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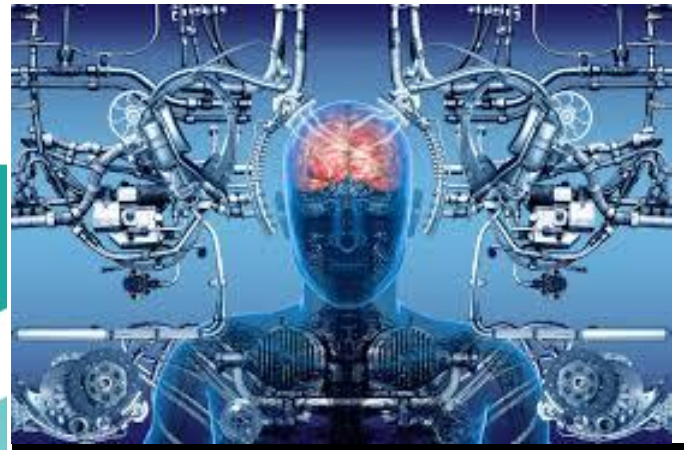
SMART Cities: Ecology, Technology, Entrepreneurship and Citizenship



Jay Mitra
Professor of Business Enterprise and Innovation
Essex Business School
University of Essex

Image sources: study.com/megabytes.com/coursera.org/saic.com

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An Agenda

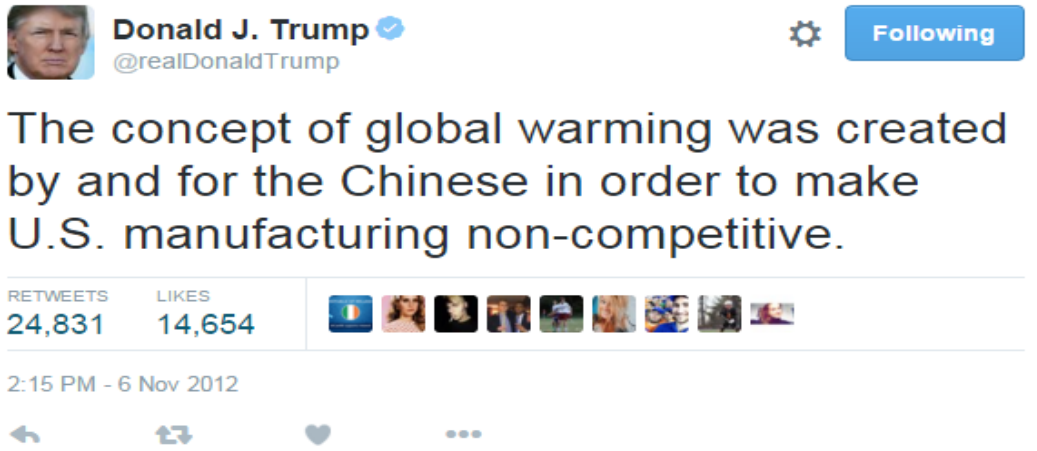
- Asking a set of questions
    - about Smart Cities, Smart SMEs, Smart Strategies and Smart Business Models,
    - and Smart Ecosystems
- Ending with challenges and opportunities

Q.1 What's not so SMART?

Going to meetings: Training to be brain dead

Using the Internet: Outsourcing memory

Sharing office space: Increased concentration of CO2 impairs decision making



Donald T & CC: Totally without oxygen

Image sources: thefamilyof5.wordpress.com/Usborne publishing/industrious office.com/

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Q2: So What's SMART?

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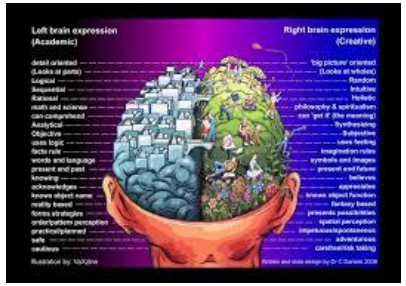

The Brain:
People: Data:
Technology:
Innovation:
Entrepreneurship

Connectivity:
Networks/
Socialisation

The Spaces/Place:
Local and Global

Image source: orangeshoe.com/ritholtz.com/safewise.com/Adam and Friends/spaces.bandcamp.com/www.aiim.org

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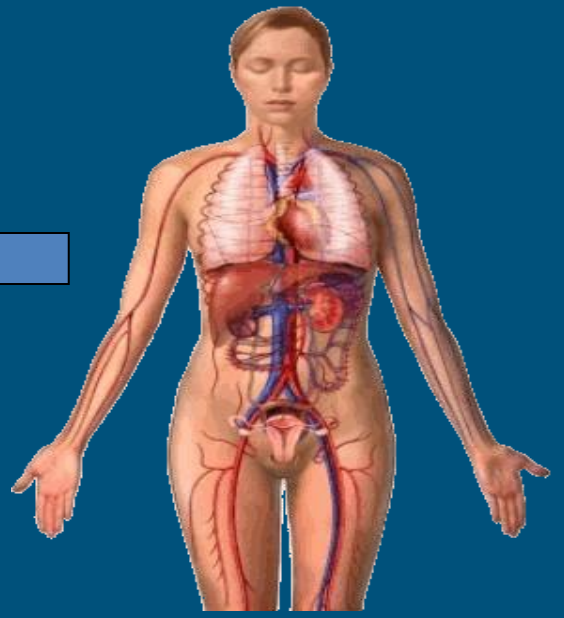
A Smart Analogy - You and Me!

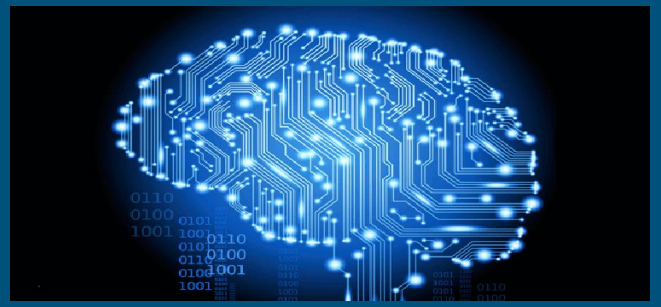
1. Sensory inputs

Hear, Touch,
Taste, Smell, See



2. **Send** Information
Via body **networks**

The Brain = Computer



3. **Store** and **Process** information
4. **Make Decisions** and **Take Action**

5. Actions
Run, Walk, Cry, Speak, Sit, Write, Sleep,
Read, Create, Eat, Pain, Joy, Sadness…….

Source:: adapted from: www.weightless.org/Mathew Bailey; slides 5-8

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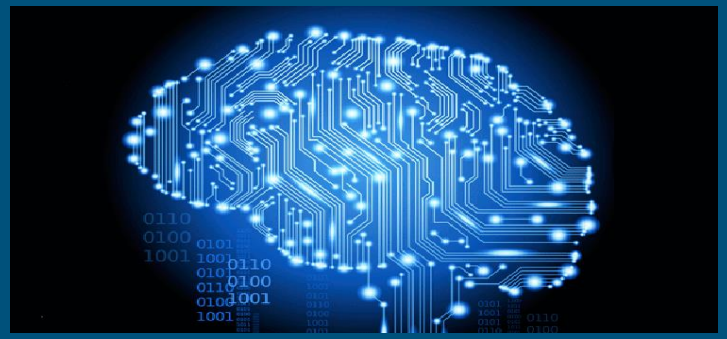
In mobile phone terms…….

"The Brain"



"Mobile Apps"

2

Available on the App Store

Google play

1

Sensors & Data

- Identity
- Location
- Accelerometer
- Texts
- Calls
- App Data

3 and 4 and 5

But note the compression of inputs & outputs

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Sensor

Wireless Network

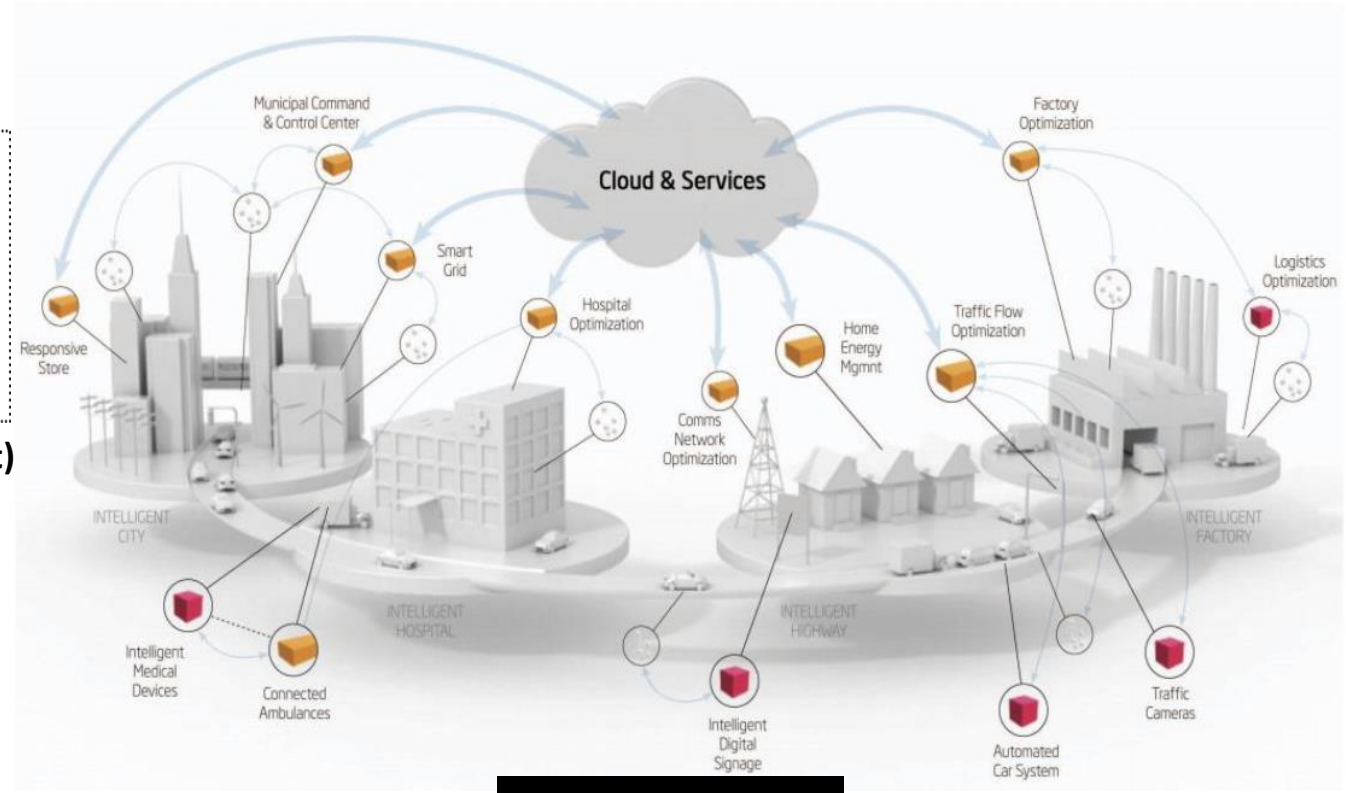
Applications

What is the "Internet of Things" (IoT) or "Machine to Machine" (M2M)?

Smart Fridge

Smart Heating

Short range wireless (100s feet)

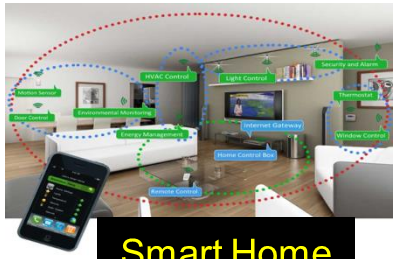


In SMART Cities

GSM™

Long Range Wireless (5kms+)

Smart Car



Smart Home

Source: adapted from -Matthew Bailey (2013) SWAN Conference

Q.3: What is a Smart City?

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SMART Dimensions

DIGITAL CITY

- Informatics (communication)
- City portals for online information services

Nunes, 2005

Mexico City, Mexico

INTELLIGENT CITY

- Intelligent systems (functionality)
- Online web-based e-learning systems integrated and interoperable with other city platforms

Weinstock and Garleghi, 2013)/Accenture

Singapore, Singapore
Amsterdam, Netherlands
Manchester, UK
Helsinki, Finland
Neapolis, Cyprus

SMART CITY

- Social and human concerns (quality of life)
- Ecological systems (sustainability)
- e-Learning platform and knowledge management
- Advanced visualization and simulation tools
- Benchmarking requirements

Caragiu, et al, 2011; Odendaal, 2003; Batty etal, 2012; Piro et al, 2014; wenge et al, 2014

Bangalore, India
Cyberjaya, Malaysia
Konza, Kenya
Montevideo, Uruguay
Bogotá, Colombia
Medellín, Colombia
Curitiba, Brazil
Barcelona, Spain
Skolkovo, Russia
Seattle, USA
New York, USA
Hong Kong, China

ECO-CITY

- Natural eco-systems
- Economic development while protecting the environment

The World Bank, 2010

Guayaquil (Ecuador)
Auroville (India)
Stockholm (Sweden)
Freiburg (Germany)
Adelaide (Australia)

Source: 'Smart Sustainable Cities: Reconnaissance Study'; UNU-EGOV/IRDC/CRDI Canada

Image sources: rebloggy.com/smartupcities.com/economictimes.india times.com/dreamtimes.com

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The Origins of the Smart City

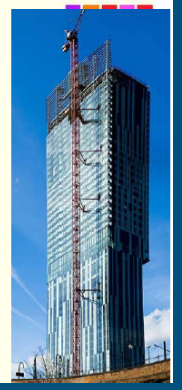
Starting Points:

- Eurocities founded in 1986
- Brussels office opened in 1992
- Telecities founded in 1993
- European Digital Cities project (94-96 - FP4)
- TEN-Telecom project 'InfoCities' (96-98)
- IntelCity Roadmap project (FP5 – 2002-3)
- Intelligent Cities project (FP6 – 2004-6)
- Eurocities Knowledge Society Forum – KSF
- Founding network of Living Labs
- European Network of Living Labs (ENoLL)

Challenges:

- Demonstrating benefits
- Mixed experiences, e.g. PPPs
- Trust and confidence
- Legacy systems and structures
- Value for money
- Economic crisis
- Risk adverse environment

Opportunities:



- Building new collaborations
- Cities understanding innovation
- Innovators understanding cities
- Majority of people living in cities
- Real citizen engagement
- Visibility and transparency
- User generated content and services

Eurocities KSF priorities:

- Next Generation Access – NGA: advanced e-infrastructures
- eGov 2.0: transformational government
- e-Inclusion: tackling the digital divide
- ICT for Energy Efficiency (ICT4EE): Green Digital Charter

Smart Cities and open innovation:

- Creating new innovation eco-systems
- Multi-level partnerships: cities, research, industry, community
- Cities closer to citizens
- Political momentum at local level

Smart Cities as Creative Cities:

- talent, technology and tolerance = creativity, innovation and diversity
- getting organised: Eurocities + Living Labs + Future Internet
- getting noticed: EU and member states

Source: This slide – adapted from Dave Carter, European Network of Living Labs/ One Manchester

Source: ***Living Labs Summer School 2012, Helsinki*** **Hans Schaffers (Slides 14-18)**

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What is a SMART city?

Umbrella term for the integration of digital infrastructure into the operation of a city to improve efficiency of municipal services, the adaptability of urban management and personalise the relationship between a city and its citizens.

London Tech Manifesto

DETAILED DATA CAPTURE

unifies data from a wide range of sources to inform decision-making

CITIZEN-CENTRIC APPROACH

is built around the needs of citizens

DYNAMIC UPDATING & ADAPTATION

adapts in real-time as the city's fabric changes

PLATFORM FOR INNOVATION

tools and environment to enable citizens to develop their full potential

SMART maps for India

SMART:
Specific Measurable Assignable Realistic Time-related

Areas of interventions

- Citizen engagement & Governance
- Mobility and Transport: Seamless
- Decongestion: Dispersed development
- Solid waste management: reduced generation, recycling
- Storm water management
- Sewage management: Decentralized treatment
- Safety and security
- Health: Minimize visits
- Education: Minimize school distance
- Environment
- Energy management: Energy efficiency, smart usage
- Water management: RWH, Minimize usage
- Smart buildings

Frugal Smart Solutions

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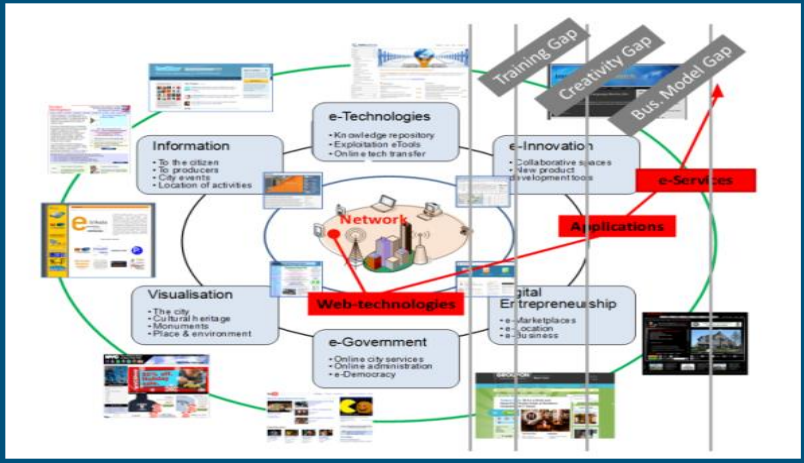
Thessaloniki smart city development
ICT transforming city activities and ecosystems

Broadband networks by large companies

- ADSL: 24/1 Mb
- Fibre optic net: 2,5 Gb
- 3G-HSDPA: 42 Mb
- Wireless: free (municipal nets)



Apps and e-services:

Bottom-up initiatives

- City representation
- City sectors
- City districts
- Citizens. Aggregation / collective content
- City administration and social services
- Location-based services
- City infrastructure and utilities
- City management

Governance challenges:

Three gaps to address

(1) Digital skills gap - TRAINING
(2) Creativity gap – LIVING LABS
(3) Entrepreneurship gap – BUSINESS MODELS

Planning for Smart district

- Development of wired and wireless networks
- Free Internet to users and business.
- Smart environments based on sensors
- e-services suitable for the community of each district
- Training services for involvement

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Manchester smart city development
Digital strategies and smart environments for urban renewal

Urban regeneration

- Since mid-1980s the City Council embarked on city regeneration
- Drive economic change through technology
- Focus on neighborhood focused action, creative city, and innovation
- In 1990s Manchester telematics Partnership
- Currently, e-services to address inequalities and digital democracy
- Balance of top-down and bottom-up actions

Digital Strategy

Started in 2008 and review in 2011 with respect to EU Digital Agenda and consulting with local stakeholders. Main objectives:

- **Digital inclusion**, generate skills and tackle the divides
- **Digital industries**, new employment, cluster of digital and creative businesses
- **Digital innovation**: working with the future Internet research community to support Manchester as Smart City

Toward Smart City

Flagship initiatives

- East Manchester: a regeneration challenge
- Eastserve: first Living Lab
- Corridor Living lab NGA project
- Next generation open access fibre optic network

Principles for Smart Cities

- Neighbourhood regeneration as starting point for a smart city
- Digital collaborations through Living Labs
- Putting people at the heart of the agenda
- An inclusive and sustainable approach to digital development
- Exemplar projects

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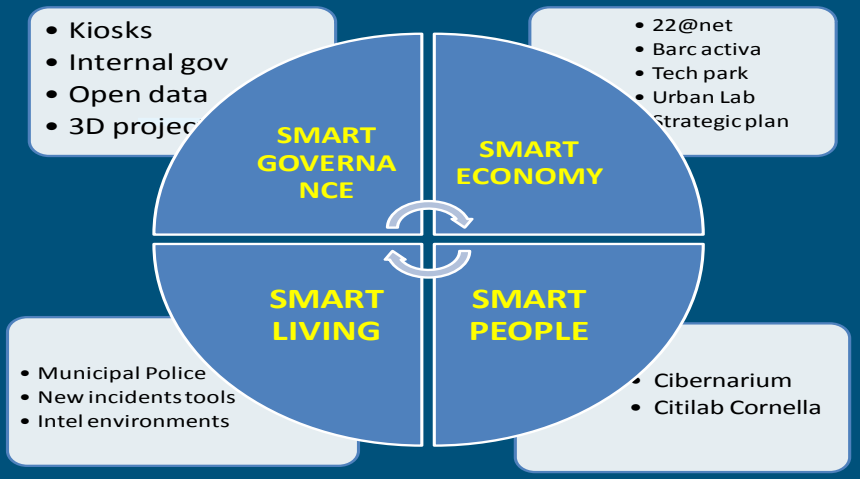
Barcelona Smart City Development

Leading role of City Hall



Smart city model: Three pillars

- Ubiquitous infrastructures
- Information from sensors, open data, and citizens
- Human capital, actors, communities

Smart City Strategy

- **Smart Districts**: 22@Barcelona; triple helix collaborations
- **Living Lab initiatives**: 22@Urban Lab, Live, Bdigital, i2Cat, Fablab, Cornella
- **Infrastructure building**: traditional and new. Integration of ICT. From fibre optic to Wi-Fi.
- **New services to citizens**: gov, quality of life, professional
- **Open data**: sensors, open standard, and city platform

SC Management

- Creation of networks of actors, organisations, departments
- Broadband network and sensor data management
- Creation of proof of concepts for systems and applications

Challenges

- Demand for human capital and skills
- VC funding for innovation
- Low global connectivity
- Development of triple helix alliances
- Collaboration between government departments

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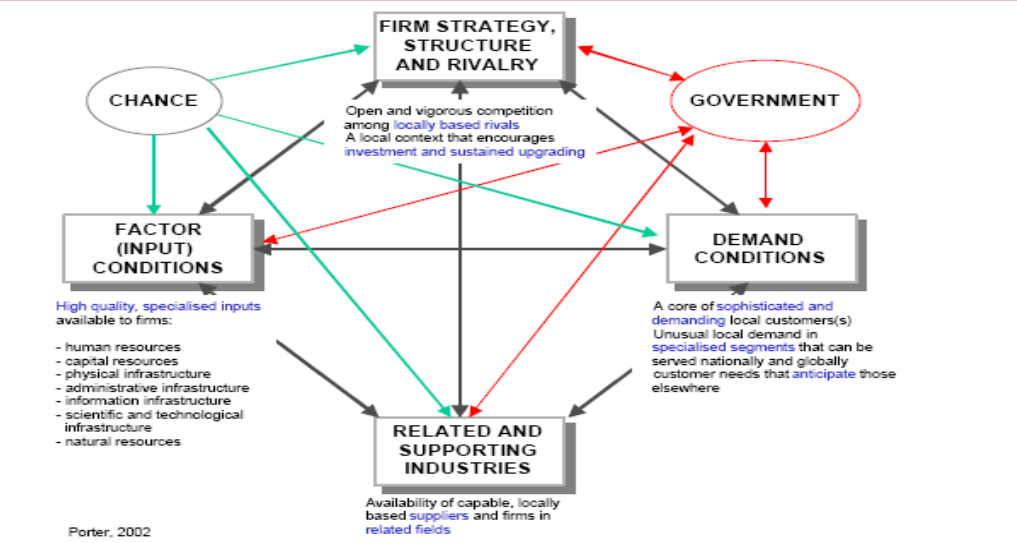
Helsinki smart city development
Living Labs and new clusters for smart city strategy



A Porterian cluster in mobile technology is emerging in Helsinki.

- Clustering strengthens motivation, incentives, innovation, and enables externalities .
- The mobile applications cluster is sustaining Helsinki ‘s Smart City strategy

Factor conditions:
Broadband, telecoms, NOKIA, skilled workforce, start-ups

Demand conditions:
Government demand, banking , transportation, etc

Firm strategy:
Companies within SMOPEC, global markets, intense local competition

Supporting industries:
Broadband infrastructure, 3G nets, specialized service providers

Competitions for Open Data apps as strategy for cluster development

- The Helsinki Regions made available public transportation data
- Apps4Finland makes data available related to environment and spatial information
- Competitions and Living Labs as drivers for the M-cluster development

SMART Frugal Solutions

Integration of Land Use and Bus System, Curitiba, Brazil

- Promotion of linear growth along the structural axes of transportation
- High-rise residential as well as commercial buildings allowed close to the structural axis
- Density reduced with increase in distance from the axis
- The roads in each of the structural axes are divided into three:
  - central street for public transport and local access with parking.
  - On both sides of the central street there are one way streets for travelling away or into the down town area.
- An express bus system covers the entire municipality area through exclusive traffic lanes

Flood management: Singapore

- Singapore's Bishan -Ang Mo Kio Park was upgraded in such a way that it helps in flood prevention through natural landscape.
  - Concrete drainage channels running through the park was converted into meandering natural river which functions as flood plains.
  - This helped in creating new spaces for recreation and in bringing back a natural ecosystem
  - Safety measures like warning systems with water level sensors, warning lights, audio announcements, etc. are also there to inform people when the water level increases.

Source: Ramesh, G. (2015). 'Frugal SMART Solutions for Pan City Development; Centre for Excellence in Urban Governance, IIM Bangalore, India

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Q.4 Does a Smart City Create Conducive Environments for Smart SMEs?

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SMART cities for SMART SMEs

- improved supply of homegrown talent
- enhanced infrastructure enabling more to start and scale
- better access to public procurement opportunities
- improved connectivity allowing businesses to provide more data-related services
- employees working virtually more seamlessly

London Tech Manifesto, icon8.com

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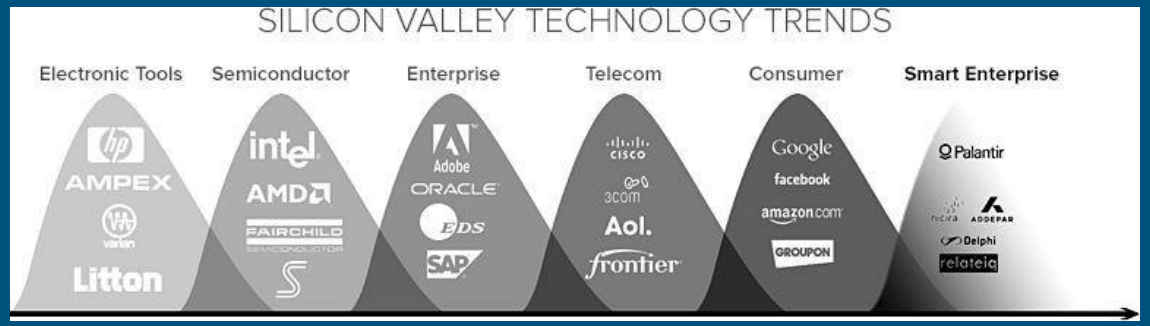
SMART SMEs features and examples

Integrate heterogeneous big data and empower knowledge workers to solve non-linear problems.

Leverage recent IT advances — chiefly from the consumer wave — to solve critical challenges in major industries.

Potential to harness network effects within industry verticals and become platforms, increasing innovation by enabling novel applications to quickly spread throughout the industry.

formation8.com, icon8.com



OPENGOV ADDEPAR NeoTek Energy Inc healthtap TAXON BIOSCIENCES RelateIQ Palantir practice fusion

GOVERNMENT

OpenGov platform allows governments to visualize critical financial data; analyze the data to flag waste; perform cross-city comparisons and benchmarks to find best practices and new efficiencies; and share financial transactions and budget collaborations to improve transparency and workflows.

ENERGY

Through novel sensor technology and software, NeoTek optimizes production and reservoir models to overcome the problem of leaving much of the oil within the reservoirs behind. Taxon Biosciences utilizes a proprietary bioinformatics approach to develop and identify microbial species that accelerate the conversion of unconventional energy sources (heavy oil, coal, shale oil.) to natural gas.

FINANCIAL SERVICES

Addepar aggregates disparate sets of data, reconciles and augments it, and provides best-in-class analysis and reporting for large private banks and registered investment advisors (RIA). Investors see all their data in real time, allowing them to perform lightning-fast analysis to address concerns while they are manageable and relevant.

HEALTHCARE

Innovation from startups like Health Tap, Palantir, and Practice Fusion may save hundreds of billions of dollars, by bringing data and doctor interaction online and then enabling patients and doctors to make informed decisions.

BUSINESS SERVICES

RelateIQ is transforming the CRM space by building a technology solution to collect data automatically from available sources to enable intelligent insights for sales, recruiting, investor management, and other critical business pipelines.

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Q.5: Is there a market for Smart SMEs?

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"Smart Cities Market by Smart Home, Intelligent Building Automation, Energy Management, Smart Heath Care, Smart Education, Smart Water, Smart Transportation, Smart Security, & by Services Worldwide Market Forecasts and Analysis (2014 2019)"

The global **Smart Cities Market** to grow from $411.31 billion in 2014 to $1,134.84 billion by 2019, at a CAGR of 22.5%

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Q.6: How can Smart SMEs navigate these markets?

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SMART Agriculture

Challenge

- 1 billion more people to feed 2020

Problem

- No cellular coverage over vast areas of land
- Surface water disappearing across the globe
- No fine tuning over “material” management
- No insight into these crop “influencers”

Opportunity

What if we can cover large swathes of land with vast amounts of cheap sensors using Weightless?

Could we use this new data to:-

- Minimise amount of water used?
- Minimise amount of fertilizer used?
- New insight into crop “influencers”?
- Increase yield?
- Manage more effectively?
- New data services for commodities market?
- New Agriculture App Store platform ?
- New businesses?

Source:: adapted from: www.weightless.org/Mathew Bailey; slides 22-25

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SMART Disaster Prevention and Protection

- Disposable sensor modules that activate automatically
- Safe, instantaneous environmental monitoring
- Pollution, radiation, temperature, vibration…
- Difficult or dangerous places
- Low cost and long battery life for sensor modules
- Simple to deploy infrastructure

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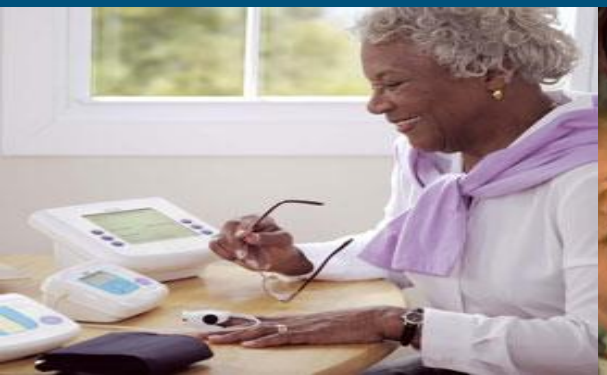
SMART “Connected” remote healthcare

- Aging population – in-home monitoring for health and wellbeing
  - Heart rate, blood pressure, temperature, position
  - Lowers total health care costs
  - Assisted Living
- Panic button alarms and emergency notification
- Rural community remote diagnostics and disease management
  - Reduces barriers to access
- Medicine dosage notification and delivery
- Low cost network Infrastructure and ARPU (device) KEY
- Ubiquitous standard for device interoperability & simpler architectures!



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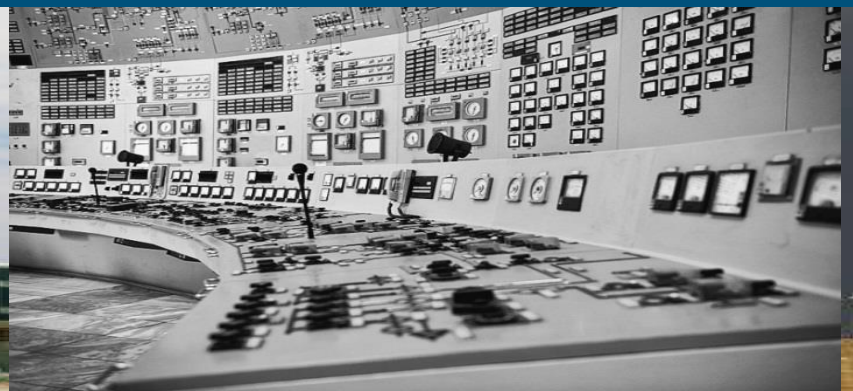
SMART Energy – Source to Consumer

- Smart Meters:
  - Domestic demand management and In-Home display for energy consumption monitoring
  - Consumer control of energy management and use
  - Japan already deploying to 10 million homes
  - UK procurement process begun – contracts awarded Q42012
    - 28 Million meters installed & commissioned by 2016
-
- Smart Grid:
  - Saves generating capacity and allows enhanced control of load
  - Annual savings of ~$2Bn for UK Plc alone, $100Bn worldwide



Q.7: What kind of business models do Smart SMEs need in these environments?

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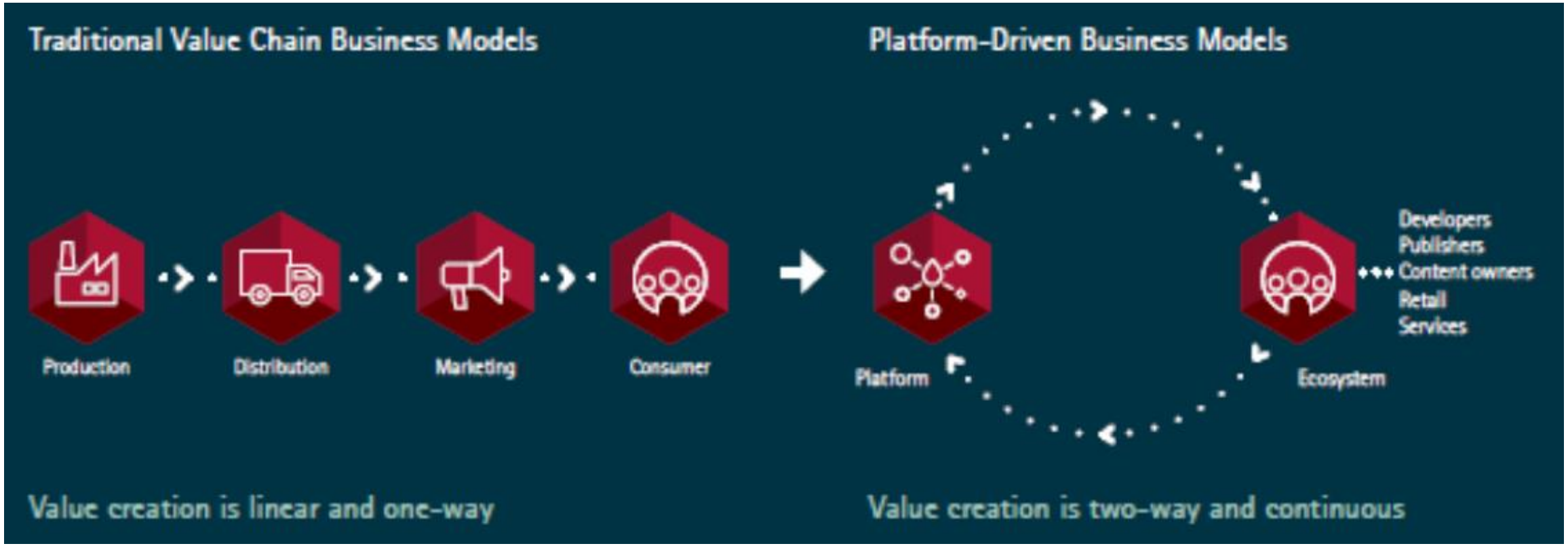
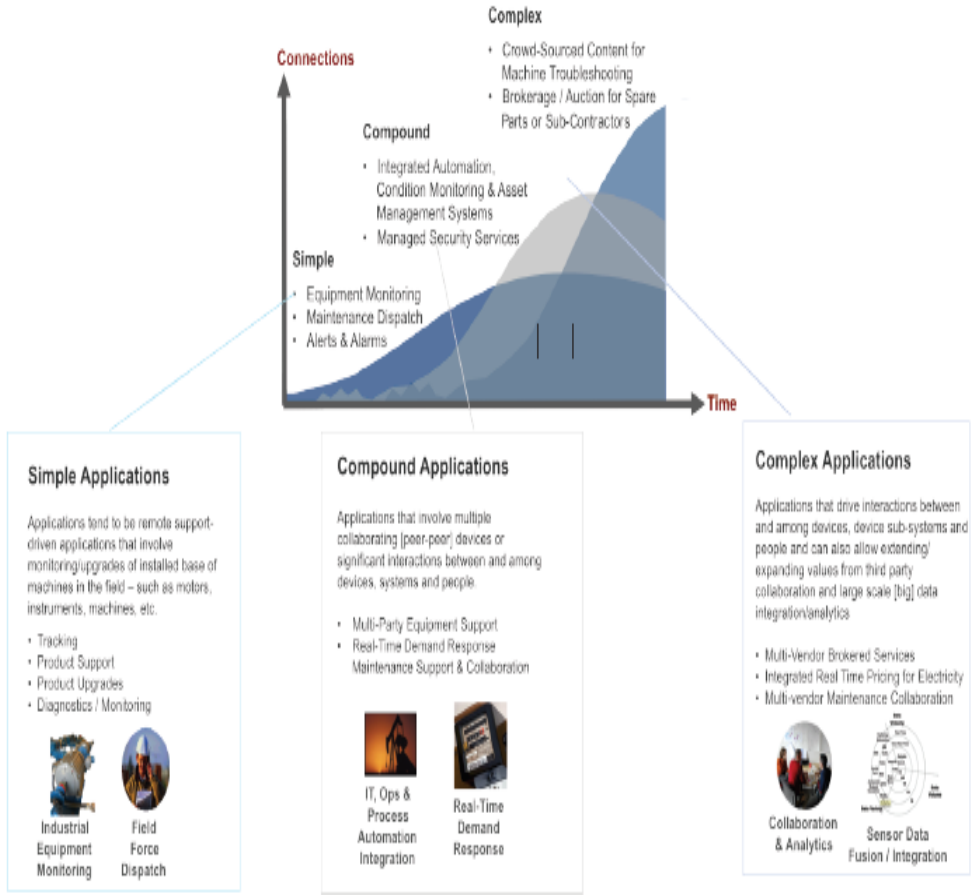
From SMART then to SMART Now



Source: adapted from Harbour Research 2010-16

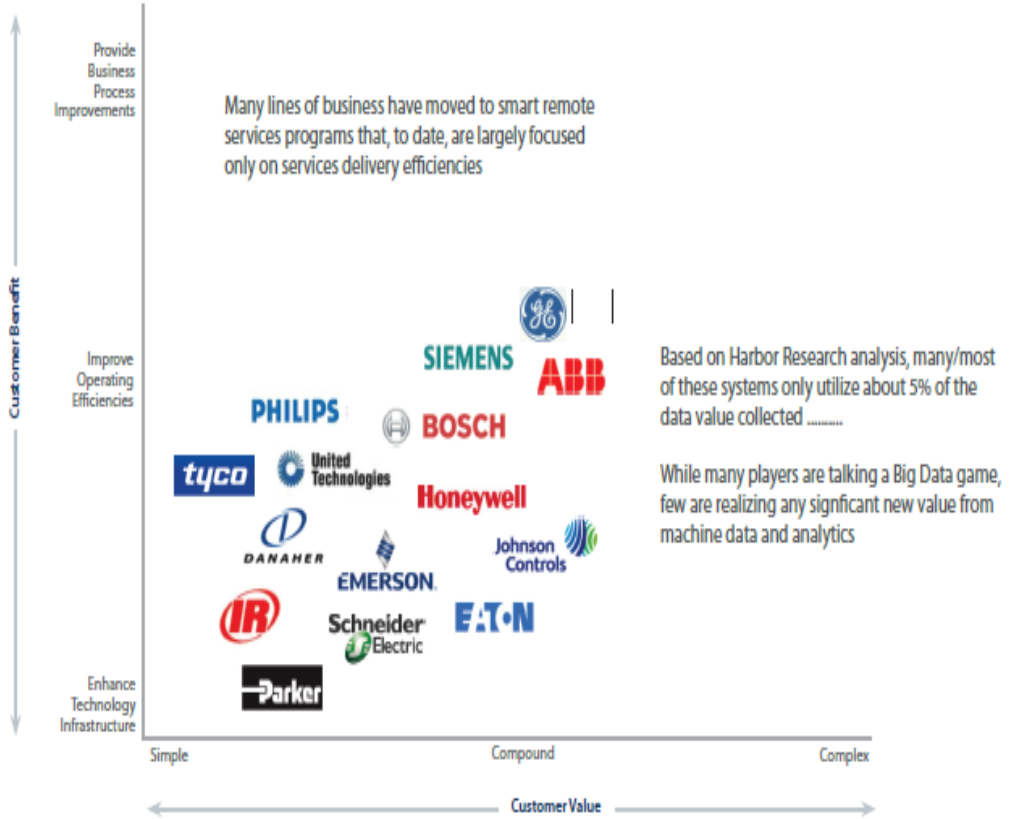
Internet of Things and Smart Services Technologies and Business Models Are Still Evolving

To date, remote services opportunity has been comprised of "simple" monitoring applications & related tracking/ location services….. future development will be focused on collaboration between devices, people and systems



What Progress Has Really Been Made In Driving New Organic Smart Services Opportunities?

In many ways, most of the larger diversified industrials have not gotten any further than "first base" in realizing connected smart systems and services values....



Source: adapted from Harbour Research 2010-16

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Supporting Business Models: Key Features

1. Platforms and networks: Internet of things & machine-to-machine communication technologies will underpin hyper-connectivity

2. **Big Data**: fuel that powers Platforms harness potential of huge amounts of data to deliver products & services

3. Deep personalisation & mass customisation: emergence of novel business models that allow masses to custom-purchase by deeply personalising their acquisition

4. Horizontalisation: Increasingly transcend verticals & provide previously unimaginable array of services on a single hub.

5. Co-creation & democratisation of production: products & services that fit our needs and wants almost perfectly by supplying our context-rich personal data to businesses of choice and public services.

6. Convergence: of ideas, technologies, resources, networks

Source: adapted from Deloitte, 2015; Accenture, 2015/16

Q.8: How does the Smart Ecosystem evolve?

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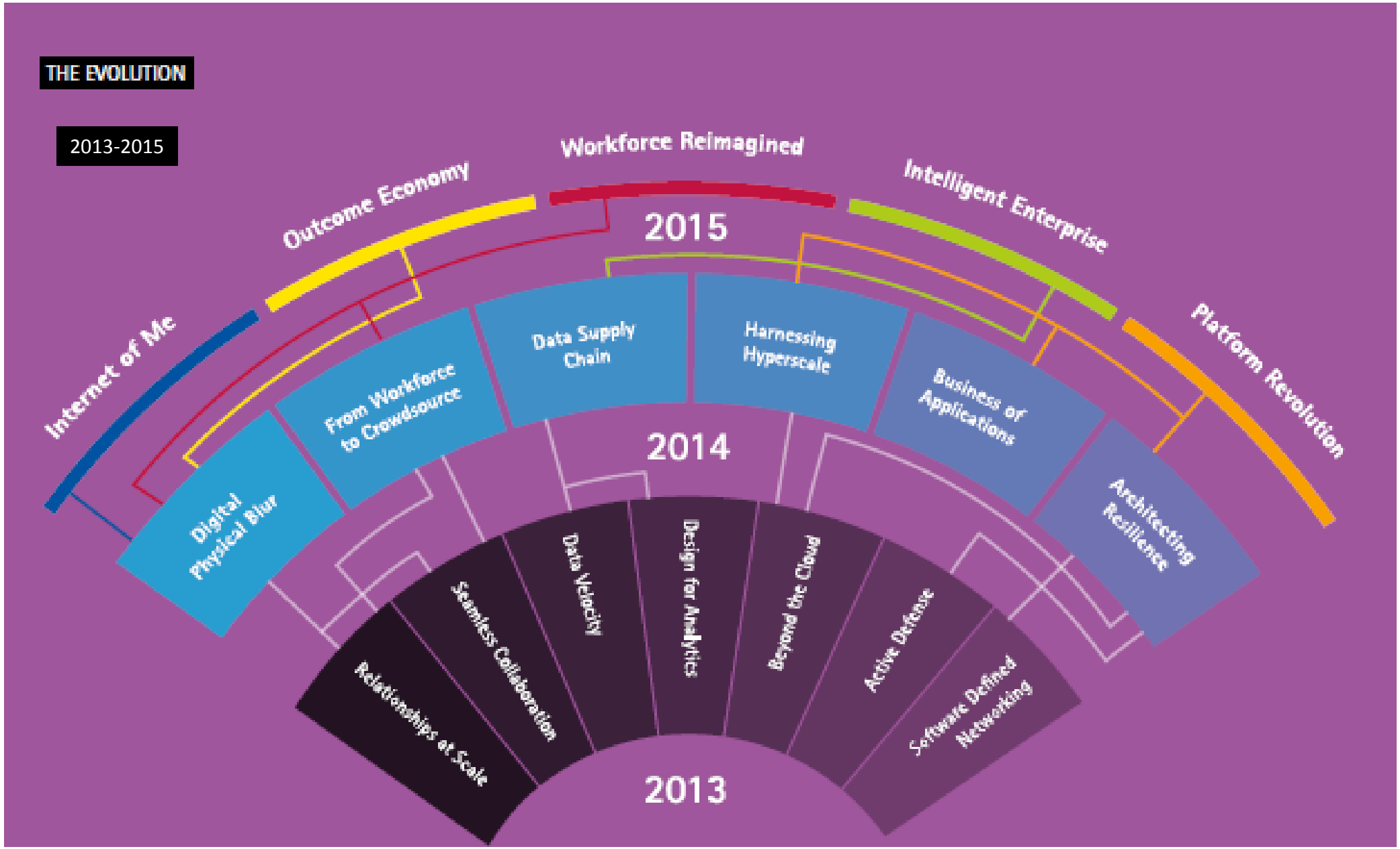
Supporting the Evolving Ecosystem - 1



Source: adapted from Accenture, 2015/16

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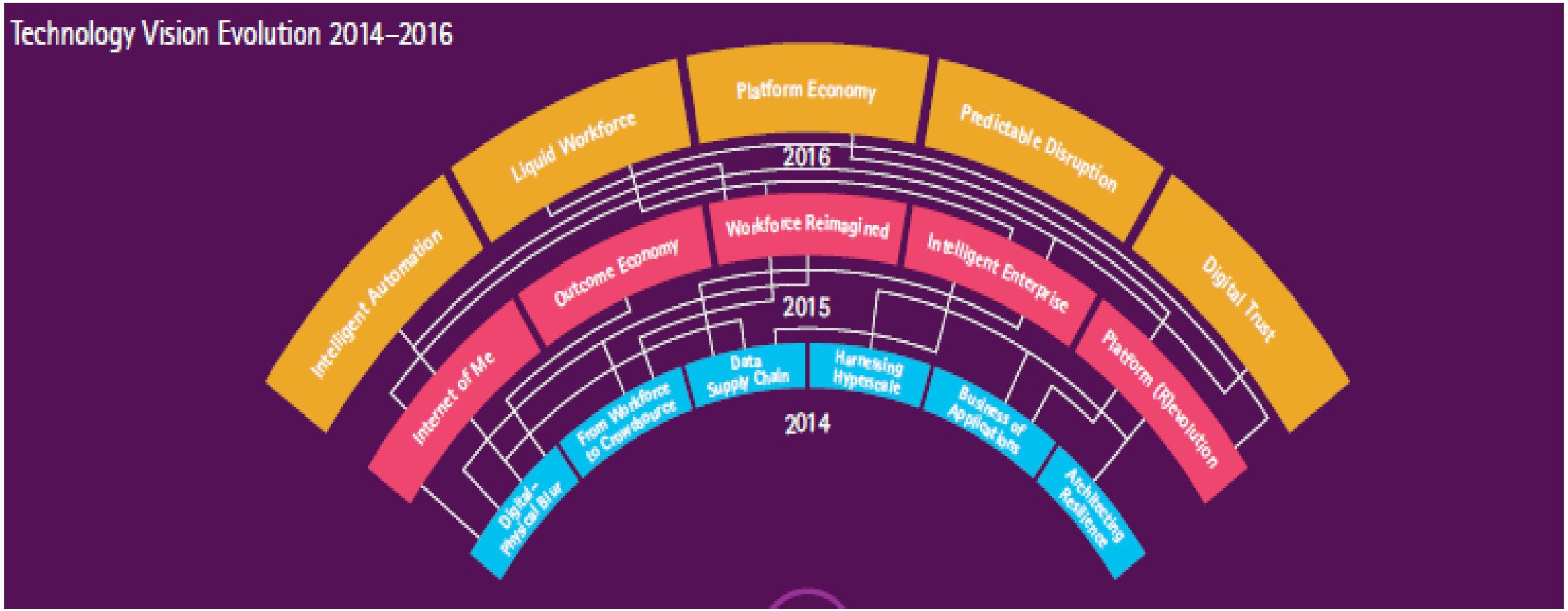
Supporting the Evolving Ecosystem - 2



Source: adapted from Accenture, 2015/16

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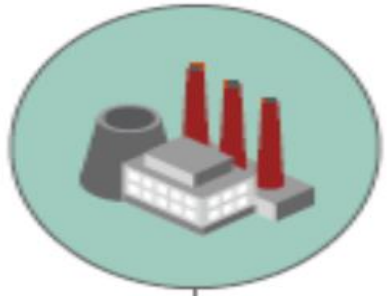
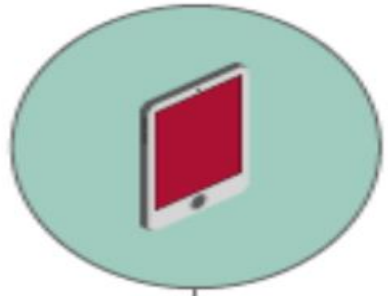
Q.9: What will be the drivers of the ecosystem now and into the future?

Macroeconomic Transformation—Platform Economy



Industrial Era
Changed every aspect of life

- Products
- Value chains (linear)
- Power of controlling supply chain
- Supply-side economies of scale
- Physical assets and capital depreciation
- Diminishing returns
- Market valuations driven by return on assets
- Growth organic or via mergers and acquisitions
- GDP as economic measurement



Digital Economy Era
Transforming every dimension of life

- Platforms
- Ecosystems (non-linear)
- Power of optimizing ecosystems
- Demand-side economies of scale
- Digital assets and innovation capital
- Distribution power law and network effects
- Market valuations driven by ecosystems
- Growth driven by asymmetric and network effects
- New measures, digital density and "free goods"

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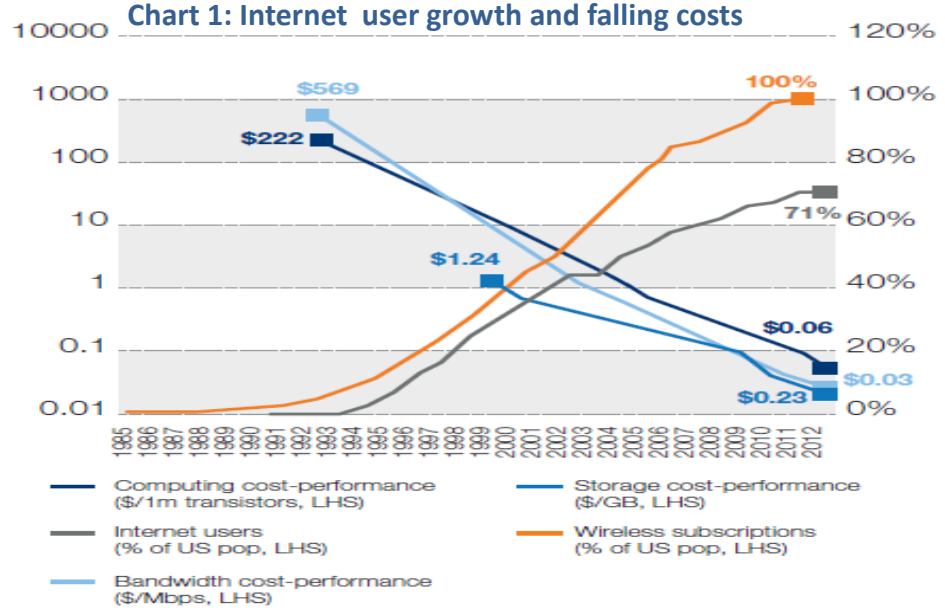
The Sharing Economy and its Disruptive Business Models

PEER ECONOMY, ACCESS ECONOMY, GIG ECONOMY, COLLABORATIVE CONSUMPTION, SHARING ECONOMY, ON-DEMAND ECONOMY, CIRCULAR ECONOMY, PEER ECONOMY, SHARING ECONOMY, COLLABORATIVE ECONOMY...

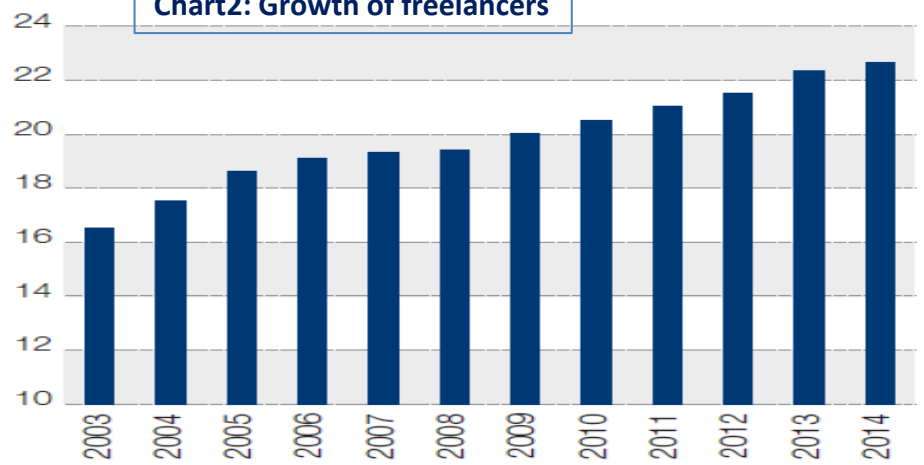
Image sources: Tikkun magazine; Collaborativeconsumption.com/ The New Yorker/next Juggernaut/Kauffman Foundation /progrss/collaborative consumption/CBC

Chart 1: Internet user growth and falling costs



Source: Deloitte University Press, 2013 http://dupress.com/articles/from-exponential-technologies-to-exponential-innovation/.

Chart2: Growth of freelancers



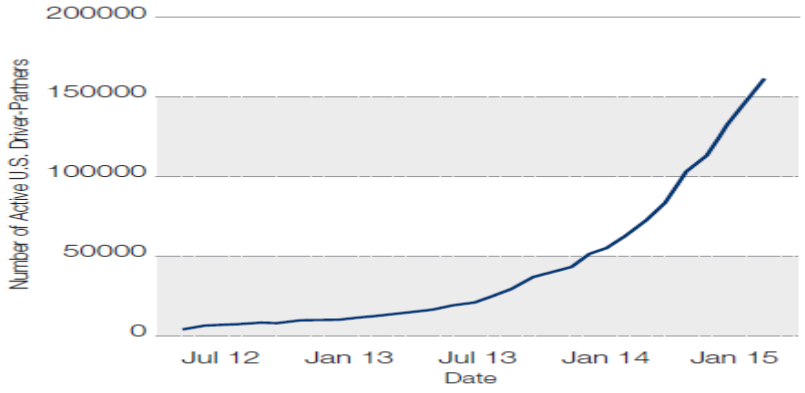
Source: Credit Suisse, The Sharing Economy.

Some Underlying Explanations

Chart 3: Airbnb summer travellers increase over years

Source: http://blog.airbnb.com/wp-content/uploads/2015/09/Airbnb-Summer-Travel-Report-1.pdf.

Chart 4: Number of active Uber drivers each month in the US



Source: https://s3.amazonaws.com/uber-static/comms/PDF/Uber_Driver-Partners_Hall_Kreuger_2015.pdf

Some Indicators

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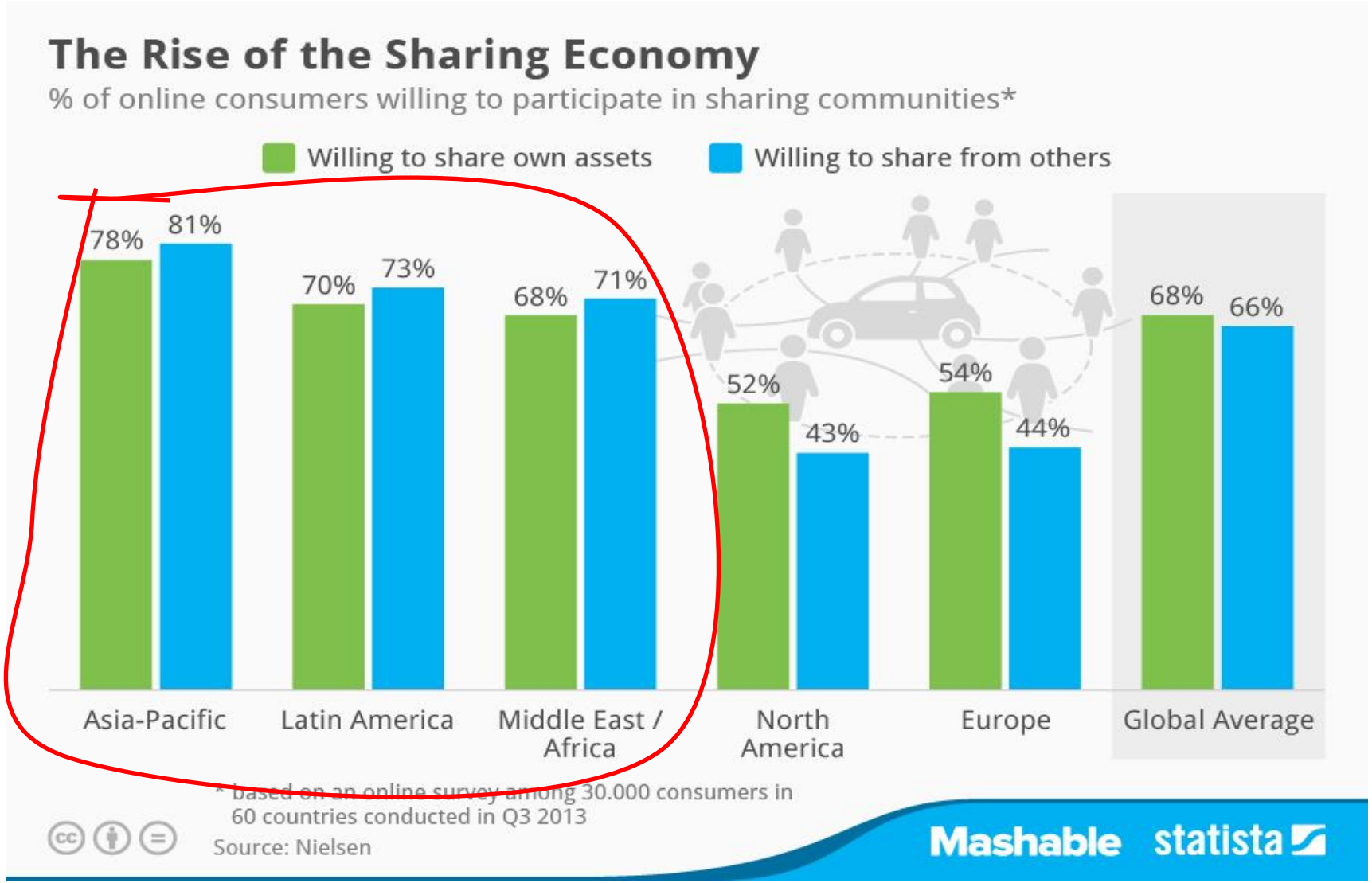
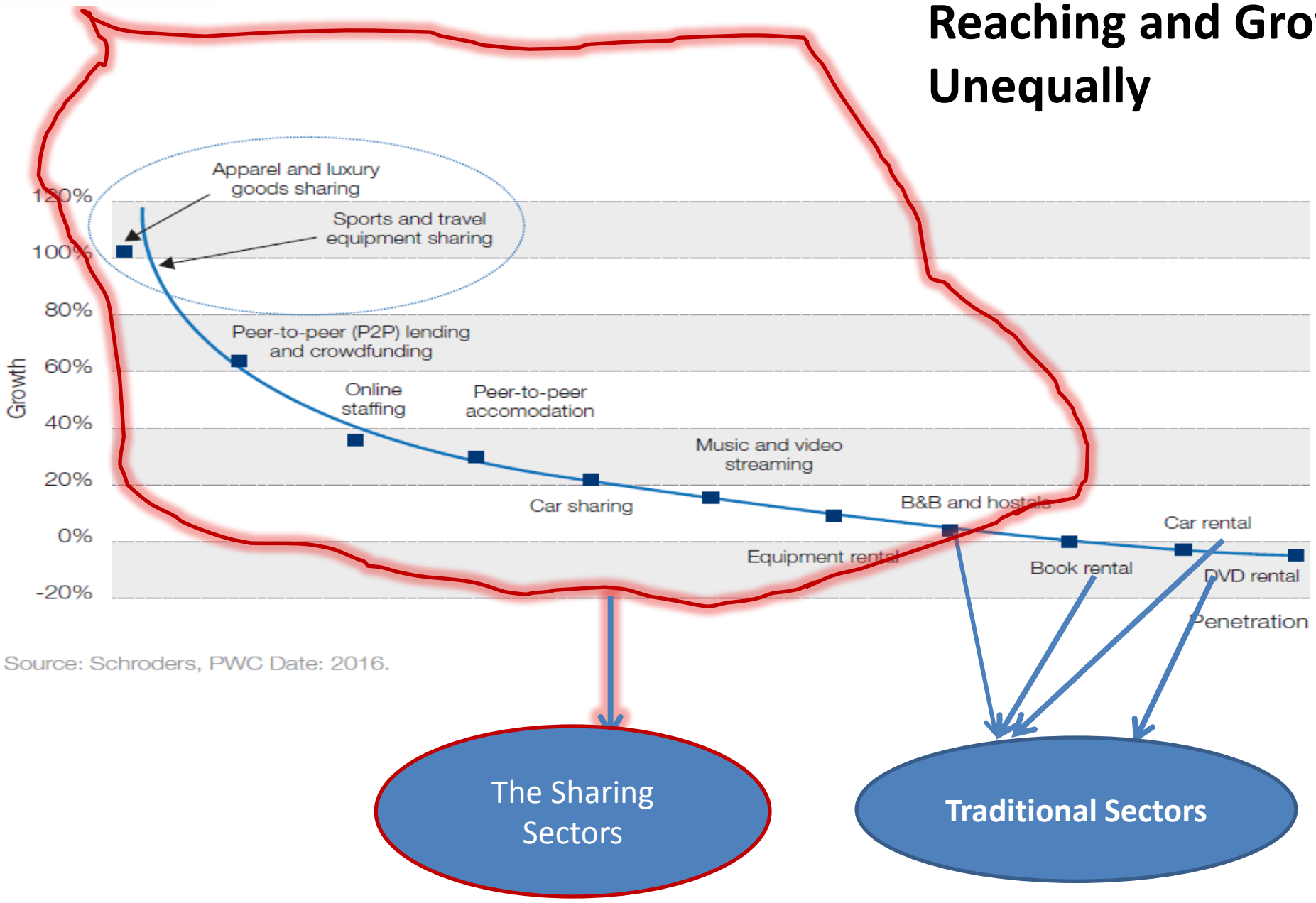
Where does the Sharing Take Place ?

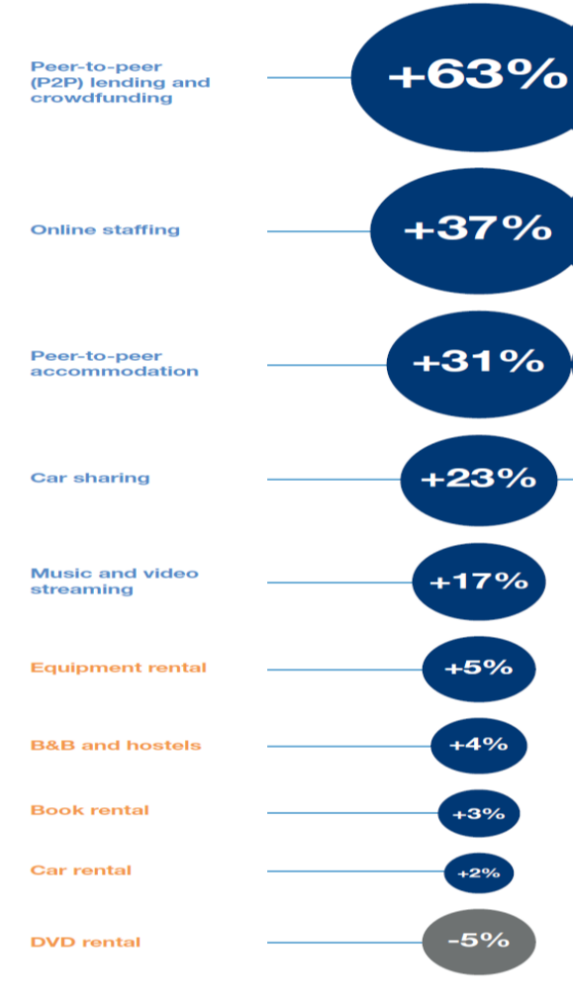


Technology to meet the needs of consumers/users and consumption first and businesses second. Note also the type of 'economies' where the willingness to share own assets and share those of others in stronger. More sharing in emerging economies!

Source: http://www.pwc.co.uk/issues/megatrends/collisions/sharing economy

Reaching and Growing Unequally





Where is the investment going?

Growth in ‘high end’ or moneyed sectors; penetration in ‘low-end’ consumer sectors

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Now and trends

90% of the data in the world has been created in the last 2 years alone

45% of the fastest-growing companies will have fewer employees than instances of smart machines by 2018

Global traffic to cross **100 Zettabytes** annually by 2025

Customer digital assistant will recognize individuals by face and voice across channels and partners by 2019

Platform technology simplifies complexity in huge networks of information (1 app can reach **over 400 million** iOS devices)

300 M European Union residents will use urban platforms by 2025

Global 3D printing market will grow to **$7,1 billion** by 2020

Global Big Data market to generate a revenue of over **$122 billion** by 2025

50 Billion things will be connected to the IoT by 2020

Smart cities to create huge business opportunities with a market value of **$1.5 Trillion** by 2020

Over 40 M electric vehicles will be sold annually around the globe by 2020

2 million employees will be required to wear health and fitness tracking devices as a condition of employment by 2018

50% of urban residents is able to share their data to improve their city mobility

81% of the inquired people in China, India, Singapore and Brazil would like to use an app to monitor daily route and traffic options

Over 40 Global Cities to be SMART Cities in 2020

Smart city technologies are seen as a mean to achieve better personal mobility solutions

Autonomous software agents will participate in **5%** of all economic transactions by 2020

Connected Living Total Market: **$730 Billion** in 2020

95% of cloud security failures will be the customer's fault through 2020

Connected living, Big Data Clouds and Smart cities to be the top transformational shifts by 2020

20% of smart buildings will have suffered from digital vandalism by 2019

Frost and Sullivan, Frost and Sullivan, Gartner

Q.10:

a) **What are the challenges and where are the opportunities?**
b) **b) How can we avoid being ‘unsmart’?**

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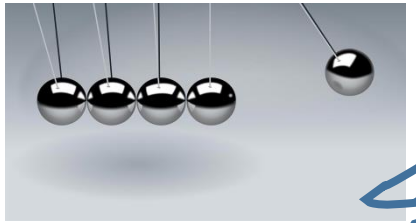
Towards An intelligent/SMART Ecosystem of Innovation

Challenges

Smart Development

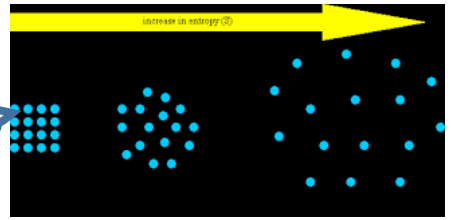


Information/Energy

Demographic dividend

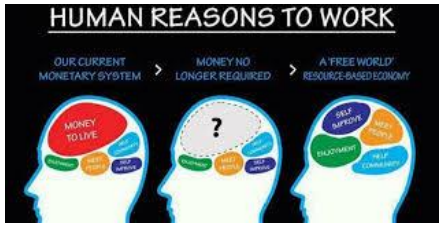
Inequality

Stagnant Growth



Entropy

Demographic deficit



Basic Income

Opportunities?

Image sources: piersonwireless.com/economictimes.indiatimes.com/kentchemistry.com/financialtribune.com/tofugu/socialeurope.eu

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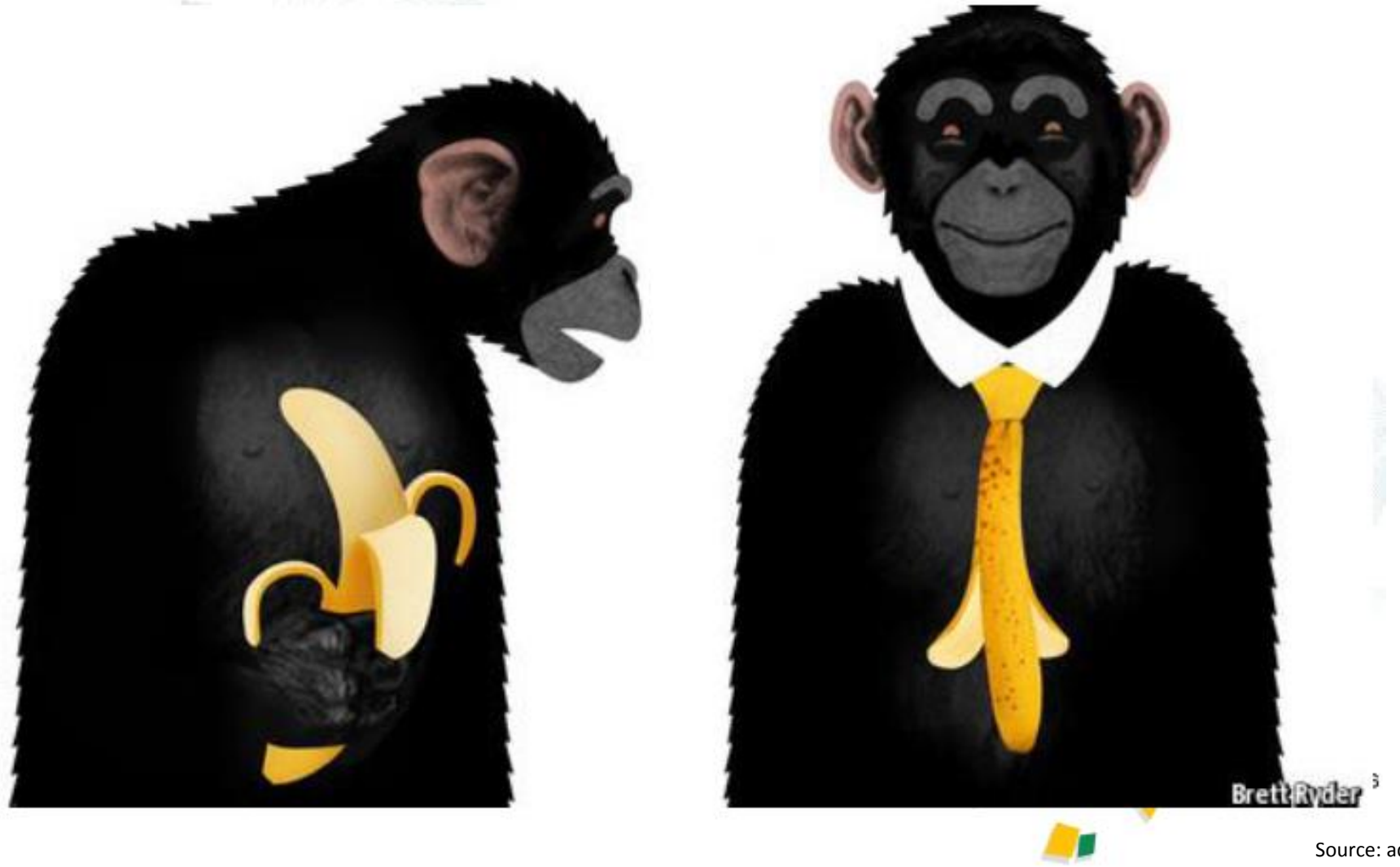
But Be Aware Of Being Too Smart About Innovation!



Source: adapted from Karuna Gopal, 2016

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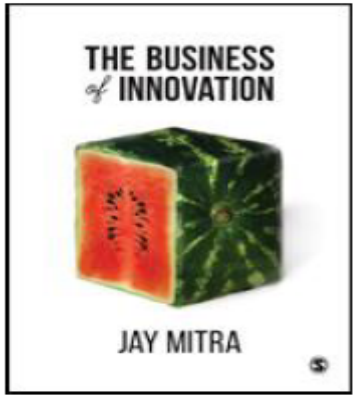
Self- Promotion!

SAGE Publishing



The Business of Innovation

Jay Mitra - University of Essex, UK

April 2017 | 336 pages | SAGE Publications Ltd

Format	Published Date	ISBN	Price
Paperback	29/04/2017	9781446210819	£34.99
Hardcover	29/04/2017	9781446210802	£90.00

The Business of Innovation focuses on what innovation means for businesses and what businesses can do to explore, drive and manage innovation. Moving beyond the narrow confines of a "how to" of innovation management, it covers the ways in which business innovation relates to people, organizations, management, systems, processes, measurement and government policy.

Featuring a series of vignettes throughout, the book sets out to track, trace and provide testimonies of the variety of innovation among diverse groups of people in organisational environments across geographical divides. In a time where innovation and entrepreneurship have an increasing role in driving economic value creation, Jay Mitra offers a critical insight into how innovation works, where it works and most importantly, who makes it work.

With a foreword by Zoltan Acs

University of Essex

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