligent mobility: in 2030, 75 % of the world's population will have mobile connectivity (60) and 60 % should have broadband access.

Modeling and enhanced (virtual) reality will be everyday design tools across a broad spectrum, including infrastructure, cars and aircraft, climate forecasting and peace-keeping operations.

Ubiquitous sensors will govern communications devices (including future smartphones), clothes, houses, vehicles and drones.

Additive transformation (3D printers) will play a significant part in industrial production systems, with impacts on the costs and localisation of production.

A combination of **robots, nano-technology and artificial intelligence should replace humans engaged in repetitive production or even in household services**.

A combination of nano-, bio- and information-technology will revolutionise healthcare.

Synthetic biology should enable many new applications through the industrial production of biomaterials, by **replacing chemicals based on non-renewables with renewables** (biofuels, including hydrogen)

- The number of mobile broadband users is going to reach 4,693 million by 2030 (from 0.788 million today). The average broadband speed will grow by a factor of 100 or more, from less than 1 Mbps to more than 100 Mbps in 2030.
- By 2025, more than 100 billion "things" will be connected to cloud computing systems.
- By 2020, European industrial companies will invest €140 billion annually in industrial internet applications
- 5 million jobs will be lost by 2020 due to rapid advancements in the fields of technology, such as artificial intelligence and machine learning (fourth industrial revolution).

MEGATREND 3: TECHNOLOGICAL

REVOLUTION

2030 Projections

A technological revolution based on new industrial production, bio-scientific, communication and digital processes will transform societies;

■ The speed of technological change is accelerating;

 Autonomous decision-making processes will rapidly rise;

Europe and the United States will remain world leaders in science and knowledgecreation, though worries persist in Europe about applied research.

Uncertainties

The speed of convergence of technologies remains uncertain;

Potentially fundamental impacts of technologies on people and societies at large could trigger unpredictable social reactions.

Collection, analysis, and use of Big Data will be a main aspect of the future financial activity.

By 2020, more than 50 billion devices, from cars to coffee makers, will be in the internet connected.

The total value of this market is calculated around \$14 trillion from 2013 to 2022.

T4 CLIMATE CHANGE

MEGATREND 4: CLIMATE CHANGE

- Global energy consumption is rising.
- Sea level rose 19cm from 1901 to 2010 and could rise an additional 26-98 cm by the end of the century.
- GHG emissions are about 54Gt of CO2 equivalent per year, and estimated to reach 68Gt in 2030.
- Half of the bee colonies in USA and Europe have collapsed during the last 2 decades.
- EU is on track to achieve its 2020 climate/energy objectives and committed to reduce GHG emissions by 40% from 1990 levels by 2030 (from 1990 levels), and to increase by 27% from 1990 the share of renewables.

MEGATREND 4: CLIMATE CHANGE

2030 Projections

- In 2030, between 1.9 and 2.6 billion people are likely to suffer from a lack of water.
- GHC emissions are estimated to reach 68Gt in 2030.
- Large-scale exploitation of natural resources will remain concentrated in a small number of dominant countries and regions;
- Food and water supply will be about managing scarcity — a problem that will keep worsening due to climate change;
- By 2030, 93% of the rise in energy consumption will be in non-OECD countries.

Uncertainties

- The successful implementation of the Paris (2015)
 UN Convention on Climate Change.
- The willingness of USA and China to apply stricter policies to reduce GHG emissions.

T5 SCARCITY OF RESOURCES

MEGATREND 5: SCARCITY OF RESOURCES

- ➤ By 2030 global water demand could be 40% more than the current supply, and half the world could be living in areas with severe water stress by 2030.
- Some 30% of global cereal production could be lost in current production regions due to water scarcity, yet new areas in Russia and Canada could open due to climate change.
- Over the last 20 years, inflation-adjusted food prices have doubled and may rise by an additional 150% by 2030.
- ► BP forecasts a 37% increase in world energy demand from 2013 to 2035, of which 96% will come from emerging economies.
- ➤ By 2035, China is expected to consume nearly 70% more energy than U.S.

MEGATREND 5: SCARCITY OF RESOURCES

2030 Projections

- 62% of the seafood eaten in 2030 will be farm-raised and 70% of that will be consumed in Asia. China is expected to produce 37% of the world's fish by 2030, while consuming 38% of the world's food fish.
- By 2030, Japan solar could reach 100GW of installed PV generation capacity, or 11.2% of electricity demand.
- Renewable energy sources can meet 57% of China's electricity demand in 2030 and 86% by 2050.
- Oil and gas production in the Caspian region will grow substantially by 2030; Kazakhstan and Turkmenistan lead the growth in oil and gas, respectively.
- Use of genomics to create plants that produce hydrogen instead of CO2; High-altitude wind generators will be broadly available.
- Some rear metals will run out.

Uncertainties

- OPEC and Russia may lose market and political power due to USA shale gas production.
- Positive developments with nuclear fusion could change the energy landscape.
- Price of oil.

EU & CHINA INNOVATION 2030

UBER

LOG IN SIGN UP

TRANSPORTATION IN MINUTES WITH THE UBER APP

SIGN UP

DE, ON DEMAND

EMERGING DISRUPTIVE BUSINESS MODELS

EMERGING DISRUPTIVE BUSINESS MODELS – THE GAME CHANGERS

customization nano el mobility digitalisation research nation open changing CC digital access social populat bility H 3d 81 wate toor make peon clean shift bette society financial smart y trade dustry distribution DrO CtS demand middle canacity

CHINA 2030

Europe 2030	
Strongest Technological Areas	Weakest Technological Areas
Energy storage	Nuclear energy
IoT	Saltwater agriculture
Nano-sensor	Nuclear fusion
Brain science	Cultivated meat
Medical materials	Fish farming
Cancer diagnosis and treatment	Space exploration
Solar energy	Carbon capture and storage
3D/4D printing	Crop production
High-energy density materials	Unmanned aerial vehicle
Wearable health devices	Virtual Reality & Augmented reality
Artificial Intelligence	Customized food
Artificial organs	Aircrafts
Information protection	High density data storage

Highest cooperation potential between EU and China are:

- Environmental Management
- Robotics
- Telecommunications
- Renewable energy
- Smart energy systems of the Future
- Agricultural biotechnologies

Lowest cooperation potential between Europe and China are:

- Nuclear fusion
- Safe nuclear engineering
- Space exploration
- Drugs
- Hydrogen power

Emerging technologies in Chinese R&D

Solar energy

Emerging technology gaps and complementarities

Energy saving

		Nontonno		Optoelectronics		
		Nantenna			Robotic	5
				Graphene	Encryption	Energy storage
				l	Lithium-ion batteries	Mechanical arm
				Internet of T	hings	Air purification
				Carbon panotubos	Biotechnology	Electric vehicles Aircrafts
				Carbon hanolubes	Genetic engin	eering Data analysis
			Drones	Quantum dots	Big data OLED	Water purification
			F	м <u>+</u>	Food safety	New materials
			Aerogel	Issue engineering	Wearables	Data salety
		Understand	Desalination Supe	ralloy Biomass	Smart transportation	Longevity Sonsor tochnologies
		Soil remediation	Magnetorheological fluid	Volumetric display Smart gr	id Vehicle	technology
		Urt	pan mobility Artificial	intelligence Traffic	c safety Cond	uctive polymers Medical materials
		Lit	hium-sulfur battery Fullerene	Augmented reality	Gene the	Materials science erapy
		Metamaterials	New generation nuclear reactors	-temperature superconductivity	Body implants	Distributed power generation
Intelligent transport systems Electronic nose M					lites Nuclear operav	Information protection
		Memristor	N	luclear fusion Lithium-a	ir battery Flexible electr	onics Physical internet
		Cryoprotectant	Superconductors	Hybrid fuels Brain-computer interface	Crop production Additive ma	anufacturing Digital imaging
Ν	Maglev train	Tachograph Amb	ient intelligence Sy Flywheel energy st	nthetic diamond Mag torage Quantum comput	netic refrigeration 3D dis ting Molecular assembl	er Energy generation systems
Virotherapy Scramjet	Solar s	ail Educational toys	Electroencephalography Vitrification Unman Unmanned a	Regenerative medicine ned vehicle Anti-gravity aerial vehicle Nano-sensor	Biometrics Industrial interne Stem cell Full genome	Environmental management sequencing
Pulse detonation engi	ine Spaceplane	Bioplastic	fural robot	Smart cities Micro air ve	hicle Synthetic biology	uter space Aulti-functional structures
Arcology	Aritificial organs	Stealth technology	3D bio-printing Concentrated	I solar power Vaccine develop	en transport Vehicular oment Three-dimens	communication systems sional integrated circuit

Big in Europe (measured by numbers of patents)

Strong and weak innovation capabilities

Key strengths

- Strong manufacturing capabilities with fast execution, large scale, and a large domestic market.
- Strong industrial learning and knowledge absorption capabilities.
- > An entrepreneurial mindset among the Chinese people.

Key weaknesses

- Academic learning, where basic research, teaching, and language capabilities lag behind.
- Institutions, which need to become more supportive of innovations.
- Access to resources, where shortages of food, water, and natural resources are expected to bean important driver of innovation.

Uncertainties related to China's innovation performance toward 2030

Three key uncertainties

Consumer-driven innovation

VALLETTA 2030

VALLETTA

The future of research managers

- What are the trends affecting our business and Modus Operandi?
- ► What are the drivers affecting our future?
- ► What are the prospects for future managers?

VALLETTA

Methodology

F

Focal Question

66 What are the main factors that will affect Research managers

by 2030?

SEARCHING FOR TRENDS: RESEARCH MANAGERS

Think of our environment

Inner World: University, Research centre, etc

Operational environment : Researchers, Competitors, regulations, DG Research, etc **Contextual Environment:** Global Economy, Media, S&T policies, etc

DOING: IDENTIFYING & EVALUATING TRENDS

DOING: SELECTING TRENDS

THANK YOU