ECONOMICS:
OPEN SCALE

The scales of economy are shifting. In *The Cathedral and the Bazaar*, Eric Raymond claimed that, "the closed-source world cannot win an evolutionary arms race with open-source communities that can put orders of magnitude more skilled time into a problem." It's an assertion that challenges the traditional understanding of collective action—as well as traditional views of how to organize global economic production. Yet over the next few decades, this viewpoint will fundamentally change organizational strategy—and perhaps the nature of human organizations.

Economies of scale that used to favor large centralized institutions will now favor widely decentralized networks—and overturn conventional organizational wisdom

CHANGING THRESHOLDS: THE SHARE OF THE LABOR POOL

Mancur Olson gave us our traditional understanding of the problem of collective action: that only small groups can take advantage of the social mechanisms necessary for successful collective production. Yet the open-source software community has performed *de facto* what should not be possible *de jure*. This success suggests that some new factor has recently emerged to enable large-scale decentralized cooperation, overcoming obstacles to collective action and cooperation. That factor is arguably connective technology—but how, specifically, does it hand an advantage to open groups?

One answer to this question is that it changes the size of the labor pool—and the ability to dominate the market is directly related to the proportion of the labor pool a group or institution can capture. As the size of the labor pool goes up, the share of the labor pool within any closed institution goes down. And when the share inside the walls of the closed institution reaches a critical threshold, it can no longer compete with open processes. But how does connective technology change the size of the labor pool?

CHANGING RELATIONSHIPS: USERS AND GROUPS OF USERS

In an information economy, where the competitive value of products derives from information and ideas, the logic of *producers versus consumers* is replaced by the logic of *users*, who function as both. As Yochai Benkler explains, technology "now makes possible the attainment of decentralization and democratization by enabling small groups of constituents and individuals to become users—participants in the production of their information environment." Thus, as the market for information-based products grows, so does the labor pool.

At the same time, connective technologies support the aggregation of self-interested groups of users who can take advantage of their small scale to meet their local needs more effectively than the larger institutions that are bound to focus on a few needs of the broadest markets. Thus the open process enjoys the advantages of both large and small scale.

CHANGING INSTITUTIONS: THE PRACTICE OF INDIRECT RECIPROCITY

If open processes represent the institutional future of humanity, what will be the key levers for fine-tuning these new organizational forms?

Certainly, many tools and practices of cooperation will be key. But perhaps these future forms will be defined, as much as anything, by a refined strategy of indirect reciprocity—the willingness to give to someone who may then give to someone else. Martin Nowak and Karl Sigmund suggest that the evolution of cooperation by indirect reciprocity leads to reputation building, morality judgment, and complex social interactions with ever-increasing cognitive demands. These may well be the critical domains of future organizational theory.

—Paul Hartzog

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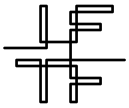


INSTITUTE FOR THE FUTURE

INTERVIEW: CLAY SHIRKY

Clay examines the new value of groups in an open economy—and the implications for large institutions.

Q | There are probably many ways to think about what's happening in the economy as open systems and processes begin to make strong inroads. You've been talking a lot lately about the significance of groups. Why are they suddenly more important? And how does this recognition help us think about the big economic picture?

It seems like a throw-away idea, but they're more important because of the Internet. Group value can now be created outside of institutional frameworks. This is a big systemic change. Meetup Moms can now meet beyond their kaffee klatches. Howard Dean can raise gobs of money. We all know these stories.

Sector by sector, there are different ways to try to understand the impact of openness. But escaping the institutional dilemma is the common characteristic across sectors. The dilemma is this: it takes resources to manage resources in an institutional framework. Remember Yochai Benkler's paper on collaborative production? The firm uses its ability to coordinate its employees to reduce the friction of the market.

But if you only get the transactions you can justify, you keep making 80/20 substitutions all over the place. In employees. In products. The question around 80/20 substitutions, though, is: why are you giving up a fifth of the value? If the design of the system makes it so expensive to reach those people, then you should redesign the system.

In most systems of distributed production, you have the power law distribution: a handful of people do an enormous amount of work, and most do only a little bit. Microsoft's Steve Balmer uses this fact to critique Linux. He says most of the work was done by a handful of programmers. Most participants have added only one patch each. From the perspective of a big institution like Microsoft that is paying salaries and benefits for hundreds of programmers, that's a terrible model. But Linux folks don't care. The delta between what institutions care about and what open-source groups are capable of is to take contributions from everybody without regard to 80/20 considerations.

Q | Are big institutions at risk in this environment? Are entire sectors at risk?

Institutions have overhead not only in things like salaries and benefits, but in their processes and even their identities. If a single person has an informative photo that you want to use, you don't have to worry about whether they're a qualified photographer or have a professional publishing outlet to make the decision to use that photo. But an institution has the overhead of maintaining the professional identity. They suffer doubly: their open competitors aren't forced to use conventional economics *and* they don't have to refuse contributions at the margin.

Everyone who is in a profession immediately inherits from that environment the story of why that profession is part of life itself. "The world won't function without librarians." Institutions are quick to recognize threats from other institutions. Newspapers all spilled their coffee the day that *USA Today* launched. They were galvanized. When weblogs came along, though, they couldn't even see them for years; they literally couldn't recognize them as a threat.

Seeing that threat requires you to see that your institution is an accident. Journalism is not a first-order aspect of society. Journalists can't even ask the question: are bloggers journalists? It isn't a valid question at all.

The current threat is not that old institutions are lined up against new ones. It's that the old ones are lined up against a new ecosystem. Each weblog is a teeny tiny competitor to the media. Even the largest are puny, but it is the ecosystem that threatens. The same is true for Microsoft. The presence of an ecosystem that produces code is a threat.

Institutions are victims of their own monopolies, whether a corporate monopoly or the monopoly of a profession. Monopolies are insects; they're exoskeletal. When AT&T said they were becoming competitive, they just vanished. Anyone who has a circumstantial monopoly is screwed because today's engineering is breaching the exoskeleton, and there's no alternate source of value. Scarcity is the only thing keeping those big monopolies going.

I was talking recently with Charlie Leadbetter in the United Kingdom about Benkler's paper "Sharing Nicely." I asked, "Are you predicting that these new modes of production take over everything?" He said, no, you can see how you might want qualified engineers to design your nuclear containment environments. Then he stopped himself and said he thought there were even pieces of that you could strip out and do differently.

CLAY SHIRKY is an adjunct professor in New York University's Interactive Telecommunications Program. He's also a consultant and writer on Internet culture and economics.

Q | A lot of discussion has focused on how far open systems can extend beyond the software world and what other sectors might be especially vulnerable. How would you describe who's most vulnerable?

We're not really talking about who this affects or doesn't. We're playing for all the marbles. Everything is on the table, especially if it has an information component and involves a group.

Take Meetup's most active group—the stay-at-home moms. In the center of the United States, where work has become the new center of activity, stay-at-home moms are more isolated than ever before. They turn to this software because it solves a coordination problem.

The noneconomic nature of production of previously economic items is starting to get attention now. The production of noneconomic goods, like social capital, is important, too. The open-source story has been told through a business lens. The frame is: Linus, an upstart, challenges Microsoft. But the big story here is that stay-at-home moms create missing social capital using these tools. It's not a business story, but the effects may be larger in economic terms—like the suburbanization of America.

There may be a major economic shift here without economic products. There may be important new goods not created by a market economy. These lack the normal framing.

Q | So what should we be looking for if we want to understand the economic impacts of openness?

Look at what Christopher Alexander proposed—the pattern languages. Look for new pattern languages for peer production. For example, graduate students are looking for credit, so the non-anointed nature of the peer-to-peer effort is a provocation, and openness will sort in favor of those who have the most radical acceptance of the basic proposition. This is the underlying pattern.

Ultimately, if you want to understand this, you need to frame it as a social issue with economic ramifications. Keep your eye on the social changes that have economic effects even though they aren't themselves economic.

Jerry Michalski, IFTF Research Affiliate, asked Clay to consider the macroeconomic effects of openness.

COMPARING OPEN AND CLOSED STRATEGIES: AN AGENT-BASED MODEL

Agent-based models are increasingly used as tools for investigating phenomena that are not well understood. Paul B. Hartzog[1] has created such a model to explore the dynamics of open versus closed systems, specifically in the realm of software development.

The model is organized around a cycle of software production in which development leads to quality, quality leads to use, and use leads to further development. At each step in the model, agents (which you can think of as users) can learn about available software from their neighbors or discover it on their own. They can compare open and closed versions of the software for a given software slot (which you can think of as a type of software); they then make an adoption decision based on an adoption threshold.

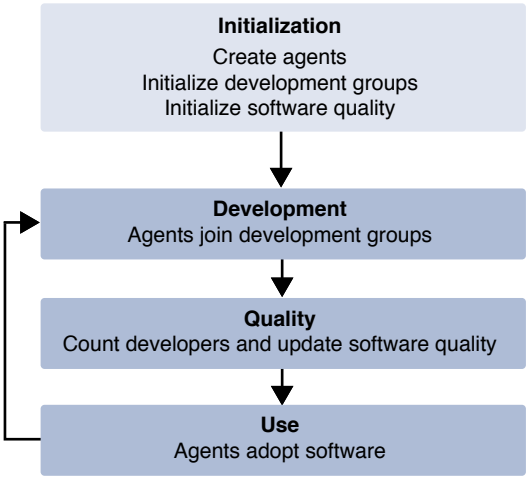
Agents each have an assigned adoption threshold at which they will adopt an open version of a software type. The threshold is compared to a quality difference between the closed and open versions of the software, which acts as a proxy for the "costs of switching" and varies from agent to agent. Because the threshold can be either negative or positive, it can simulate both early adopters who will switch even if the open software is not yet as good as the closed version, as well as loyalists who will not switch until it is markedly better. Agents also have different development thresholds that affect how likely they are to join the open software development group.

Software use in the population increases the number of developers available to that particular software group. Because centralized development incurs both material and contractual property costs per developer while decentralized development does not—open-source developers use their own equipment and their own donated time—a parameter is used to regulate the number of developers each closed development group can support, and the mechanism serves to constrain the total size of closed development groups.

Four key parameters were varied during the run of the model:

- Connectivity of the population varied from 0 to 100%
- Number of agents (a function of connectivity) varied from 0 to 441
- Closed developer share varied from 1% to 9%
- Initial advantage for closed software quality

1 How the Model Represents the Cycle of Development and Use



Source: Paul B. Hartzog, 2005.

[1] Paul B. Hartzog is an IGERT Fellow at the Center for the Study of Complex Systems, University of Michigan. He is a member of IFTF's Future Commons and has been an active participant in our research on cooperation during the last two years.

DETAILS

MORE CONNECTIVITY MEANS MORE OPENNESS

The model results suggest that as the connectivity increases, the likelihood of all the agents converging on open development for all the software increases.

Specifically, as connectivity increases from 33% to 100%, the percentage of runs that converge on open solutions increases from 20% to 60%. In addition, with greater connectivity, the models converge more rapidly on the open solution—taking an average of 808 steps to converge at 33% but drop to an average of 301 steps at 50% and 151 steps at 100%.

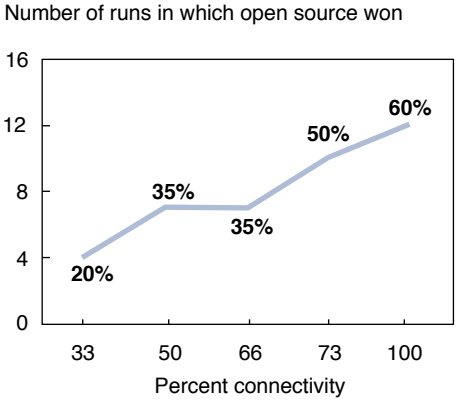
THE PATH OF CONVERGENCE: OPEN WINS

When the model runs converge on an open solution, the path toward convergence follows a typical pattern. Due to the initial advantages enjoyed by closed software—higher quality and more developers—adoption of closed software almost totally converges in the population during the first step. However, when the closed software groups are not able to maintain enough developers to outpace the spread of open development in subsequent runs, the closed software eventually falls behind while its open counterparts rise to success.

THE PATH OF DIVERGENCE: A MIXED WORLD

If the closed systems can capture enough developers early on, the model converges on either a closed solution or a mix of open and closed. In the latter case, adoption of closed software almost totally converges during the first step. As the runs progress, only some of the open development groups are able to acquire enough developers to produce software of high enough quality to compete with the closed counterpart.

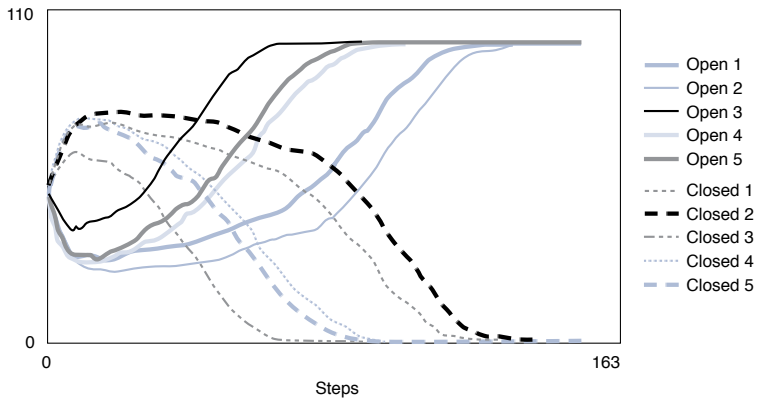
2 Increase in Convergence to Openness as Connectivity Increases



As connectivity increases, the percent of runs that converge on open-source solutions increases.

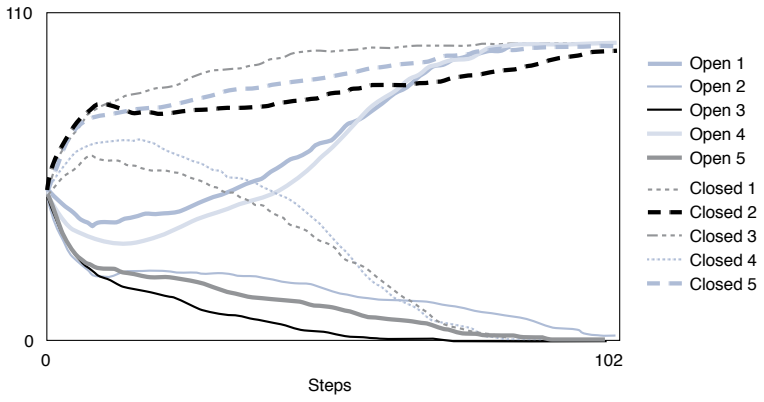
Source: Paul B. Harzog, 2005.

3 A Typical Run That Ends in Convergence on Open Software



Source: Paul B. Harzog, 2005.

4 A Typical Run That Ends in Divergence



Source: Paul B. Harzog, 2005.

FEWER CLOSED DEVELOPERS MEAN FASTER WINS FOR OPENNESS

In the real world, closed software projects can't capture large numbers of developers due to material costs, costs of coordination, and other barriers that centralized production faces. The model uses a variable closed developer share as a proxy for these barriers. Because the costs are variable, exploring this parameter exposes a sweet spot at which competition between open and closed software is possible. Outside that sweet spot, either open or closed software will dominate the entire space.

In the model runs, when closed groups are able to capture only 5% or less of the developers, the model always converges on an open software world. When closed groups are able to capture 8% or more, closed worlds result. At 6% or 7%, the software environment is a mix of open and closed.

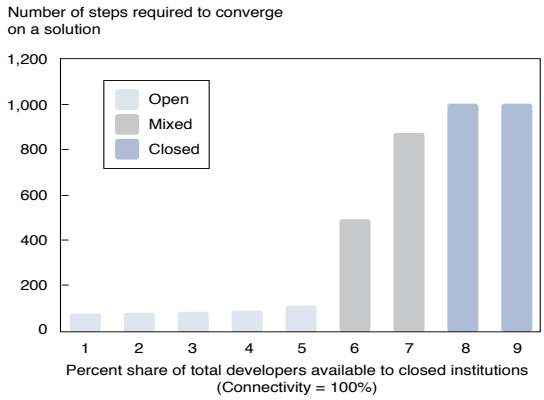
THE QUALITY BAR FOR OPENNESS

In the course of any model run, the quality difference between closed and open software changes as closed or open groups capture more of the developers. The model shows that the quality bar for open software is much higher than the quality bar for closed software. Even though individual agents can choose to switch from closed to open at any time—as long as the open version is within their adoption threshold—the open quality has to be much higher than the closed quality before all agents switch to using the open version in all five software slots.

WHEN OPEN QUALITY WINS

In model runs where all the agents converge on open software, there is a marked divergence between open and closed quality. Closed quality is initially higher, but once it is surpassed by the quality of the open software, the closed development community is unable to support its developers. The loss of development becomes a positive feedback loop that causes further loss of developers and a rapid leveling off of the quality of each closed software offering.

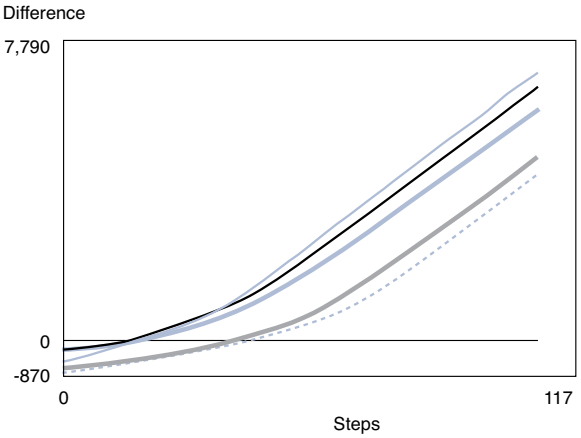
5 The Impact of Closed Developer Share on Speed of Convergence



When the maximum closed developer share is 6%–7%, open and closed software compete for a longer period of time before converging on one or the other.

Source: Paul B. Harzog, 2005.

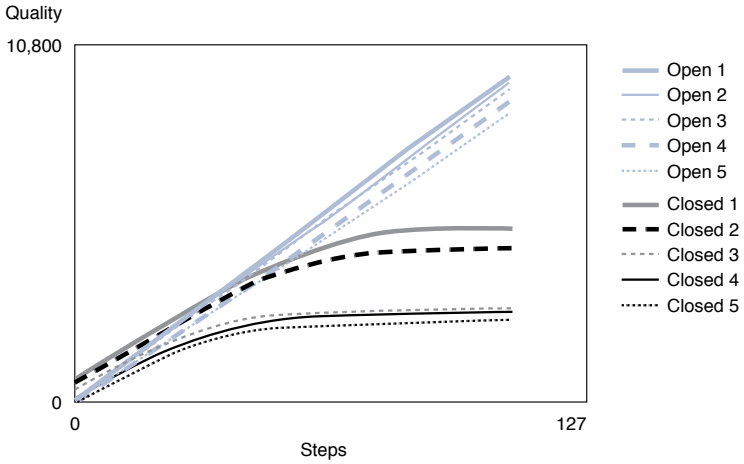
6 The Difference in Software Quality Over the Course of the Model Run



The quality differential has to rise well above zero before everyone switches to open software.

Source: Paul B. Harzog, 2005.

7 The Quality Curves for Open and Closed Software



Source: Paul B. Harzog, 2005.

STRATEGIC CHOICES

This model suggests that centralized hierarchies should not be too rudely rejected, but should be seen as effective methods of production during specific periods when connectivity is low. Only as technology makes cooperation among large numbers of people possible does decentralization become a feasible alternative.

Robert Axelrod and Michael Cohen suggest in *Harnessing Complexity* that because complexity is "rooted in patterns of interaction among agents, then we might expect systems to exhibit increasingly complex dynamics when changes occur that intensify interaction among their elements ... reducing the barriers to interaction among processes that were previously isolated from each other in time or space."

In short, because closed groups have to support their developers and open groups do not, open groups can diffuse to very large numbers. As a result, the closed groups cannot leverage the value of large-scale cooperation in the way that open groups can.

Closed groups can make two key strategic choices to improve their competitiveness vis-à-vis open groups.

Make Closed Groups More Like Open Groups

A clear implication of the model, perhaps the clearest, is that closed development groups should take advantage of the things that make open development successful. This means becoming more like the open groups. However, if closed groups become more like open groups, then would they really be closed groups anymore?

The answer is: it depends. In an attempt to leverage the benefits of volunteer labor, Google engineers can take up to 20% of their time to work on any project they want, achieving a kind of internal openness without losing their closed-firm boundary. However, regardless of whether closed development processes change into or are replaced by more open development processes, the production environment as a whole trends toward more open cooperation. This is achieved via selection against development groups themselves as well as selection against the strategies enacted by those groups.

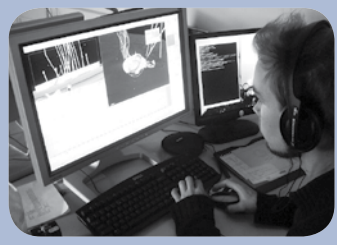
Capture an Initial Advantage

Another possibility is for closed development groups to continually capture an initial advantage on a round-by-round or software-by-software basis. They can do so by letting go at the top, the point where the open version is beginning to become competitive, and release the closed version into the open. This was Kevin Kelley's advice when he advocated "abandoning the highly successful in order to escape from its eventual obsolescence." This suggestion has been employed in the economy. Netscape, concerned over the loss of adoption of its browser, opened its code to the community. IBM followed with some of its products. The lesson is that by becoming more open, a development group can gain a community of interest that will participate in the creation of new value.

To Run
1) if all agents are using open software in all five slo
   a) **stop**
2) if the run reaches 1000 steps
   a) **stop**
3) agents **do**
   a) adopt-software
      i) agent randomly **selects** one of the five so slots
         (1) if any neighbors have a version of th software different than the agent's ow e.g. open or closed version **then**
            (a) if the quality difference between two software versions is within t agent's open adoption threshold t adopt the open software, assignin the a 1 to that software slot
      ii) **if** a random number between 1 and 100 is than the software discovery rate paramete 5% **then**
         (1) **if** the quality difference between the software versions is within the agent's open adoption threshold **then** adopt th open software, assigning the a 1 to th software slot
   b) join closed development
      i) agent randomly **selects** one of the five s slots
         (1) **if** the agent is not already develop that group **then**
            (a) **if** the percentage of developers users for that software is less th closed adoption development rat
               (i) **if** a random number between and 100 is less than the job change rate of 1% **then** join development group
   c) join open development
      i) agent randomly **selects** one of the five slots
         1) **if** the agent is not already developin group **then**
            (a) **if** any neighbors are in that develo roup **then**

DETAILS

Orange is an open movie project that uses open-source Blender 3D graphics tools with a community of over a million users.



STRATEGIC PLANNING:
Identify key thresholds for open systems

In *Toward a New Literacy of Cooperative Strategy in Business* (SR-851A), IFTF identified seven key "tuning levers" for improving cooperation within large systems. One of these was thresholds. The agent-based model of open systems presented here has identified two crude thresholds for the success of open versus closed systems: connectivity (with a critical threshold between 50% and 75% connectivity) and share of the developer population that an institution can capture (with a critical threshold at a 6–7% share).

A next step would be to refine these thresholds using more complex representations of both connectivity and closed developer share. But it would also be strategically useful to identify other potential thresholds that drive the success or failure of open systems. For example, taking a cue from Nowak and Sigmund on indirect reciprocity, we might test thresholds of reputation building, morality judgment, complexity of social interactions, and level of cognitive demand. These thresholds could translate into critical strategic initiatives for both closed and open systems.

TECHNOLOGY & DESIGN:
Cultivate design to shape organizational practice

One of the key lessons of openness is the role that technology has to play at both the macro level—overall connectivity—and the micro level, where specific tool designs influence the social behavior of users. In fact, in widely distributed open systems, technology may well take the place of the manager, setting in place the structural environment in which individuals, groups, institutions, and even states may succeed or fail.

For technology designers, this new social–managerial role of our tools demands a much more sophisticated understanding of interaction design. Technologies of cooperation are those that focus on solving some of the key problems of collective action, including things like reputation building. In this sense, tool design moves from a focus on individual productivity and ease of use to a much more strategic role in understanding how to support cooperative group behaviors. This is undoubtedly the frontier of technological design.

COMMUNITY/POLICY:
Model a larger "sharing economy"

It would be well worth the effort to extend the basic concepts of the model presented here to something other than producing software—or any single type of product. While pharmaceuticals, media, telecommunications, and perhaps even basic infrastructure goods such as power and transportation might converge on open practices in the future, there is a larger macroeconomic framework for openness.

Scholars like Eric Raymond argue that the openness community is a "gift culture" that threatens the capitalist world economy. Howard Rheingold suggests that open source refers not just to the software but also to a method for developing it and perhaps more importantly, a method for maintaining a "public good." Yochai Benkler defines a class of shareable goods that are analogous to labor and information sharing in commons-based peer production. We should certainly attempt to understand such challenges before the economy as a whole is beset by the transformations it has thus far ignored.

IFTF is continuing its research on modeling the open economy. For more details, contact TYF Program Director Kathi Vian (kvian@iftf.org).