POLITECNICO
MILANO 1863

Quali Hub per la Ricerca Scientifica e Tecnologica? Riflessioni su MIND-HT

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I. Introduction

II. Human Technopole within MIND

III. Research Hubs and Computational Sciences: A Case Study

IV. Conclusions

Human Technopole within MIND

MILAN
THE ECOSYSTEM

MILAN
THE ECOSYSTEM

MIND – Milano Innovation District is a new city district. A new ecosystem fostering collaborative innovation to create **social, cultural and economic growth**.

The area of over **1 million sqm** is part of a network connecting **worldwide innovation districts**, including Silicon Valley and the Cornell Tech Campus in New York.

ACADEMIC

University of Milan
scientific faculties: 18.000
students, 1.800 researchers

CLINICAL

New **Galeazzi research and treatment hospital**:
16 floors, 150.000 sqm

CORPORATE

117 companies & startups
have sent a proposal
to set up their HQs

MIND

3 PUBLIC ANCHORS

- 600 beds / 9.000 people/day
- 1.500 researchers/ 7 research centres
- 20.000 students and staff

480.000 mq

THEMATIC PARK

FUTURE CITY

partnership with
LendLease

MIND: The Partnership

Arexpo is the firm that owns the site of more than 1 000 000 m² that hosted Expo 2015. The company's mission is to transform the area into an international park of science, knowledge and innovation.

Lendlease, is a leading group in the infrastructure and real estate sector that operates in four continents: Australia, Asia, America and Europe. Lendlease's vision is to create the best places to inspire and enrich the lives of people around the world

Arexpo partners are mainly public institutions

- Ministero dell'Economia e delle Finanze — 39,28%
- RegioneLombardia — 21,05%
- Milano Comune di Milano — 21,05%
- Fondazione Fiera Milano — 16,80%
- Città metropolitana di Milano — 1,21%
- Comune di Rho — 0,61%

12.741
Employees

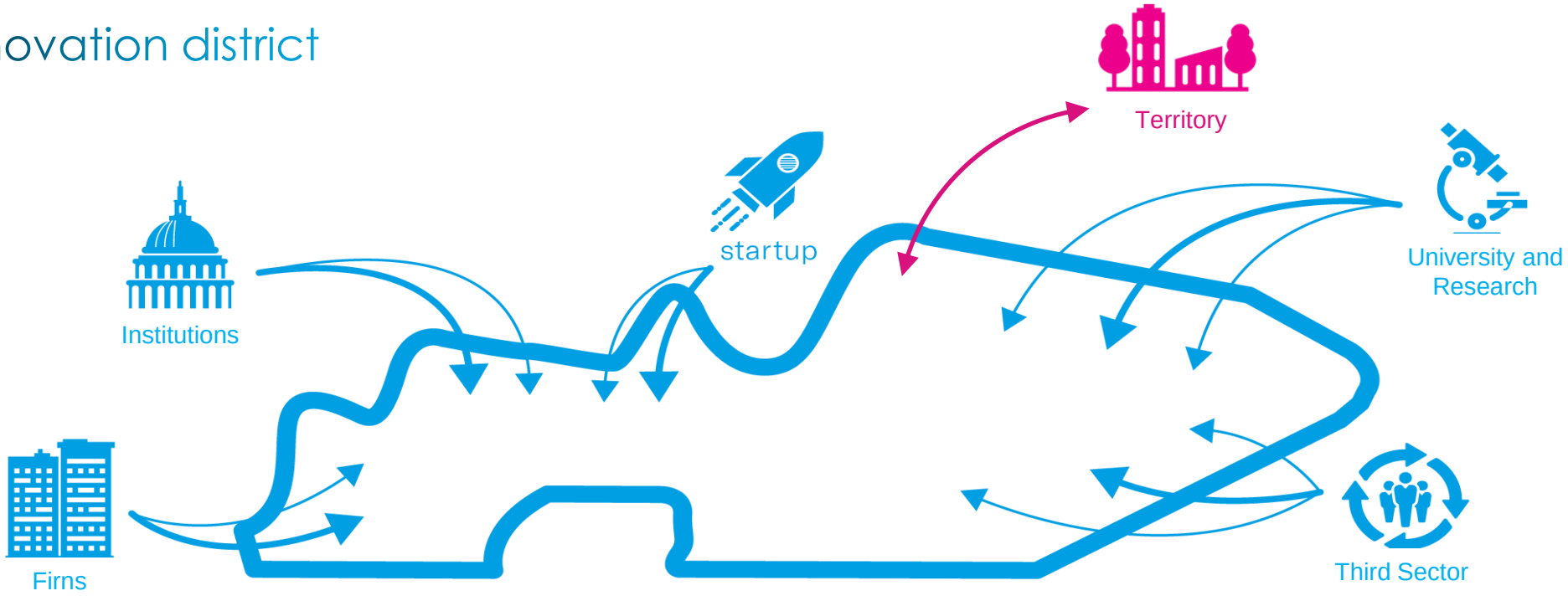
9.6 bn
Capitalization

57.442
Shareholders

56.7 bn
Real estates in the portfolio

The Vision

The innovation district



A new way of living

Stimulate integration

living lab

Living the city

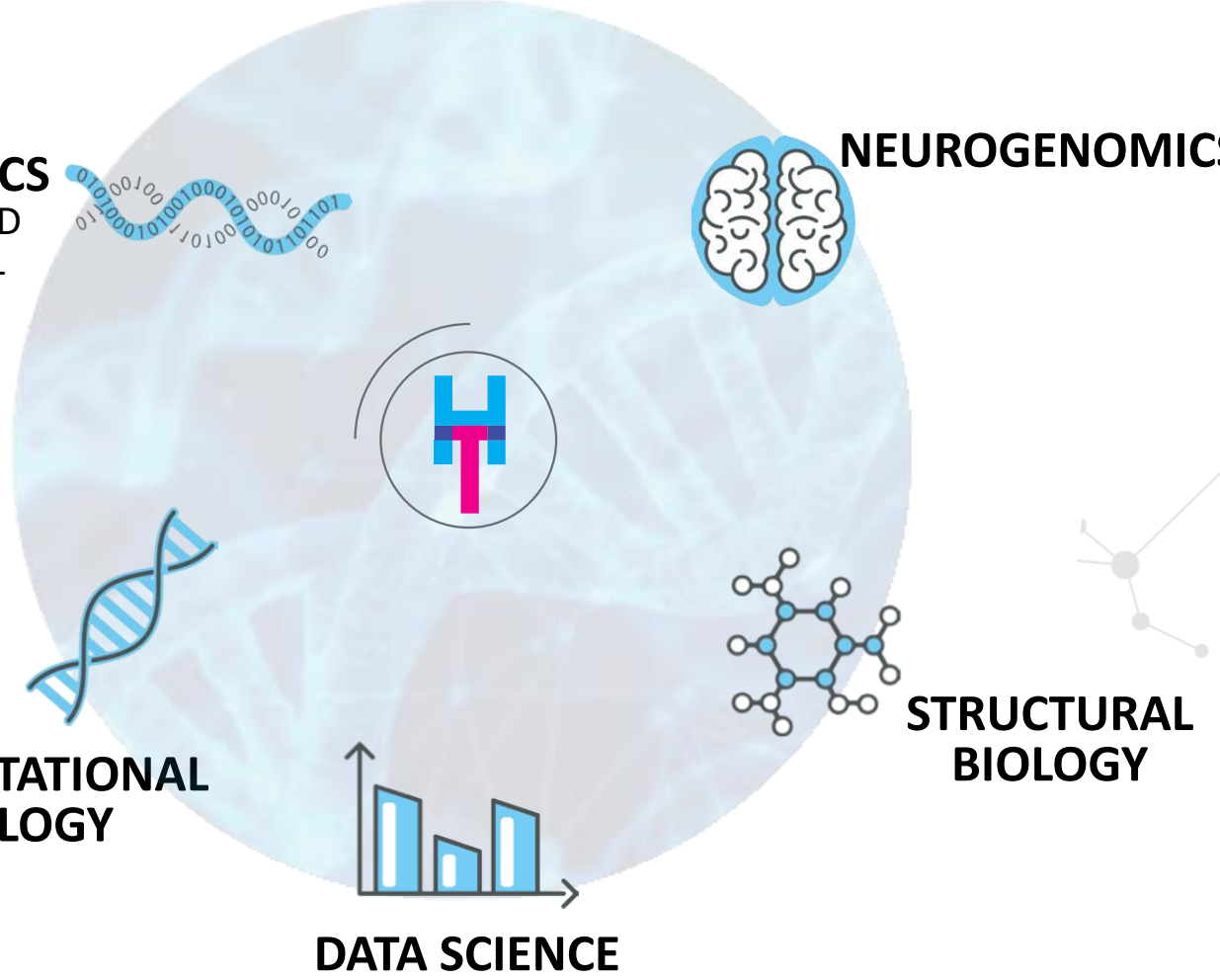
Innovative mobility

Social inclusion

MIND

Human Technopole

- Promote human **health and well-being**
- Develop **personalized approaches** to tackle diseases
- Apply an **interdisciplinary approach** to human biology



FACILITIES

Cryo-EM user facility for high resolution molecular structure determination. A technique that studies samples cooled down to cryogenic temperatures.

A **genomics facility** to develop, set up and implement essential technologies: DNA/RNA sequencing, support large scale studies by HT researchers and nationwide screening initiatives.

Data storage and high-performance computing to manage **petabytes** to **exabytes** of scientific data.

Visitors programme offered to scientists interested in accessing HT facilities. Selections via a **transparent process** on the basis of project-based applications.

HT CAMPUS

A LARGE SCALE NATIONAL RESEARCH INFRASTRUCTURE

Palazzo Italia

September 2019

Data Centre

End of 2019 – start of 2020

Wet labs – first release

Summer 2020

Microscopy facility

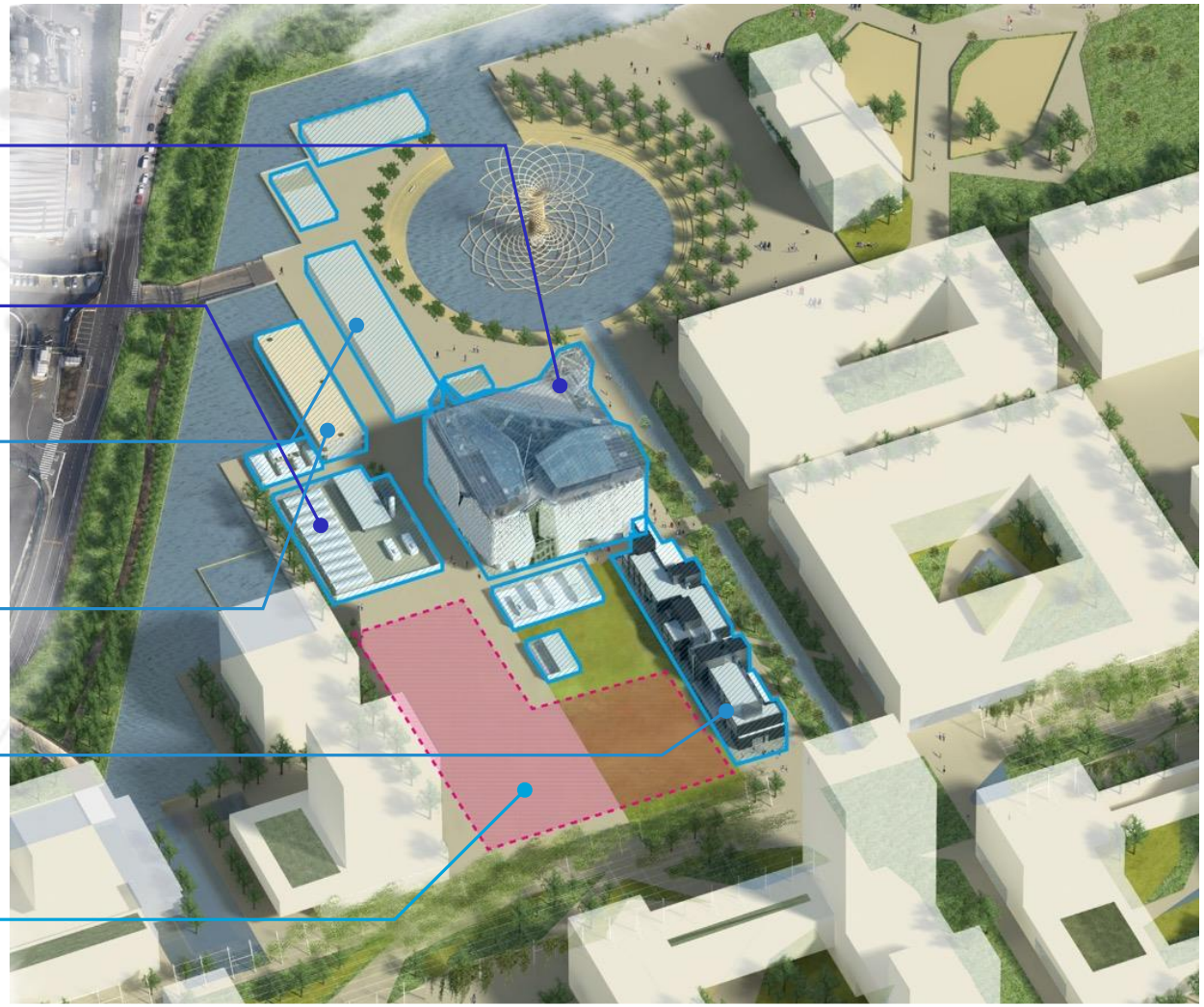
Autumn 2020

Wet labs – second release

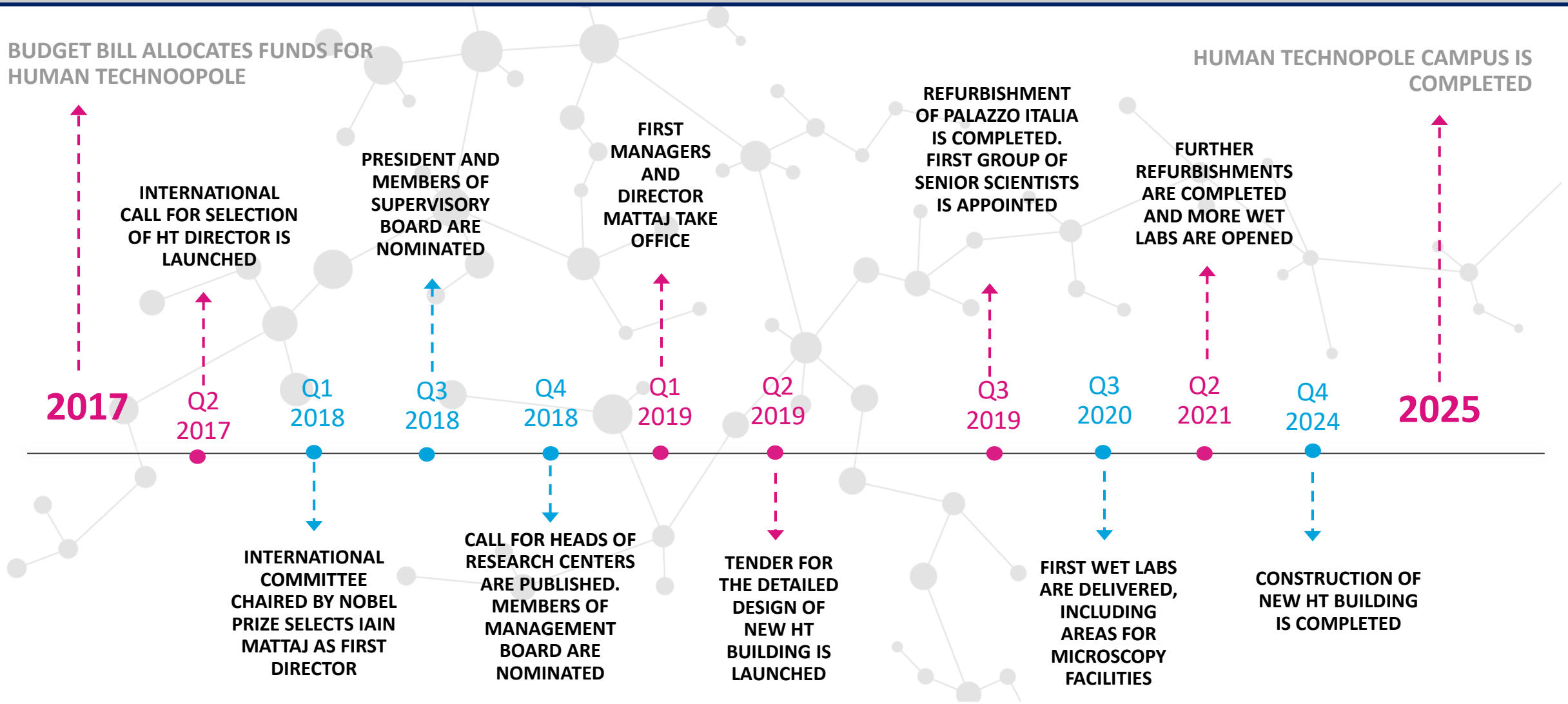
Spring 2021

New building

End of 2024



HUMAN TECHNOPOLE TIMELINE



INTERNATIONAL BENCHMARK

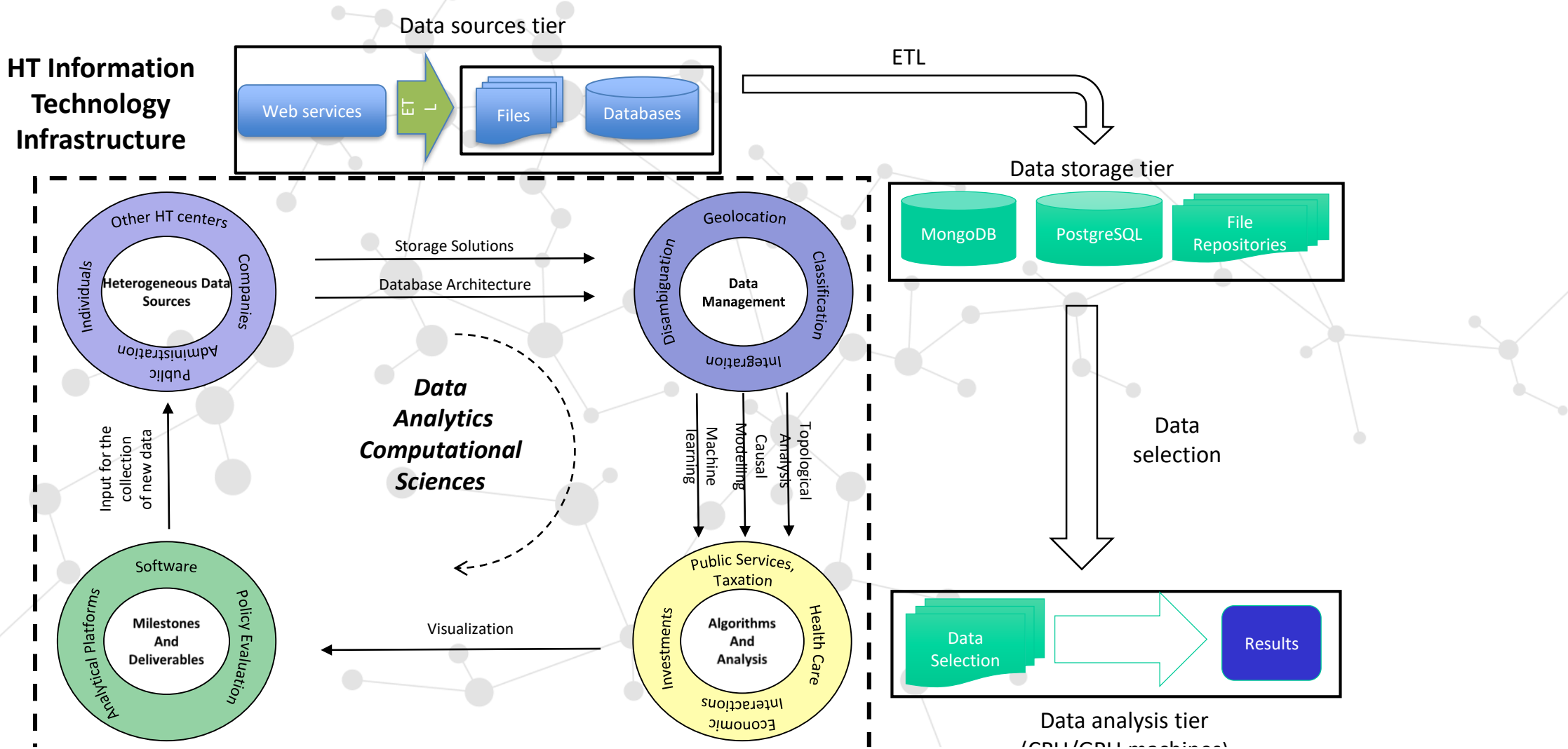
Recent case studies

	Starting year	Type of organisation	Country	Staff	Sponsor
Human Technopole	2016/2017	Foundation	IT	1.400	Government
DEZN	2009	Research center	DE	900	90% Federal, 10% State
The Francis Crick Institute	2007	Consortium	UK	1.500	46% Government, Charities
Wellcome Sanger Institute	1993	Research center	UK	900	Private charities

Which Platforms?

Which Commonalities Across Fields?

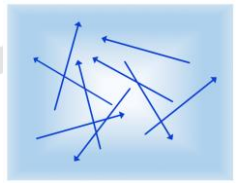
CADS: Center for Analysis, Decisions and Society



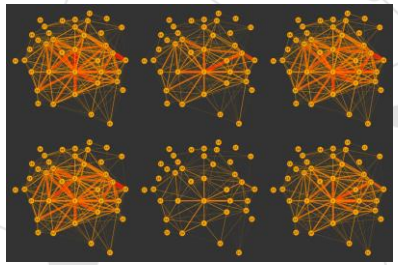
Computational and Methodological Platforms for Integrative Data Analysis

Inferential and predictive tools for complex data

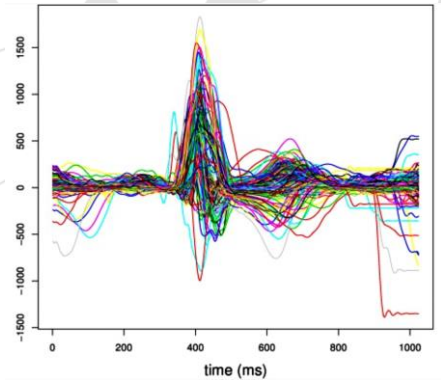
Numbers



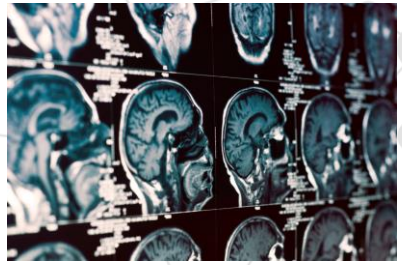
Vectors



Network (Lovato et al. JRSS-C, submitted)



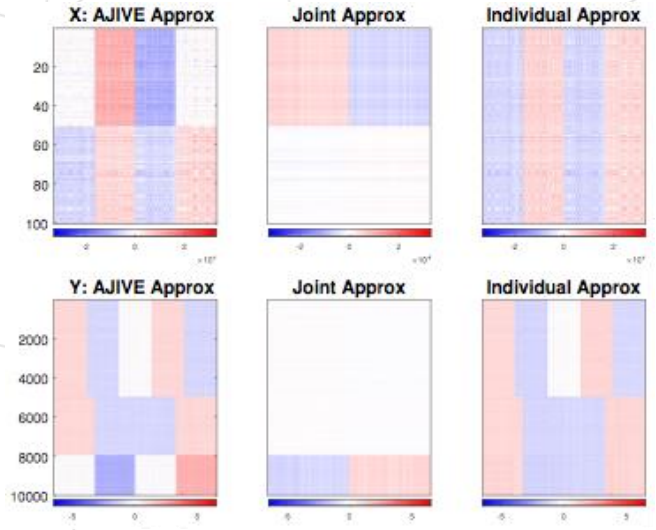
Curves



Images

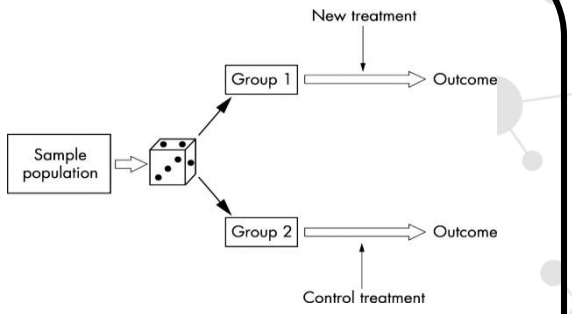
Pini et al., JMVA 2018

Different sources and modalities (imaging, genome, behavioural data, clinical data, etc. Joint variability inherent to underlying conditions, specific variability of each source



Feng et al. JMVA, 2018

Machine Learning and Causal Mechanisms in RW

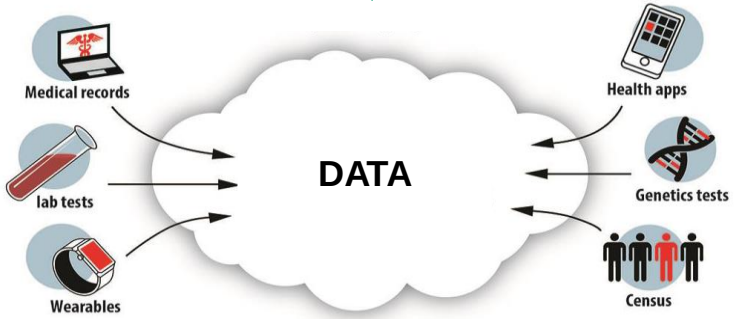


Randomization

Standard clinical experimental design

External validity?

- Uptake by different subpopulations
- Acceptability
- Cost and sustainability



Real-world evidence (RWE)

CADS

Inform (almost) Experimental Design

Monitoring of disease/indication burden in the population

Monitoring of disease status and treatment outcomes

Health Technology Assessment: Cost effectiveness of drugs/treatments in RW

On Computational Social Sciences

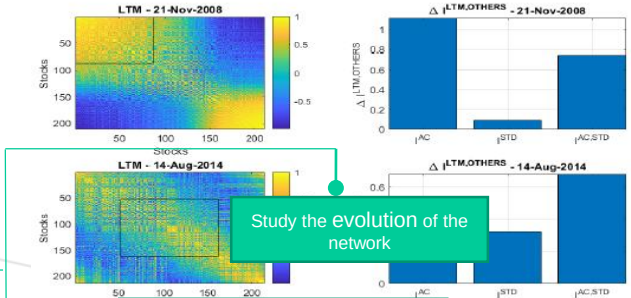
Too Big to Fail

Nodes' importance

Too interconnected to fail

Among Items

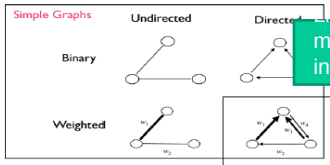
Over Time



Study the evolution of the network

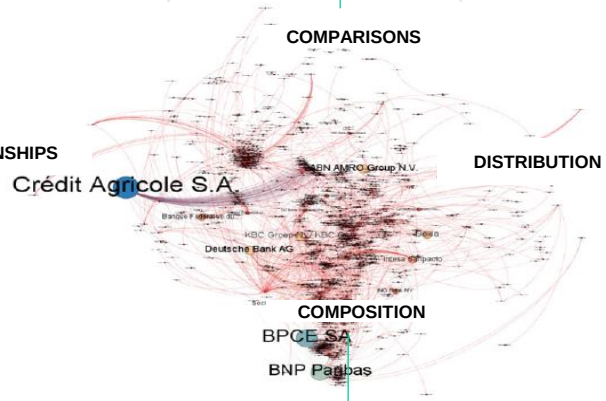
Forecast the dynamic of the system

Networks where nodes are economic agents (individuals, firms, consumers, organizations, industries, countries, etc.)



market interactions.

RELATIONSHIPS



DISTRIBUTION

Identify "structural (topological) properties" of the network sequence, i.e. stable and robust statistical properties of network statistics

Robust yet Fragile

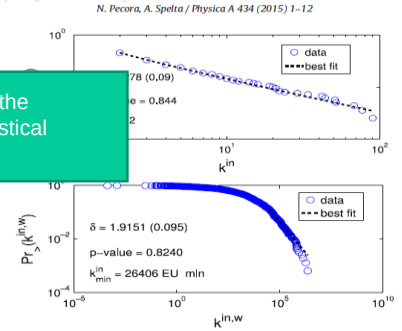


Fig. 3. Cumulative distribution functions and maximum likelihood power-law fits for: k^{in} (top panel) and $k^{in,w}$ (bottom panel).

Writing models to explain why real-world networks are like they are and prove that network structure may influence what goes on in networked systems

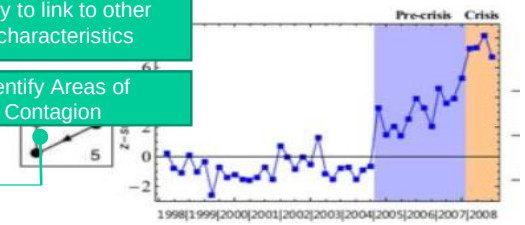
Comparing statistics across different networks

Network Models

Clustering Analysis

Nodes have tendency to link to other nodes with similar characteristics

Identify Areas of Contagion



Discussion

I. Why Computational Sciences? Why Research and Technological Platforms?

II. A Research Hub, a Research Center and a Platform: Challenges

III. Which Functions for the National Research System?