DAIdeas Innovation in action

VOLUME 5 NO. 1 SEPTEMBER 2008

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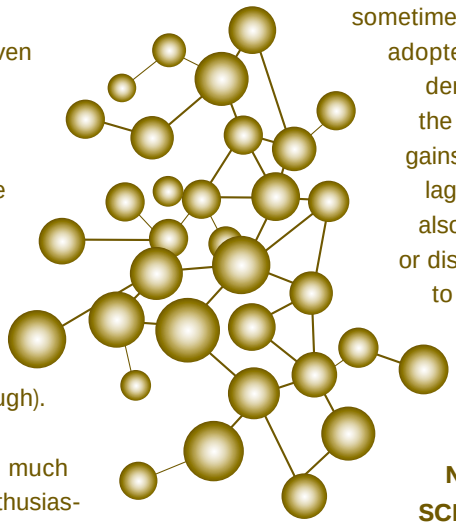
Value Networks: Leveraging Economic and Social Linkages for Development

In 1995, Apple's Newton saved the world.

In *Under Siege 2: Dark Territory*, Steven Seagal foiled another nefarious plot. And he did it by leveraging the communications features built into Apple's Newton. Don't remember the Newton? Think of it as the prototype Palm Pilot, just bigger. Anyway, Seagal's character uses his Newton to send a message to the outside world—from the moving train! He saves the world (train's a wreck, though).



Alas, no one could save the Newton, much to the chagrin of those of us who enthusiastically embraced that pioneering device. The Newton died, and the Palm Pilot inherited the earth.

What pushes an innovation beyond the crowd of early adopters? Malcolm Gladwell is generally credited with popularizing the concept of the tipping point—where the allure for a few becomes the norm for the many. What accounts for the successful diffusion of some phenomena? What accounts for the flops?

As it turns out, we know much more about diffusion processes that succeed. Research on successful diffusion dates back to 1943, when two researchers from Iowa State College, Bryce Ryan and Neal Cross, studied the adoption of hybrid corn. They found a pattern that has since been confirmed for many phenomena: successful diffusion follows an S-curve, sometimes steeper, sometimes flatter (see page 2). A few early adopters test out the innovation. As they demonstrate that the gains far outweigh the costs, however defined, adoption gains momentum until only a few laggards are left. Much of this dynamic also applies to the spread of rumors or diseases. (Incidentally, Apple appears to have learned from its Newton experience, having launched more than its share of S-curves to an adoring market.)

NETWORKS: AN EMERGING SCIENCE

But the ability to deliver net gains is not enough. To hit the rising slope of the S-curve (the inflection point), the diffusion process in social and economic networks demands effective communication—both objective and persuasive. What are the factors that drive communication, adoption, and exchange? Until recently, we have lacked a clear understanding of the characteristics of communication and influence in living networks—human or otherwise. The science of networks has only recently emerged as a powerful framework for understanding the dynamics of interaction and for crafting strategies that take advantage of the structures and processes that define networks.

Partly spurred by the growth of the internet, which provides distinct quantitative indicators of the existence

and strength of communication linkages, network science has progressed tremendously in recent years. It is only a decade ago that Duncan Watts and Steven Strogatz showed how nodes in a network can belong to tight local clusters yet still be only a few links away from any other node on the network. The coexistence of these variables accounts for the "small world" of social and economic networks.

Similarly, Albert-László Barabási and his colleagues at Notre Dame, and others, noted that the distribution of the number of links for a given node in real-world networks follows a power law, with many nodes having only a few links and a few nodes having a large number. The few nodes with lots of linkages are the hubs that play a critical role in any network.

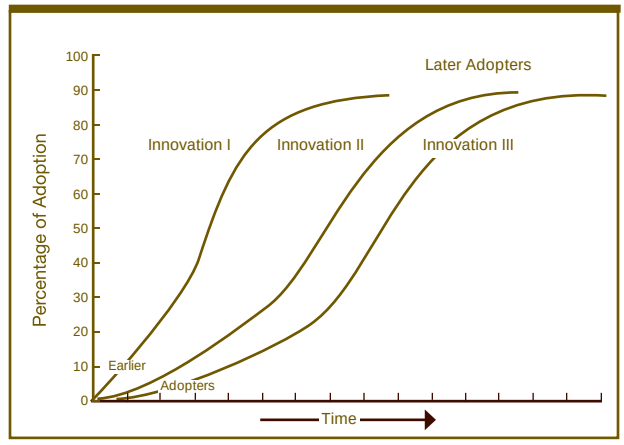
Such insights have moved us beyond using the concept of networks as a convenient metaphor and toward a better empirical understanding of the factors and processes involved in network dynamics. Network science is following its own S-curve; it is now being applied to understand a range of phenomena, from natural ecosystems to the interaction of molecules in living cells or the resilience of the internet to attack.

VALUE NETWORKS DRIVE DEVELOPMENT

How does this emerging understanding relate to development? This will be the subject of a forthcoming issue of DAI's journal, *Developing Alternatives*, featuring keynote articles by Cesar Hidalgo and Ricardo Hausmann, and by Stijn Claessens.

Looking at development through the network lens is critical from a strategic point of view. For anyone who has tried to help integrate local economic clusters—such as small farmers—into global value chains dominated by buyers and retailers, the tendency toward "spontaneous order" has a familiar ring. Geographic proximity and common dependence on skills, raw materials, know-how, and so forth lead to the formation of economic clusters, which in turn are linked to partners (raw material providers, buyers, retailers) elsewhere through long-distance linkages. The concept of global value chains in many ways was an attempt to capture such long-distance linkages, but a chain is a linear concept. In reality, local clusters almost always deal with more than one set of partners. Even if they sell their entire production to one buyer, they retain linkages to other

THE INNOVATION S-CURVE



Source: Everett M. Rogers, *Diffusion of Innovations* (5th edition), New York: Free Press, 2003.

social and economic groups. In effect, they are part of a network that creates value!

Random or purposive linkages tie together groups of local clusters across space. For example, studies of job search patterns show that people do not find jobs in their immediate social network. They rely on "weak" links to other groups. The same holds for successful economic clusters: the printing machine cluster around Heidelberg, as described by Michael Porter, became successful because of its long-distance linkages to user clusters.

The concept of the value *network* adds a powerful dimension to the supply-driven notion of a geographically limited cluster with unspecified and largely unexamined linkages to the outside world. It is more comprehensive than the notion of the value chain—a one-directional link between producer and end market. And it combines the insights gained from the analysis of the patterns of commercial innovation diffusion into a broader concept of linkages and nodes in an economic network that thrives on exchanging knowledge. In short, it contains the seeds for a far more flexible framework than we currently have for conceiving development strategy.

HUBS IN ECONOMIC NETWORKS

Networks revolve around hubs. How do such hubs appear? Barabási and his colleagues showed that network dynamics are driving the process. When networks grow, there is a tendency for new nodes to link to "popular" ones, those with the largest number of links

and highest activity. The “rich get richer,” as Barabási puts it.

In economic networks, hubs serve as exchanges for products, information, and □nance. In the classic Walrasian model in economics, the auctioneer serves as the hub who sends price signals and to whom economic agents communicate their supplies and demands. Moving from this hub-and-spoke to a multidimensional network adds a dose of realism because there are many “auctioneers.” Computational economics has shown that simple decision rules in agent-based modeling create trading networks.

The prosperity of key locations—Switzerland, Singapore, the United Arab Emirates—attests to the importance of hubs in economic development. Singapore’s economic drive was spurred by the emergence of its port as a major goods hub, supplemented by its superb communications infrastructure. In fact, as a location it ended up as a “network orchestrator,” a role that is increasingly played by major □rms, such as Li & Fung, which in effect build ad-hoc value chains for a given market (or even a given order) from their existing value networks. Nongovernmental organizations also can act as network orchestrators. For example, kiva.org has emerged as a hub enabling contributors worldwide to lend to micro-entrepreneurs in developing countries. Trade shows and similar events act as information exchange hubs. The economic importance of Leipzig was largely founded on its role as host of the Messe, a trade fair that dates back more than 800 years and which continued even under the communist regime of the German Democratic Republic. (Leipzig was also a major hub in the network that toppled the communist regime.)

A NETWORK PATH TO COMPETITIVENESS

Network concepts go beyond the critical role of hubs. A group of researchers, primarily at Notre Dame and Harvard University, has explored the paths for upgrading economic performance through the product space. The basic argument is simple. The “relatedness” of product categories, as demonstrated by actual trading patterns (if countries export A they are also likely to be competitive in product Y), provides a guide for assessing how easy it is to upgrade and to move to new products.

The transfer of know-how and specialized infrastructure is easier for related products. One example: the existence of a cold chain and the expertise to manage it means that countries competitive in fresh cut □owers are also likely to be competitive in aquaculture products. Applying the product space approach to real-world issues—should we invest in that particular value network or are other options more promising?—adds an exciting dimension to economic development practice.

APPLICATION TO FINANCIAL NETWORKS

Modeling and analysis of □nancial networks have made great strides in recent years. Much of this approach focuses on the role of banks as key intermediaries between supply and demand. Banks serve as hubs in □nancial networks. Anna Nagurney at the University of Massachusetts and her colleagues have shown how network structures enable detailed analysis of processes and equilibrium conditions in international □nancial relations.

Yet network industries also mean something speci□c in economics. They are what used to be called “natural monopolies,” subject to signi□cant economies of scale because of the large costs of construction and operation of the—physical or information—network. Stock exchanges, payment systems, clearing and settlement systems, or credit bureaus provide goods and services that are subject to increasing returns to scale. The network lens provides a different take on regulation to ensure or encourage competition, a critical issue in developing nations, where access to □nance is often problematic.

Shoemakers in Ecuador. Better understanding of value networks should yield more effective assistance to small enterprises.