

# University of Essex

## CENTRE FOR COMPUTATIONAL FINANCE AND ECONOMIC AGENTS

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Supporting Crowd-Powered Science in Economics  
FRACTI: A Conceptual Framework for Large-Scale Collaboration  
and Transparent Investigation in Financial Markets

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# Keyword: Knowledge

- How do we “know that we know”?
  - Rule out things considered false based on hard evidences
  - Cumulative: over time, we build new knowledge based on previous knowledge considered to be true
  - This “tapestry” of “known” slowly evolves to encircle the infinite space of “unknowns” based on a path of ever changing knowledge foundations
  - It is all very simple (has been around for ages)
- “How we know” is an evolutionary process
  - Different phases, or “waves”
  - Each “wave” appeared to deal with limitations of the previous wave
  - Organically adjusting to an ever-changing knowledge-base, resources and culture available at different points in history and time

# First Wave: Natural Philosophers

- First forms of scientific investigation relied uniquely on “natural philosophers”. Domain knowledge was related to natural observations and research conducted by individuals
- Individualistic: Given the relative simplicity of subjects individuals could still build on previous knowledge with little or no interaction with other individuals
- Ad hoc collaboration: opportunities for interaction were left to chance and social exchanges
- The proximity with domains of study would allow for self-funding; management of resources is decentralized or in complete isolation

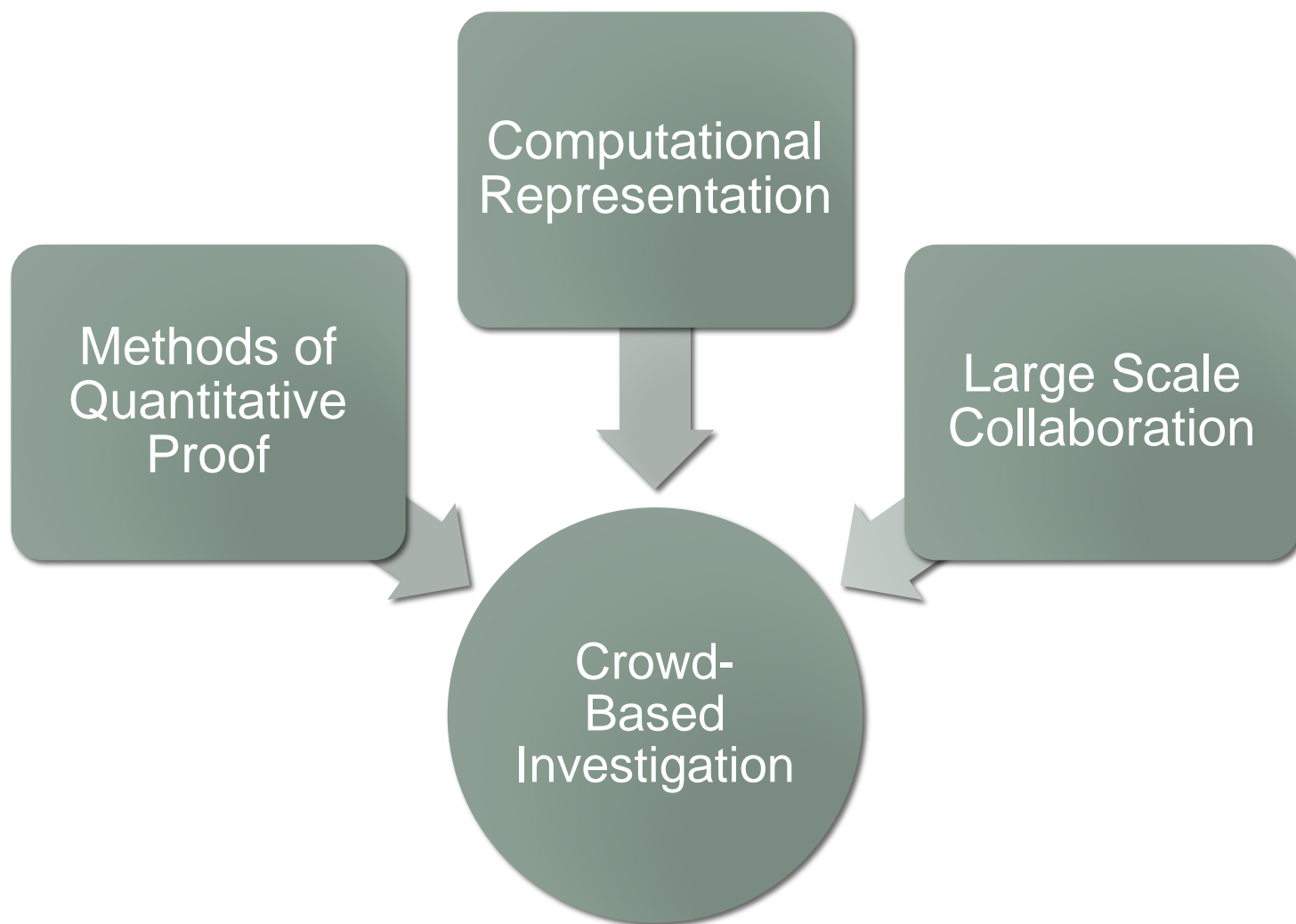
# Second Wave: Institutionalized Knowledge

- As volume of knowledge and complexity started to grow there was an increasing need for resources to properly store and share knowledge
- Means for greater interaction with participants that would not share the immediate geographical surroundings where research was taking place
- Large institutions came to fill the void, manage the vast amount of resources needed for more complex methods, more information and hierarchical communication
- Most scientific procedures evolved to match the hierarchical organization of institutions, production of objective knowledge followed

# Disruption! ... and the “Next Wave”

- Reproducibility and traceability are drifting away...
- Research is mostly driven by creativity, however...
  - Creativity does not match a hierarchical structure
  - Hierarchies verbally ask for innovation, and at the same time reject it.
- Increasing complexity brings in two disruptive forces:
  - Multidisciplinary thinking became mandatory.
    - Age of macro-expertise is gone... long live micro expertise.
  - Technology requires control.
    - Advanced technology without proper controls reject reproducibility and traceability.
    - Evidence shows that the limitation factor for scientific advancement has clearly shifted from availability of storage and computational resources to proper control of investigative procedures.

# Enablers of the “Next Wave”



# Enabling the “Next Wave”: Crowd-Powered Investigation

- Methods of Quantitative Proof: Common, comparable methods for simulations and quantitative evaluation of results (“statistical pipelines”, “economic wind tunnels”)
- Large Scale Collaboration → Maximization of collective intelligence: drawing micro-expert attention, proper cultural and human development, “manufactured serendipity” and human diversity
- Proper Computational Representation: a representation grows from needs of specialized domains, and are better suited for use cases relevant to that specific domain (e.g. architecture, economics, biotech)

# FRACTI: Crowd-Powered Investigation for Financial Markets

- FRAmework for Collaboration and Transparent Investigation for Financial Markets
- Not an implementation, or a programming language – it is a conceptual framework.
- Supporting crowd-powered investigation for financial markets.
  - Computational representation for the field of Economics.
    - Facets and Contributions
    - Financial models are defined through the application of facets:
      - Streaming, Reactives, Simulation and Distribution
      - Models → Methods of quantitative proof
    - Financial models generate and consume contributions
      - Specific taxonomy: Datasets, plots, processors
      - Properties: Classification, Identification, Provenance, Ownership and Security
      - Shareable, traceable → Collaboration in large scale



# “Knowing That We Know” in Financial Markets

- Support for collaboration in large scale
- Provenance of contributions: Traceability of simulations and lots of data
- Simplified representation so that a heterogeneous user community can conduct structured, scientific investigation in computational finance

# The Final Proposition

- Materialization of a computing platform based on FRACTI concepts.
  - Supporting the simplicity of scientific principles,
  - Leveraging modern techniques that provide virtually infinite storage and computing power
  - Allow transparency, control and large scale collaboration across a heterogeneous community of users.
- Serve as a trusted environment for exchange of ideas, procedures and data related to economics
- Results can be leveraged to educate the common investor, provide reliable data for the research community, and allow proper controls for global market surveillance that can be ultimately used for the definition of sound public policies

# References

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