Economic preconditions for a thriving VHT Ecosystem

Edwin Morley-Fletcher

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Jean Tirole

2014 Nobel Laureate for Economics

- Tirole, a French scholar based in Toulouse, is internationally known for his pioneering analysis on Digital Economics and especially on Multi-sided platforms (**MSPs**)
- MSPs have attracted a lot of attention for their indirect network effects, which, under certain conditions, have shown the capacity of driving competition between platforms to a "winner takes all" outcome.

Multi-Sided Platforms

- MSPs cumulate mutually reinforcing network effects through the implicit support derived by each of the sides served by the platform.
- MSPs thus appear to be the organisation model showing the greatest capacity to scale.

Multisided platforms and ecosystems

- A growing body of economic theory analyses digital multi-sided platforms as ecosystems, where some actors find themselves in complementary rather than competitive relationships

- MSPs offer a set of complementary products whose interactions are orchestrated by a focal firm, such as Apple, Google, or Amazon, that conditions the rules and interfaces with which a growing number of actors must comply.

- Ecosystems have been defined as "interdependent networks of self-interested actors jointly creating value".

- How do platforms and ecosystems differ? How do they emerge, and what problems do they solve?

- Several authors have even started to question whether the market is becoming obsolete as a unit of analysis and should be replaced by interconnected ecosystems.

Ecosystems are not easy to build

- In a way, by setting the goal of building an ecosystem, you engage into an exercise of designing the coexistence of emergence and intentionality.
- Planning the spontaneous attainment of an intentional outcome may seem an oxymoron.
- In fact, what is meant is designing appropriate preconditions that allow the spontaneous emergence of something that is intentionally pursued, though its effects, depending on multiscale nonlinear interactions, remain partially unpredictable.

Lessons learned on innovation and platform ecosystems

· An innovation ecosystem aggregates all actors whose contributions are essential to generate interrelated innovations.

· A platform ecosystem aggregates developers of complementary and interdependent products required to extend the value of a core platform technology.

· Both are characterised by:

o their "generativity"— i.e., the capacity for the continual creation of variant system components offering new affordances to the technology user.

o a modular interorganisational architecture that enables a nonhierarchical alignment of actors' interests.

o governance arrangements that are functional to internalize the externalities of these cooperation interdependencies.

What is an ecosystem ?

- Borrowed from biology, in economics the term ecosystem generally refers to a group of interacting entities that depend on each other's activities.
- These interdependent entities have varying degrees of complementarity, i.e. they can achieve some alignment though operating with significant individual autonomy.
- All together they form a symbiotic community capable of converging on the adoption of strategies by which:
  - each entity reinforces each other
  - collectively they can overcome multiple co-evolution challenges
  - decreasing risks
  - increasing certainties.
- This ecosystem is an organisational structure which is different from both hierarchies and markets.
- Its level of interaction depends on the flows of resources and information.

Standards and ecosystems

- Standards can be considered as institutions that can be created through purposive actions and which play a fundamental role in supporting the success of ecosystems.
- The development of ecosystems faces a key challenge: the participating actors' existing work-practices and technological solutions are seldom spontanenously harmonised.
- For an ecosystem to succeed, standards must be developed and implemented, which is clearly challenging in the absence of an orchestrating leader.

An ecosystem orchestrator

- Technological change requires coordinated responses, but decentralised ecosystems may face the risk of creating inadequate decision-making structures to manage complex interdependencies.
- A crucial pre-condition is the presence of an ecosystem orchestrator being, by design:
  o a central agent at the nexus of a distributed network of value creators,
  o tracking, monitoring, nudging and (when necessary) steering a fruitful use resources without needing to own them.

Three high level questions:

1. Are we to analyse more in depth the lessons to be derived from digital economics applied to MSPs and ecosystems?

2. Are we to take into account that the VHT ecosystem needs to be a component of a larger endeavour to build a strong European Health Union aiming at democratising technology and facilitating data-access-driven innovation, through the establishment of a common European Health Data Space?

3. Are we to consider this EHDS as a health specific ecosystem (comprised of rules, common standards and practices, infrastructures and a governance framework) evolving towards the creation of an open ecosystem-oriented market?

Further data economy implications

1. European policymakers view Personal Data Brokers (PDBs) and Personal Information Management Systems (PIMS) as promising building blocks of a fair and transparent data-driven digital economy and have facilitated their emergence through new privacy rights such as a right for data portability.
2. The "European strategy for data" highlights PIMS and PDBs as important new intermediaries to empower consumers in the personal data economy.
3. PDBs enable personal data markets by offering consumers financial rewards for the data that they have created at online content and service providers (CSPs) as a by-product of their usage of these services.
4. PDBs integrate functionalities of PIMS, allowing consumers to store, manage, and monitor their personal data from various CSPs in a single information system under the control of the user.

Data portability

- Data portability rights allow users to access the data stored about them at any CSP free of charge and in a machine-readable format, and to transfer that data to a third party of their choice.
- Article 20 GDPR demands explicitly that CSPs shall transfer the respective user data directly to a third party if instructed to do so by a user.
- Consequently, user data can be transferred to the PDB at relatively low transaction costs and even if consumers are not very technology-savvy.

Data altruism

- The Data Governance Ac (DGA) formalises the concept of data altruism, whereby individuals or businesses give their consent or permission to make available data that they generate – voluntarily and without reward – to be used in the public interest.
- A common European consent form for data altruism will allow the collection of data across Member States in a uniform format, ensuring that those that share their data can easily give and withdraw their consent.
- It will also give legal certainty to researchers and companies wishing to use data based on altruism.

An ongoing policy debate

- How will the EHDS encompass the operational functioning of entities being qualified as EU recognised data intermediaries and EU recognised data altruism organisations?

- How will these important developments be reflected in the way in which the VHT ecosystem is analysed in EDITH's roadmap?

An evolutionary VHT ecosystem

- In the current draft of the VHT Roadmap, the only question raised until now regarding the ecosystem has been the following:
- "Can we figure out an evolutionary transition leading the VHT community from a pre-competitive setting to a mature market system?"

A Distributed Ledger Technology

All imagined phases hinted at in the VHT Roadmap presuppose a system of Distributed Ledger Technology (DLT)
- o allowing to permanently trace all types of assets exchanged on the DLT
- o also tracking their provenance
- o securing the findability, accessibility, semantic interoperability, and reusability of all activated resources.

What is a DLT?

- A DLT is a network of computing devices which jointly operate a replicated distributed database

  o where each local replication stores a set of transactions between actors operating through the same DLT protocol

  o preventing double-registering of transactions and manipulation of balances.

- By creating this guaranteed digital space, a new layer of automation becomes possible, based on process automation through software programmes called Smart Contracts.

- This way, without recourse to any central authority, the DLT can deliver Trust, Transfer and Settlement, minimising at the same time transaction costs

- Given that the boundaries of organisations are determined by transaction costs, especially search and information as well as bargaining and enforcement costs, a DLT-based ecosystem has the great advantage of operating on qualitatively reliable data-rich information systems without being paralysed by excessive transaction costs.

Three evolutionary phases

- **Honour ledger**: the DLT infrastructure will host exclusively pre-competitive transactions and work on incentives based on forms of reputational scoring.

- **Token ledger**: pre-competitive and competitive transactions will coexist, and exchanges will be facilitated through the issuance by the DLT infrastructure, of digital tokens with no direct monetary value, but operating as the scaffold on which symbolic prices can emerge through supply and demand of all assets traded, included the DLT services.

- **Money marketplace**: the ecosystem will mature and specialise: while some entities dealing mainly with pre-competitive transactions will continue to exist, a growing number of entities will increasingly focus on competitive transactions in the form of B2B exchanges, with prices set in Euros and no-more in tokens.

Reputation (*Honour ledger*)

- The ecosystem operates as **a barter mechanism facilitated by a technological precondition**: the creation of a DLT infrastructure which is initially largely EU-funded
- The DLT allows to trace:
  - all accesses
  - all transactions
  - all reputational outcomes
- The DLT makes it easy to:
  - share a dataset or a model in ways compliant with the FAIR principles
  - translate such data or model sharing transactions into:
    - a citation-based reward system
    - a reputational scoring mechanism
- The metric of success is how much data and how many models are shared by the actors who will be induced to operate through the EU-funded DLT platform (as a necessary precondition for accessing further VHT research and innovation EU-funding)

Beyond simple reputation barter (*Token ledger*)

- In a second phase, by introducing **digital tokens** issued by the entity governing the DLT infrastructure, it will be possible to make the incentives for what one can get in return for his/her shared resources much fine-grained and flexible.

- In its basics, tokens will be issued to whoever contributes resources to the ledger.

- The "cashing-in" of tokens, by operators contributing resources to the ledger exchange system, and the "paying-out" of tokens, by operators purchasing assets offered by others, will allow the development of an increasing nexus of token prices for all transactions taking place through the DLT, which will also begin to charge a token-fee for its services.

- The VHT ecosystem will use its growing token economy to experiment with how it can become progressively self-sustained.

A symbolic currency becoming in due course convertible

- A token is a symbolic **computerized "currency" tied to specific purposes**, that can be exchanged for assets or services within a community of practice, allowing such an ecosystem to experiment allocating and tracking symbolic value exchanges among its actors.

- Initially, tokens will only have a value only within the VHT DLT system.

- In a further phase, once there has been a sufficient uptake of the tokens, it will also become possible to purchase them in exchange for money: this will apply mainly to external entities not having contributed resources to the ledger but wishing to use the VHT DLT facilities.

- Further tokens will be gained anytime shared resources will be used, while everybody will pay with the tokens they have accumulated for being allowed to use somebody else's resources.

Differences in governance models

- In the reputation phase, the governance may remain minimal:

  o day-by-day operations can be ensured by a small consortium paid to do so and to adopt basic technical decisions

  o any major decision on the infrastructure is taken with recourse to a direct democracy model, in which all contributors can participate in decision-making with an assembly process.

- In the token phase, the DLT infrastructure should substantially remain a largely public-funded resource, but its governance will require a more structured representative democracy.

- The main focus will be on the quality of service for its users. Systems must scale to extensive collections and handle distributed solutions relying on multiple hardware and software providers.

- When the development strategies of research groups and companies that have purchased tokens and are willing to use the DLT will become a key factor, the metric of success will be how important the VHT becomes in the development strategies of public and private developers.

Ensuring long-term sustainability

- The VHT infrastructure will have to be run by a legal entity, possibly organised as a joint undertaking between the EC and major European industrial players, as already experimented in other similar cases.

- An EU-funded segment of the VHT should operate for the not-for-profit researchers, where most interoperability technicalities standards will be tested and standardised.

- Other segments, certified for interoperability by the legal entity, will be fully commercial and operating on a private basis, pursuing sustainable business-to-business models.

More complex and broader valuation mechanisms

- In a more advanced stage of development, the VHT DLT infrastructure will possibly also engage in analysing how incentives linked to automated assignment and distribution of value and quality validation can be determined by ML mechanisms valuing different attributes or even through Shapley-value mathematical methods determining the only distribution satisfying a collection of properties within a coalition game.

Towards a sustainable VHT ecosystem: Resource Valuation

- Economic incentives ensure principled, fair valuation of resources, and allocation of value to participants
- "Valuation" is not necessarily tied to economics, e.g., it may provide means to measure the *quality* of a resource
- Critical in a vibrant ecosystem with a multitude of resources addressing the same/similar needs
  - e.g., quality-based ranking can quickly identify "best" resources for a given task
- The value of an ecosystem is normally much higher than the sum of its components, precisely because of the large number of non-economic interactions that happen within it.

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Would it make sense to have a first experimentation with VHT tokens? (1)

- If the VHT nascent ecosystem were to experiment using tokens it would develop this way a first metric of the interactions which can flourish within it.

- Are there already available elements capable of starting to trigger such a process?

- Pretty soon we will have the repository operating on a growing number of use-cases, but there may be complex issues trying to apply to such a repository a token-based metric of interactions within a very short frame of time.

Would it make sense to have a first experimentation with VHT tokens? (2)

- Perhaps, we can think of a less complex experiment.
- We have a web based application for Q&A on EDITHs website, which provides an innovative tool for automatically keeping updated on the rapidly expanding open-source scientific literature related to Virtual Human Twins and will soon allow to generate thematic summaries on any topic addressed within the EDITH knowledge base.
- If all registered users would receive an amount of tokens to track how they make use of the Q&A tool, this could trigger some amount of general curiosity on EDITH's developments, while possibly also contribute to broaden the VHT community by leveraging a spreading interest in testing EDITH's Q&A.

Is there the need for additional work?

- We heard yesterday the confirmation that the European Commission considers as essential the fostering of an inclusive multistakeholder collaborative ecosystem
- The EC is also soon going to announce the specifications for the expected procurement call for delivering a platform for advanced virtual human twin models integration and validation.

- Approaching EDITH's meeting in Amsterdam, scheduled for July 15th – 16th, 2024, we can consider whether developing a digital economics analysis of the systemic preconditions of the VHT ecosystem would be a significant step to be undertaken in the coming months, and whether quantifiable interaction experimentations might provide a metric for defining some meaningful performance indicators.

Thank you

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