Paving the Way for
Complexity & Data Science research in Aviation

Data Science in Aviation Workshop

8 September 2016, EASA HQ, Cologne

About Innaxis

Non-profit research organization

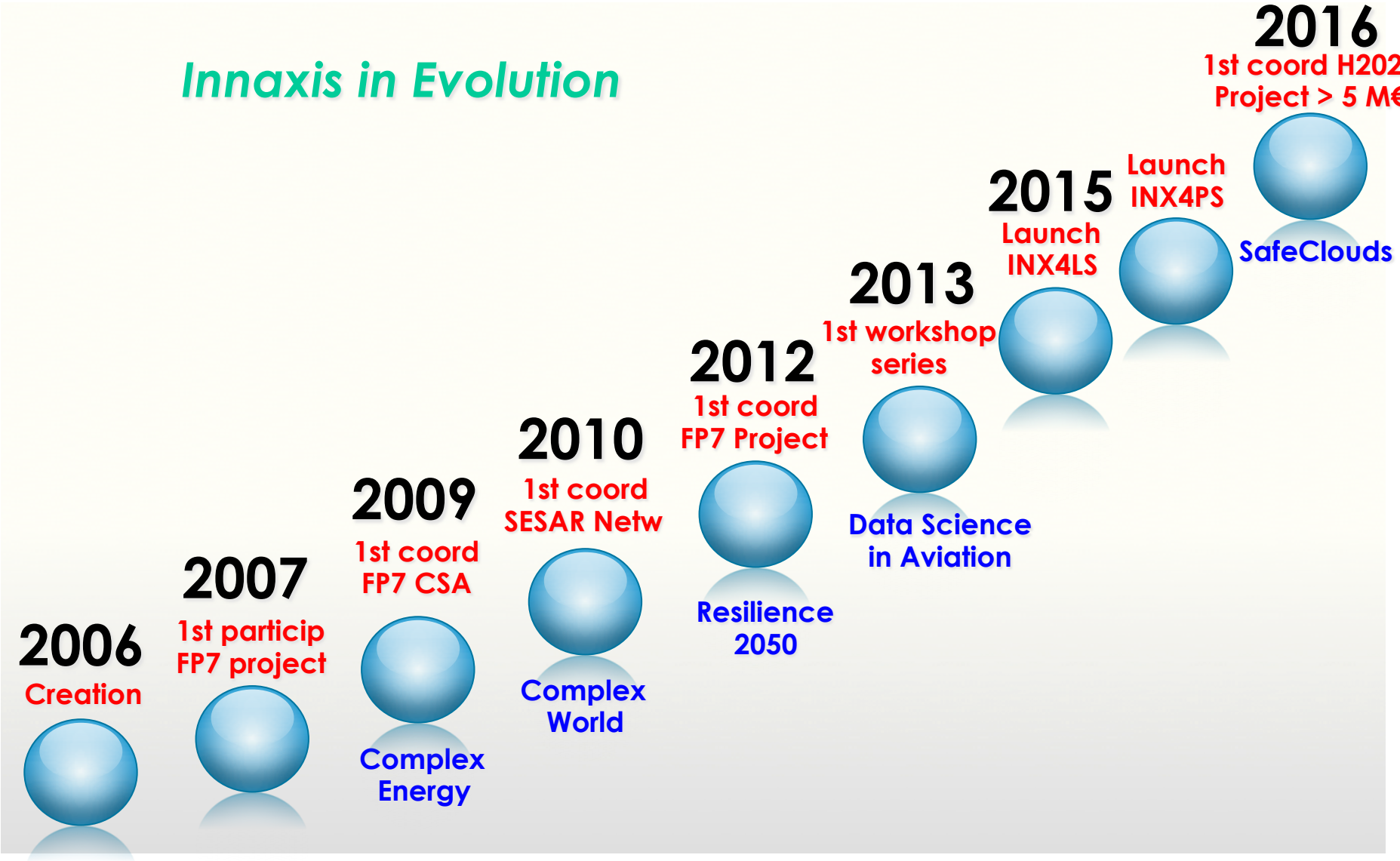
Founded 2006

Strong experience in EU-funded collaborative projects
Also as **coordinator**

Complexity theory and domain-specific applications
New modelling techniques (complex networks, agent-based,…)
Network-centric perspective, new metrics
Data science, data-driven creation of knowledge

25 european projects with academia, industry, public admin
300 scientific papers and deliverables
35 scientific events organized

Innaxis in Evolution



Research network

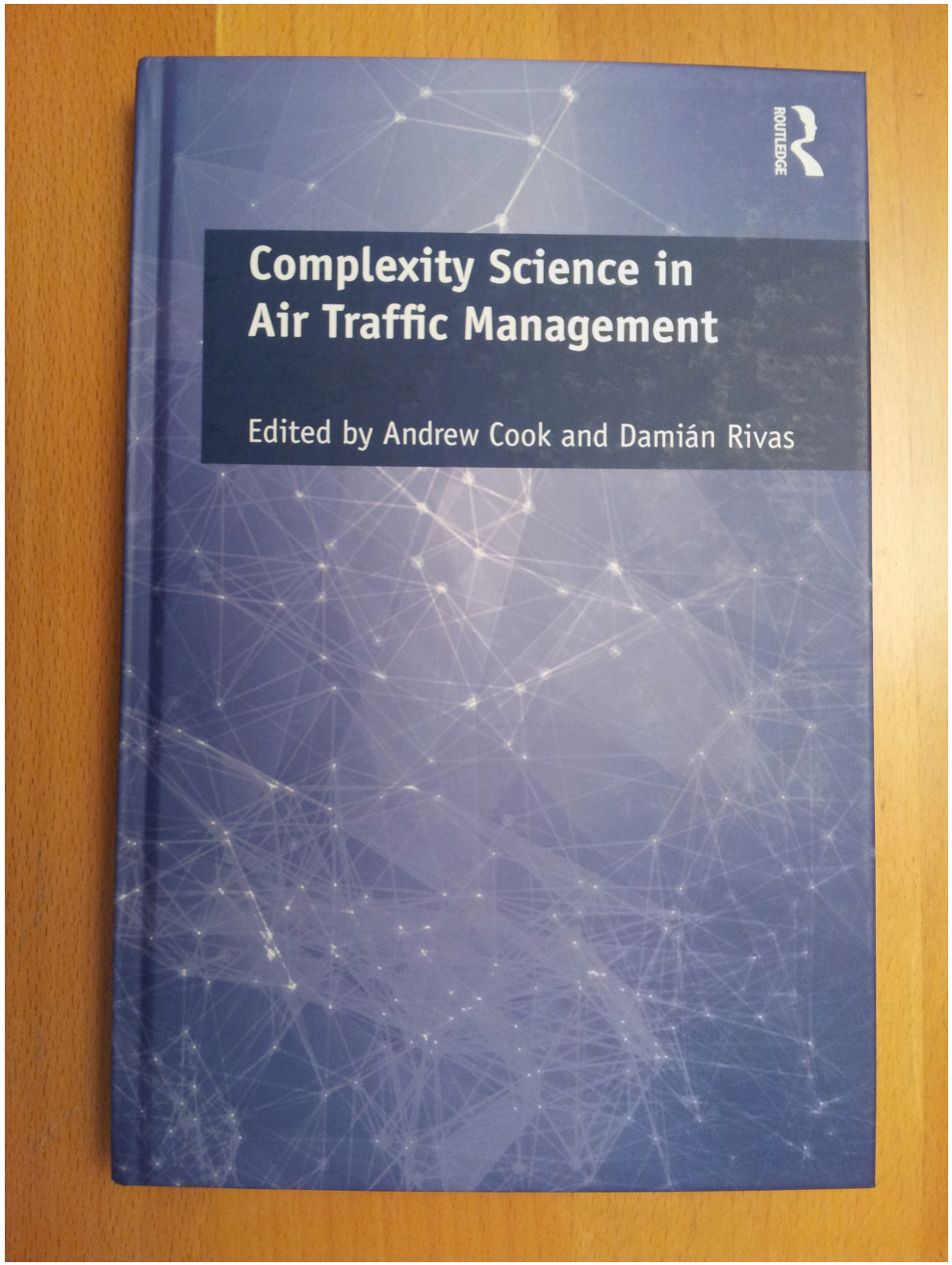
Started 2011. Budget 1,5 M€
3 Universities (Sevilla, Westminster, Palermo) + DLR + NLR
Coordinated by Innaxis

Resilience
Uncertainty
New metrics
Emergent behaviors
Complex data analysis > **Data Science** > **DSIAW, 4th Edition**

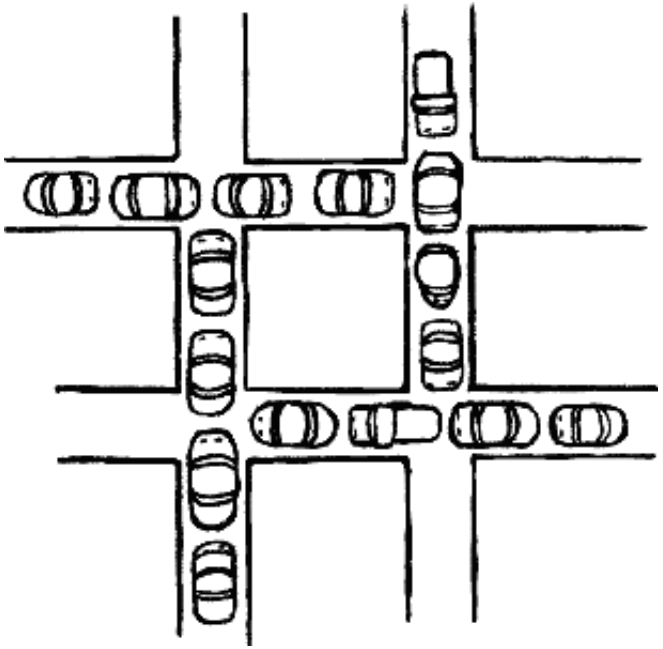
8 PhDs / Wiki / 20 events / Book
http://complexworld.eu/wiki

Report **"Complexity Challenges in ATM" tomorrow**

Buy the book ! ☺


ROUTLEDGE
Complexity Science in
Air Traffic Management
Edited by Andrew Cook and Damián Rivas

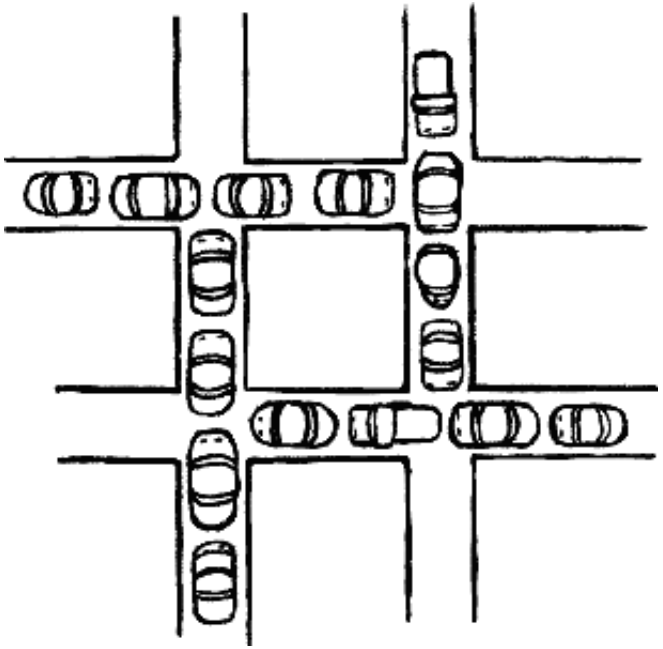
Data: opportunity or nightmare ?



Data: opportunity or nightmare ?

More data
New tools
New science

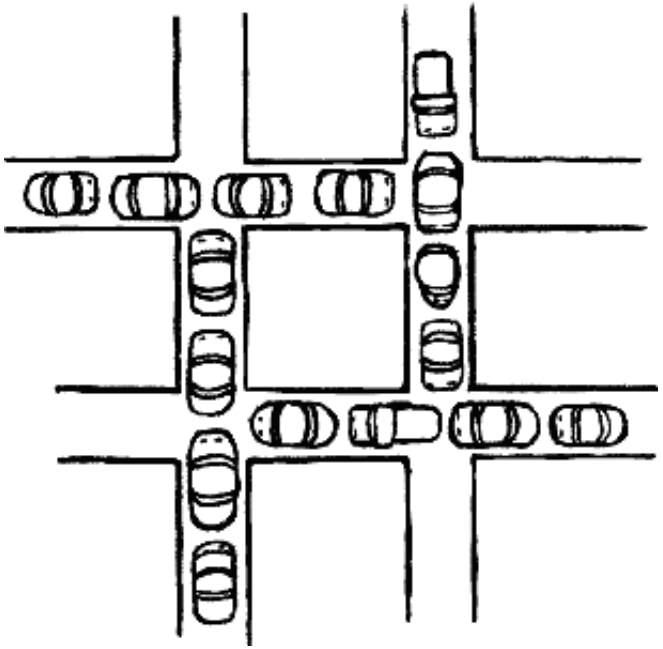
Multiple sources
Internal/External
Unstructured




Analytics
Teradata
Insight
NoSQL
GreenPlum
Google
distributed
BigQuery
Netezza
Terabyte
HBASE
databases
Facebook
ebay
Mobile
MangoDB
Structured
Data
Cloudera
Hadoop
filesystems
MapReduce
Realtime
DBMSs
Petabyte
Social
Apps
Big
amazon
Sensor
Pig
Deep
columnar
Exabyte
Exadata
Oracle
Linkedin
Hive
Sentiments
Twitter
Unstructured
HANA

Data: opportunity or nightmare ?

More data
New tools
New science

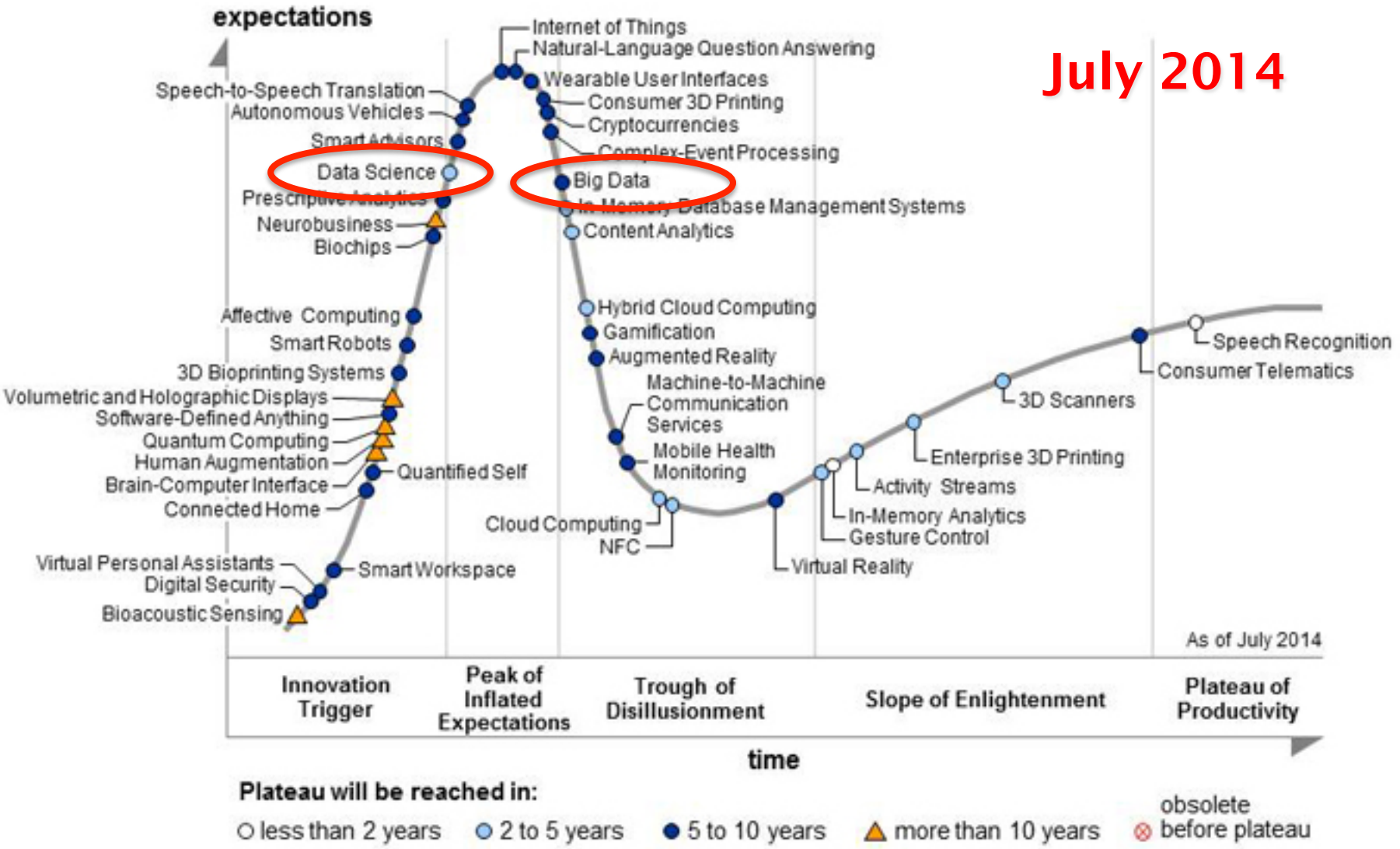


Vendor hype

Everybody sells
Big Data solutions

Do Big Data or die !! (once more)

Data: opportunity or nightmare ?



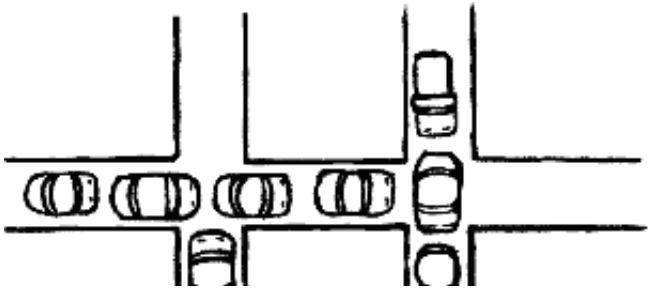
Data: opportunity or nightmare ?

July 2015

Big Data has disappeared !

Data: opportunity or nightmare ?

More data
New tools
New science

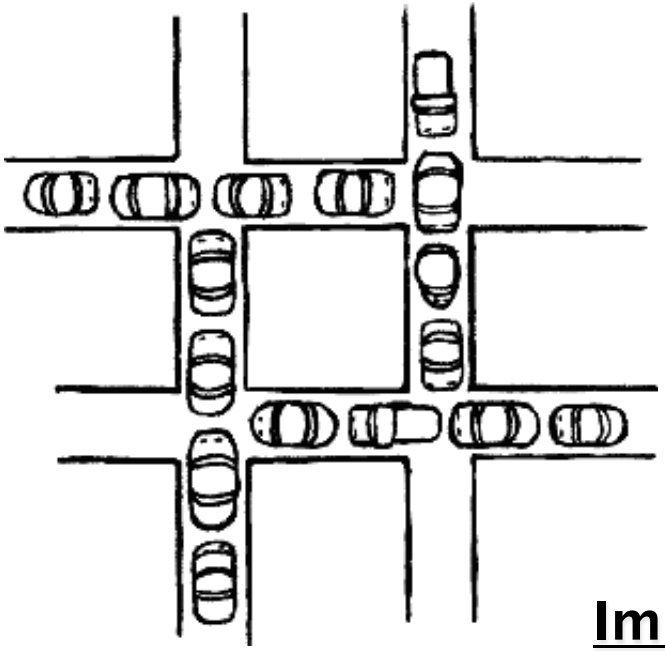


Vendor hype

Back to basics: serving organizations with specific purposes (other than buying from vendors)

Data: opportunity or nightmare ?

More data
New tools
New science



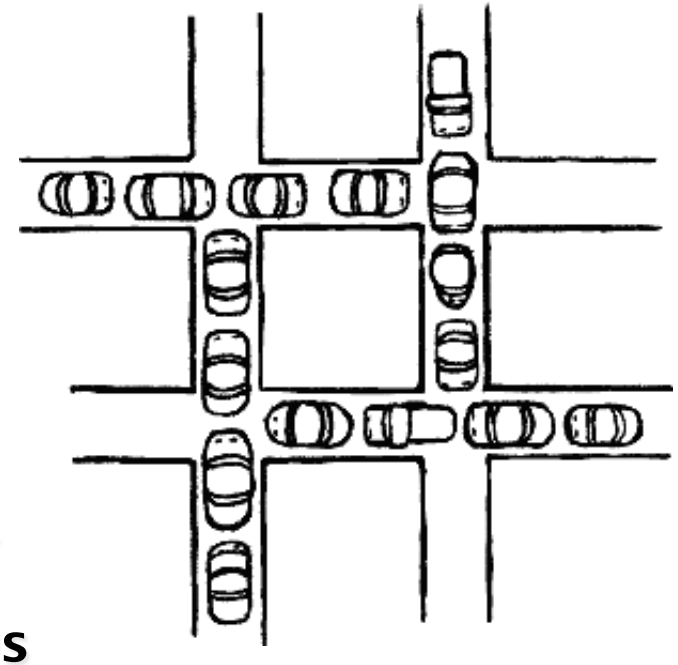
Vendor hype

Technical challenges

Implicit knowledge
Access: right data, right time, right format
Data quality
Silos, proliferation

Data: opportunity or nightmare ?

More data
New tools
New science



Business & IT
> Purpose
Communication
Faster timing
More stakeholders
Digital business ?
Organization: CDOs

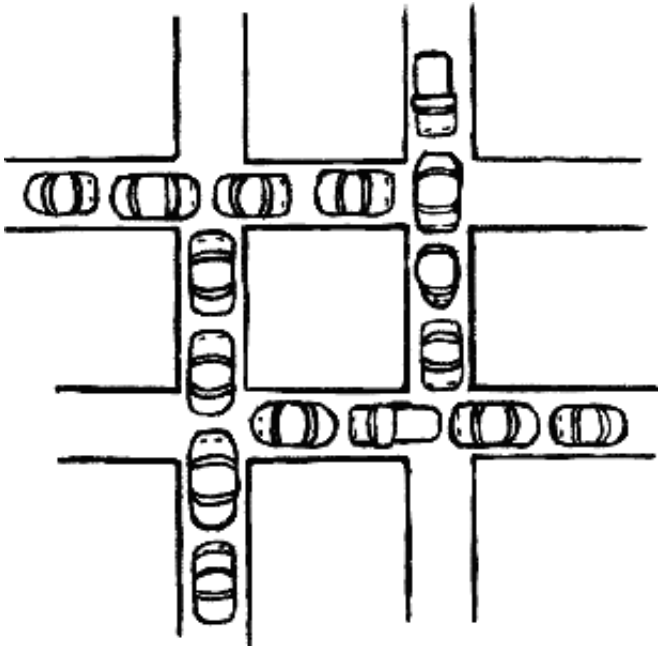
Vendor hype

Technical challenges

Data: opportunity or nightmare ?

Greater complexity !!

More data
New tools
New science

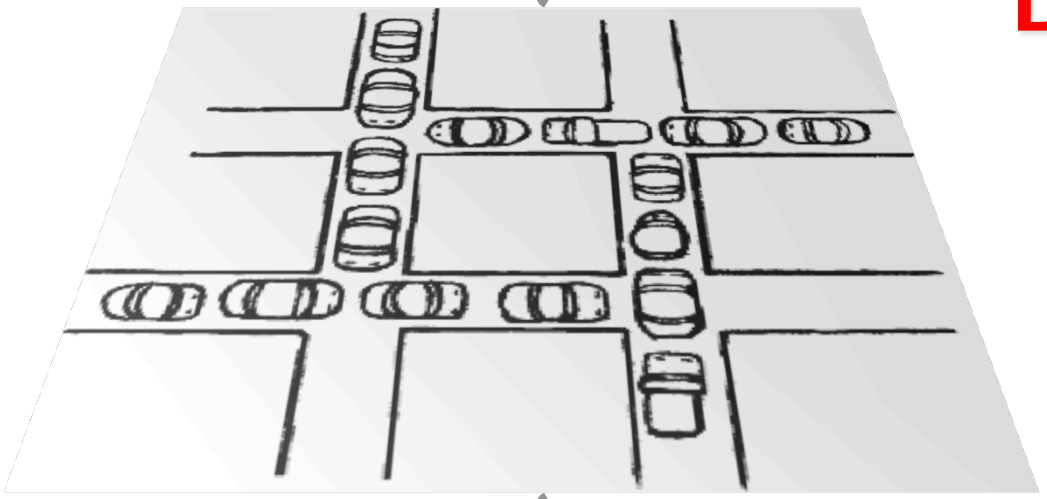


Business & IT
> Purpose

Vendor hype

Technical challenges

Data: opportunity or nightmare ?



Emergent approach

Data on Purpose

Failure to deal with complexity

Data on Purpose

A (very) **bold hypothesis**: the growth in data, tools and science enables going from descriptive to prescriptive
> **Making the world more manageable**

Our vision:
this hypothesis is **generally FALSE**
(more complexity reduces predictability and controllability) but can be
made TRUE in specific contexts and scales

Two big risks

Dimensionality

Framing

Two big risks

Dimensionality

Every big challenge has infinite dimensionality

Every human (or artificial) action to understand is based on reducing dimensionality to a practical size

Two big risks

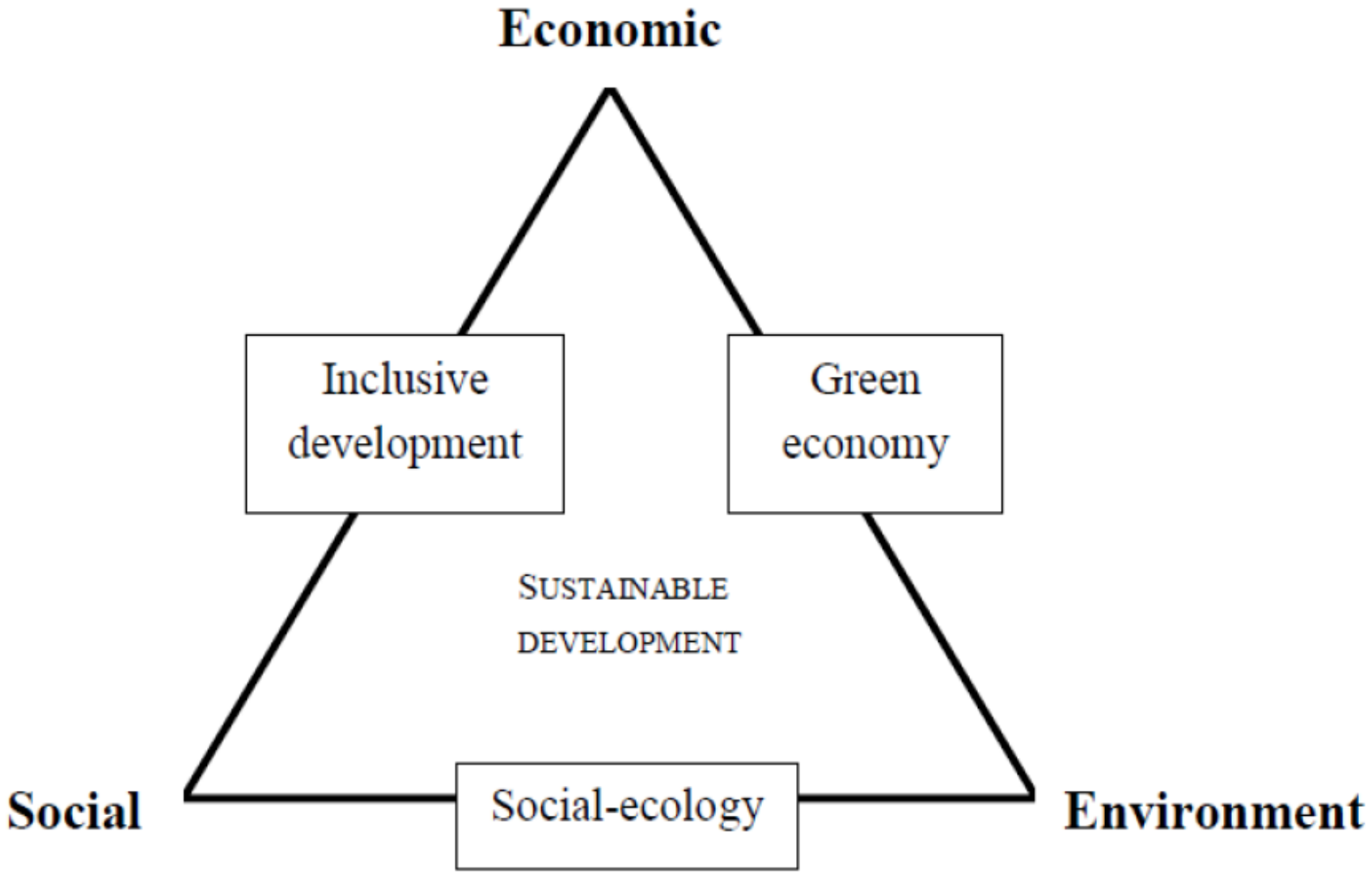
Framing

Every analysis is based on a certain representation of reality

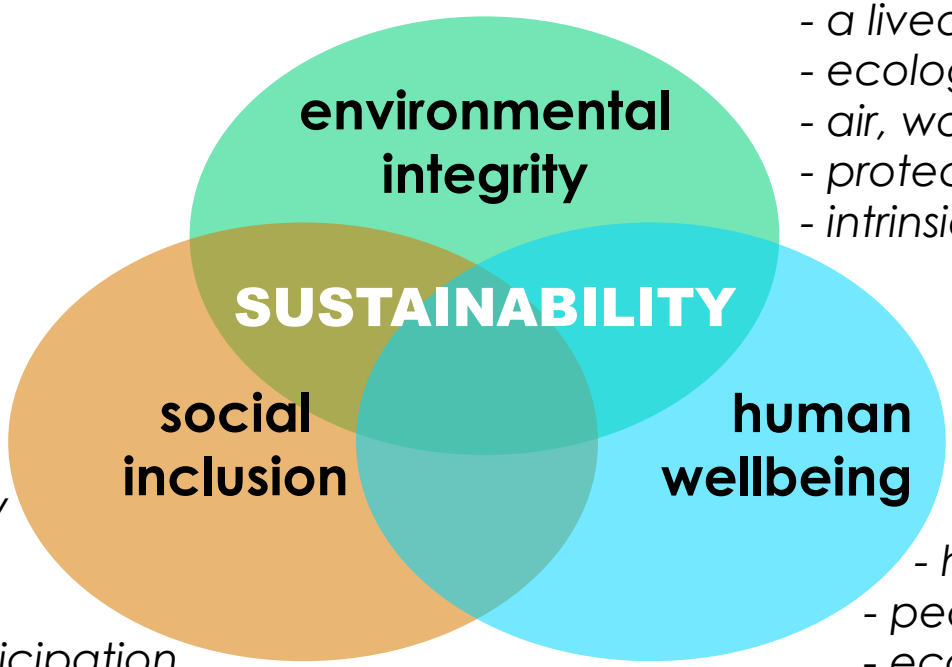
Every representation is based on some kind of modelling (implicit or explicit)

Every modelling is derived from some theoretical assumptions about reality (implicit or explicit)

From a wrong framing…



…to relevant purposes



- *a liveable climate*
- *ecological balance*
- *air, water and soil quality*
- *protection of biodiversity*
- *intrinsic values of nature*

- *global equity*
- *political equality*
- *shared interest*
- *common action*
- *community participation*

- *poverty elimination*
- *livelihood security*
- *health and education*
- *peace and nonviolence*
- *economic development*

Ref. Andy Stirling "From Knowledge Economy to Innovation Democracy", Nov 2014

11:15-12:15	Data Science for Aviation Safety	David Pérez, Innaxis	Data-driven research addressing aviation safety intelligence
		Pablo Hernández Coronado, AESA	Safety Intelligence
12:15-13:30	Lunch break		
13:30-14:30	Data Science for Air Navigation	Jacky Civil, UK NATS	An ANSP's use of a Business Intelligence Warehouse
		Sebastian Wangnick, Eurocontrol-MUAC	Data analysis of the effects of occupancy variability on ANSP operational sector productivity at MUAC

14:30-15:30	Data Science for Mobility	Samuel Cristobal, Innaxis	Data for a seamless European traveling in 2050
		David Scarlatti, Boeing	Big Data Analytics for Time Critical Mobility Forecasting
15:30-16:00	Coffee break		
16:00-17:00	Tools for Data Science	Jens Krueger, Fraunhofer ITWM	Technologies for High Performance Data Analytics
		Christophe Hurter, ENAC	Interactive Multidimensional Data Exploration with Image-Based Visualization.
17:00-17:30	Wrap up and closing	Carlos Alvarez Pereira, Innaxis, President	
17:30-19:00	Networking cocktail		

www.innaxis.org

Carlos Álvarez Pereira calvarez@innaxis.org
David Pérez Mendoza dp@innaxis.org
Paula López-Catalá plc@innaxis.org
Samuel Cristóbal sc@innaxis.org