A 400 year old University in the heart of Dublin City Centre

Ireland’s Leading University

Facts and figures

- **17,000** students from **122** countries **11%** are international
- **2,500** staff . . . **40%** of academic staff from outside Ireland
- Library collection has over **6,000,000** items, and provides electronic access to over **30,000** journals

A GLOBAL UNIVERSITY:

- **TCD is ranked 67**\(^{th}\) in the World and **21**\(^{st}\) in Europe across all indicators (QS World University Ranking 2012)
- **TCD is ranked 16**\(^{th}\) in the World in terms of International Outlook (Times Higher Education World University Ranking 2012)
- **TCD is ranked 33**\(^{rd}\) in the World in terms of International Faculty (QS World University Ranking 2012)
- **TCD is ranked 38**\(^{th}\) in the World in International Collaboration (2011/2012 Leiden Ranking)
• TCD is ranked 44th in the World in terms of Research Impact
  (Citations - Times Higher Education Ranking of World Universities 2012)

• TCD ranks in the top 1% of research institutions in the world in 18 fields of Science & Technology
  (Source: Thomson Reuters Essential Science Indicators, January 2013 update)

• TCD is 63rd in the World and 10th in Europe in Research Performance alone
  (Leiden University Ranking of World Universities, December 2011)
• TCD has been involved in the FP since its inception

• TCD has a ranking of 82nd in Europe in the programme of the top 250 beneficiaries (November 2011)

• TCD had 146 FP7 research projects covering topics from security, telecommunications, health, environment and agri-food to energy
  – Value to TCD € 60,728,220
  – Total value of projects € 505,497,966
  {Figures from Enterprise Ireland (from the start of FP7 up to June 2012}

• TCD ERC awards: 8 starting grants and 5 advanced grants ( results known as of February 2013)
TRINITY’S RESEARCH THEMES

AGEING
CANCER
CREATIVE TECHNOLOGIES
DIGITAL HUMANITIES
IDENTITIES IN TRANSFORMATION
IMMUNOLOGY, INFLAMMATION & INFECTION
INCLUSIVE SOCIETY

INTERNATIONAL DEVELOPMENT
INTERNATIONAL INTEGRATION
INTELLIGENT CONTENT & COMMUNICATION
MATHEMATICS OF COMPLEXITY
NANOSCIENCE
NEUROSCIENCE
NEXT GENERATION MEDICAL DEVICES
SUSTAINABLE ENVIRONMENT
TELECOMMUNICATIONS

SMART & SUSTAINABLE CITIES
Urban Population Growth

By 2050, ~70% of population will live in cities

World Health Organisation
Urban Sprawl

Negative impact on transportation and CO₂ emissions
Negative impact on cost of public services

“Cities of Tomorrow”, European Union Regional Policy, 2011
In 2007, congestion induced economic losses in Dublin were 4.1% of GDP

“Smarter Cities for Smarter Growth”, IBM Institute for Business Value, 2010
Premature Deaths:
Increase ~150 per million (in 2000) to ~390 per million (in 2030)

OECD, 2008
Ecological Footprint

World uses 50% more resources than can be sustainably produced. High-income countries average five times that of low-income ones.

“Living Planet Report”, WWF, 2012
Smart Cities
- Big data acquisition
- Big data management
- Big data mining
- Middleware
- ITS
Existing Smart Cities Research

**Smart Cities**
- Big data acquisition
- Big data management
- Big data mining
- Middleware
- ITS

**Not enough for Future Smart Cities**
- Using the data
- Behavioural change
- Closing the loop

**INFORMED DECISION MAKING + CONTROL**
City resource usage optimised through automated, collaborative decision-making and control
Example: Roads are a Shared Resource

- Increase in demand for road transportation

- The problem:
  \[ \text{demand} > \text{supply} \implies \text{congestion} \]

- Expand the road network?
  - Build new roads to increase the supply
  - Infeasible in the long term

- Demand management
  - Ramp metering
  - Route guidance

- Supply management
  - Variable speed limitations
  - Lane control measures
  - Incident detection
Example: Roads are a Shared Resource

- **Flexible**
  - Only used when needed
  - Bottleneck
  - Merging
  - High demand

- **Scalable**
  - Loosely-coupled
  - Slot abstraction

- **Focus on traffic management and optimisation**
  - Applied to various scenarios

**Guaranteed Arrival Times**
Trinity Smart and Sustainable Cities Research Centre: Multi-Disciplinary

Computer Science and Statistics

Engineering

Health Sciences

Smart and Sustainable Cities

Business

Law

Social Sciences
Data Fusion
Integration of heterogeneous urban data sets

Gamification

Citizen Centric Services

Green City Map
Highlight initiatives, resources and events

Fixed Sensing
Sensors are fixed at a place in the environment (e.g., meteorological sensors, CCTV)

Opportunistic Sensing
System dynamically selects a sensor to collect data (e.g., temperature sensor on a smart vehicle)

Participatory Sensing
Citizen Mobile devices

Open Government Data

Scalability
Trust
Security
Standardization
Interoperability
Innovation Sandbox

Application of science to multiple City domains
Mobility, Energy, Water, and cross-domain integration
Thank you.

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