

Distributed Problem-Solving Organizations and Strategies of Open Innovation

By

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An agenda of basic questions

- *What is meant by “open innovation strategies” (OIS)?*
- *How are OIS and “distributed problem-solving”(DPS) related to the standard management economics model of the firm?*
- *What is especially required for effective DPS?*
- *What is the relationship between OIS and the IPR regime?*
- *When and where can OIS be profitably deployed?*

What is meant by OIS and how is it related to DPS organizations?

OIS and the “Open Source” metaphor

‘OIS’ is now used in referring (metaphorically) to practices that draw inspiration from the paradigm provided by the large and successful projects that are developing **“open source” software**.

Free/Libre Open Source Software (*FLOSS*) projects are a mode of R&D management that **contrasts with closed, centrally managed corporate research organizations** that typically

- are integral components of a business firm’s innovation process,
- rely on internal personnel (employees)
- create intellectual property rights for exploitation by the enterprise.

Open source and Open Science

The FLOSS paradigm of “commons based peer production” (Benkler) is itself has **evolved from the spatially and institutionally distributed mode of research organization that we now refer to as “Open Science”** – to contrast it with the system of closed, proprietary R&D.

How does OIS relate to the familiar management economics model of the firm ?

OIS involves 3 key departures from the conventional business management model for R&D:

- **organizing the use of external distributed knowledge and information resources**
 - provided by external agents without contractual relationships to the firm
- **disclosing specific information about the firm's innovation-goals and capabilities**
 - allowing “outsiders” freely to access information about its products or practices, instead of retaining exclusive control of the latter (as trade secrets or IPRs)
- **spending own resources to encourage contributions of effort from unmanaged external parties**
 - by offers of direct pecuniary “rewards” for contributions that the problem-holder identifies as “valuable”
 - or by indirect reinforcing voluntary contributions by creating prospects of public recognition and peer esteem.

--- in all of these, “open-ness” is the touchstone .

What is especially required for effective DPS.and hence

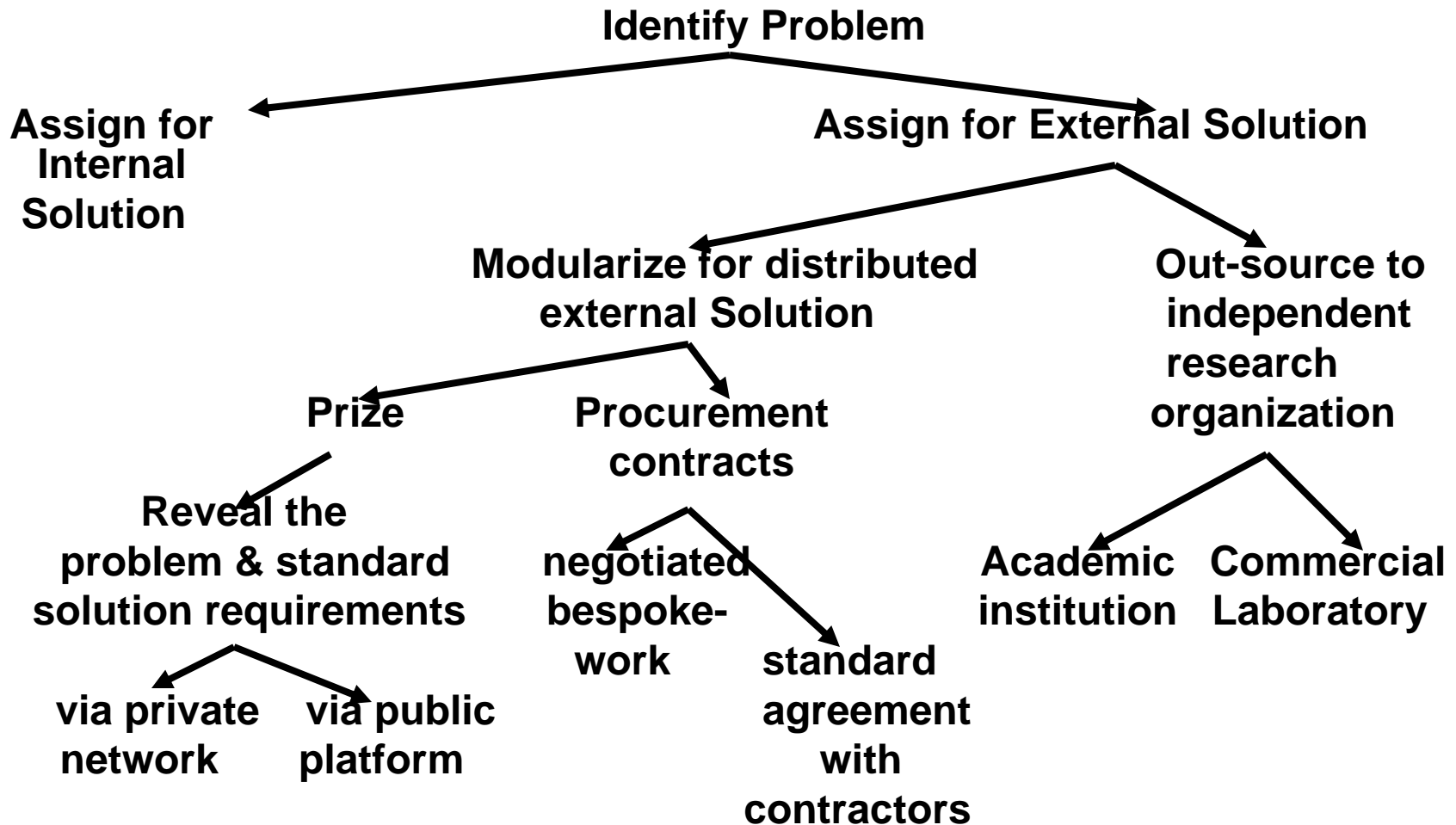
for OIS?

- There's no need to radically revise (much less to abandon) the “theory of the firm” as a managed activity with recognizable boundaries, a reasonably well-defined objective function, and a capability for interactions with other kinds of ‘organizations’.
- ***But DPS organization requires special capabilities on the part of firms:***
 - Designing a semi-decomposable (modular) “architecture” for their innovation project – allowing engineering design sub-problems to be separated and “distributed” to “teams” that are not under continuous central management
 - Setting granularity of “manageable problems” and solution requirements suitable for the capabilities of individual external “solvers”
 - Establishing an appropriately open communication structure
 - Arranging incentives or selecting among extant “reward systems” for solvers
 - Understanding and screening heterogeneous, novel “solutions”

Remark: The foregoing ‘capabilities’ are displayed by really big distributed projects in “open science” research -- e.g. CERN’s ATLAS

Relating OIS to management economics models of “the firm” -1

Characterizing the problem- holding firm’s “decision-tree” for the “make or buy” decision on R&D for innovation



Relating OIS to management economics models of “the firm”

-2

A more encompassing organization equilibrium perspective is needed, including these elements:

Parametrically fixed features:

- ***Problem-holder (PH)***: [problem articulation capability | goals, market structure, line-of-business, organization and location]
- ***Problem-solvers (PS)***: [potential number, **distribution of expertise** | characteristics (soloists, ensembles, “conducted” organizations), goals, motives]
- ***Communications structure***: Are there Intermediaries (platforms, brokers)?

If yes: How do they structure informational flows and what do they bill for?

If no: what kind of communication regime -- open (two-way “broadcast”)?, via symmetric & fully connected network?; asymmetric with PH→PS broadcast and PS→PH private?: PS→PS allowed, or excluded?

OIS in theory: towards modeling distributed problem-solving for innovation -3

The endogenously determined variables:

X, R, N | for a given communications structure:

- **Problems the problem holder (PH) selects for external solution, X :**
having attributes x (cognitive domain, complexity, granularity, degree of modularity, existence of standard solution methods, etc.)
- **Reward structure(s) offered for required solution(s), R :**
 - unique winners, or multiple winners?
 - pecuniary prize vs. “royalties” from commercial exploitation? vs. “peer esteem”?
 - IP claimed by PH for commercialized “solutions”? for all submitted solutions?
 - commercial payment vs non-pecuniary rewards?
- **Number of candidate solutions generated: N**
- **Expected value, V of “the” solution, $E \{V(X, R | PH's \text{ characteristics})\}$**

OIS in theory: towards modeling distributed problem-solving for innovation -4

The decision- process equilibrium for the players:

- For the ***ProblemHolder*** :

$$[\text{Prob } X][E \{V(X, R) \}] - [\text{ExternalSearch Costs, including broker's fees } (f)] \leq E\{\text{Net Benefit of InternalSearch for Solution}\}$$

- For all N of the ***ProblemSolvers*** :

$$E [R / N] \geq c + f \text{ (opportunity cost of the effort + platform fee } (f))$$

- For a **platform-providing firm (“broker”)**:

“Service fee” (f)extracted from the *PH* and the *PSs* (*when the above conditions are satisfied*) yields:

expected profit on the broker's platform investment

> the normal rate of return.

When and where can OIS be profitably deployed – without IPR protections?

For OIS that do not directly exploit trade secrets, or IPR ownership rights by exclusive use in production, or by patent and copyright licensing, i.e.,

- firms that allow others to use a key information asset, such as a database (e.g., Netflix) ,
- or that give away a product or a service – providing it under GNU GPL or Open Document, or a Creative Commons (Non-commercial Use) Licenses (e.g., IBM, SUN),
- or revealing to rivals a cost-saving production method that has not been patented, or left in the public domain

there are basically 3 ways for a profit-seeking firm to extract value:

- 1) Retaining monopoly power in the market for a good or service that is gross complement of the commodity that is being freely provided (Hirschleifer, 1972)**
- 2) Retaining monopoly power over a productive asset that is a strict complement of the method that is freely disclosed (Van Alstyne and Parker, 2000)**
- 3) Deriving positive externalities from the practices that other firms are induced to adopt by the action of the firm (e.g., Google with cell-phones)**

When and where can OIS be profitably deployed – without IPR protections?

Three ways in which a profit-seeking firm can extract value:

- 1) Retaining monopoly power in the market for a good or service that is gross complement of the commodity that is being freely provided** (Hirschleifer, 1972)

e.g., many firms, and consultants make profits selling “distributions” FLOSS code, including documentation and customer support services; IBM and other firms interested in software and middleware security issues recently formed an “open research consortium with several university computer science departments, to do research without claiming any IP!

- 2) Retaining monopoly power over a productive asset that is a strict complement of the method that is freely disclosed** (see Van Alstyne and Parker, 2000)

e.g., Netflix owns its data on movie ratings, and can let others work with it to write a superior ratings algorithm (for a prize), because the algorithm without the dataset is not worth much, and nobody is going to reproduce the data to enter competition with Netflix. (Recall that owners of large pine-wood forests in the US were happy to openly promote the development of creosote treatment of softwoods, for telephone poles, railroad ties, etc., because a superior method of using a resource raises the wealth of the resource owner.

- 3) Deriving positive externalities from the practices that other firms are induced to adopt by the action of the firm**

A precursor of Google’s recent release of a 3-G cellphone chip --Sematech Project in the US involved IBM and TI contributing to the development of an industry standard for “stepper”s, with a view to benefiting from the reduced fixed costs of that capital good, which lowered entry-costs of other firms into the merchant market for chips, where IBM, etc., were marginal buyers.

Many of the current uses of a DPS-based OIS really aren't so new

- **Reciprocated networked search** by expert problem-holding/ problem-solvers: von Hippel's (1988) employed engineers who firms allow to "trade in trade-secrets"
- **Broadcast search** by problem-holding firms offering prizes, now ICT enabled and organized by an intermediary "platform" -- such as *InnoCentive* (Lakhani-Jeppessen, 2007),
- **Inter-corporate R&D ventures** (Chesbrough, Hargadon, et al): may be JRVs among *PH-PSs*, or precompetitive research consortia – which typically must be able to modularize the problem for distributed solution; or, alternatively *form a new central R&D group, or outsource to an independent R&D lab organization* that is centrally managed
- **Intra-corporate, multi-locational R&D organizations** also need to manage parallel research teams, coordinate distributed work, and control information and workflows: they can imitate methods of large open science projects, such as CERN ATLAS experiment group (Tuertscher et al., 2007) and do this in a decentralized organization –if they can design a suitably modular architecture for the system.
- **Donations of code to open source software communities** by firms in software services and grid services (e.g. IBM, HP, SUN), permitting partial exit from software production and maintenance activities, while building services (and proprietary software) applications that are complementary to the FLOSS code base.

There may be “useable tools” for businesses and other organizations pursuing open and distributed innovation in the ferment of ICT-enabled experiments involving Web 2.0 user-generated content, open collaboration and collective intelligence

open collaboration environments (platforms for FLOSS production -- e.g.: [SourceForge.net](#), [Freshmeat](#), [Savannah](#),..etc.)

- “crowdsourcing” (coined by J.Howe) as searching for new ideas for software, ranked by voting and rewarded by royalty shares if IP is assigned to a commercial innovator -- [www.Cambriahouse.com](#)
- “broadcast search” –offering cash prizes for solutions to specified applied science problems, e.g., [InnoCentive](#)
- open content film production (“Film 2.0”, based on large “club” of contributor-sponsors who exercise “voice” on film storyline, design, etc. – e.g., [Swarm of Angels](#))
- news reporting and aggregation (e.g. [Digg News](#), [Reddit](#), [OhMyNews](#))
- interactive learning environments (using multiplayer games design -- e.g. [Seriosity](#))
- online medical professionals’ chat room with “thread” analysis (and information sale to clients, e.g., “physician knowledge ecosystem” – [www.Sermo.com](#))
- online “social book-marking” of web-content, e.g., [del.icio.us](#)
- shared repository of “map mashups” -- e.g.,based on personalized [Google Maps](#)
- prediction markets (e.g., sporting events -- [www.Betfair.com](#); Iowa election markets – [www.biz.uiowa.edu/iem](#); [HP](#)’s internal sales forecasting)