Complex Systems Technologies and Open Innovation Strategy: “Why Open Source will only Grow”

Anju Singh

UGC- NET- JRF, Gurukul Kangri University, Haridwar.

Abstract
In the modern era, the greatest achievements involve designing and improving the sprawling architectures of our planet. There is a scientific catchall term for these architectures: “Complex Systems”. Complex Systems are hugely complicated, but that’s not what earns them their name. Here, the word Complex is a synonym for “unpredictable”- or at least not easily predictable. Complex Systems comprise thousands or even millions of cooperating parts whose interactions are not linear, but emergent. Working together, they produce surprising outcomes.

“The firms that can harness outside ideas to advance their own businesses while leveraging their internal ideas outside their current operations will likely thrive in this new era of Open Innovation,” wrote Henry Chesbrough, executive director of the Center for Open Innovation at UC Berkeley’s Haas School of Business. While much of the information about the level of Open Innovation that is going on is anecdotal, a survey by the National Science Foundation released in 2010 showed that 11.5 percent of the $330 billion in R&D conducted worldwide by US corporations in 1988 was performed by other firms. In the Pharmaceutical industry, the number was 25 percent. Of the $330 billion total, 18.8 percent was performed outside the United States.

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1. The Insights and Technologies of Complex Systems
We know a complex system when we see one. In fact, they’re everywhere. We interact with dozens every day. They exist both in nature and by design and make up the fabric of our lives. A cardiovascular system is the collaboration of a heart and lungs, veins,
capillaries, blood and chemicals—all complex systems in themselves—that in turn cooperates with a digestive system, nervous system and so forth to produce a surprising outcome: animal life. Wheat is a combination of a roots, stem, leaves, chaff and grain kernel, along with many molecular-level components, all of which interact with sunshine, soil and water to produce the largest source of vegetable protein in the world. An e-commerce website is the front end of a complex retail system that conspires with a supply chain, an energy grid and a financial system to deliver goods and services to customers at the click of a button. The engine, brakes and design of a car, the roads, bike lanes, pedestrians and traffic lights trains, buses and airplanes—they’re all components of a highly complex transportation system that takes us where we want to go.

Making the world work better is about untangling and managing complexity. Doing so—whether to transform industries, markets, societies or nature—requires serious science. But curiosity and experimentation aren’t enough. Solving systematic problems also requires a particular combination of vaulting ambition and profound humility—the level of ambition to tackle seemingly unsolvable problems and enough humility to recognize that no single entity can make the world work better and no single entity can control a complex system. What we’re really talking about here is progress, which by definition is communal.

2. Knowledge Ecosystems Creation Through Open Innovation

A century of research, development, public-private sector collaborations, venture capital and M&A has firmly ingrained the concept of the knowledge–based organization into the minds of progressive corporations. But the concept took on a new dimension with the introduction of the World Wide Web in the mid-1990s. And now, more than a decade into a new millennium, it’s becoming clear that organizations that think of themselves in isolation may miss out on an important new model for value creation: Open Innovation in a network economy.

Consider Procter & Gamble. The165 year-old merchandiser’s journey “from insular to open” illustrates the dramatic changes that are underway. When A.G.Lafley was appointed chief executive of the American consumer products giant in 2000, he was faced with flat sales, lackluster product introductions and a swooning stock price. By the time Lafley retired in 2009, P&G’s sales had doubled, its profits had quadrupled and the company’s market value had increased by more than $100 billion. Observers credit Lafley’s adoption of a new open innovation strategy for helping to deliver those stellar results. These days, more than half of all new product ideas come from outside parties, and about 40 percent of them come from outside the United State. Meanwhile, P&G has increased its hit rate—the percentage of new products that succeed—from 15 percent to 50 percent.

Gone are the days when corporations were vertically integrated behemoths, handling everything from prospecting for natural resources to delivering finished products to customers. These days, companies leverage distributed supply chains, business ecosystems and their partner’s diverse skills and concentrate their own resources on what they do best. A dramatic example is Bharti Airtel, India’s leading
mobile communications provider, which outsources all of its IT operations and network management to other companies (including IBM) and focuses on market development. At the same time, many companies are shifting their mindset from hoarding intellectual property to investing in intellectual capital that they create with others via open source software and other shared–effort strategies. Such approaches can produce large–scale efficiencies. For instance, by joining forces, individuals, Universities and companies were able to produce and share the core Linux computer operating system, an effort that required an estimated 145,000 person-months of work and would have cost an individual company more than $1 billion to produce, according to a 2006 report prepared for the European Commission.

These external resources such as volunteer contributors, Innovation Communities and Ecosystems, and surrounding networks represent the growing sources of Value Innovation and Knowledge creating Ecosystems.

3. Open Business Models of IBM and Linux:

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Chesbrough’s thinking was heavily influenced by the aforementioned phenomenon of open source software. With roots in the early days of personal computing when hackers shared simple programs with one another, open source software emerged as a force to be reckoned with for corporations in the 1990s. Web Browser pioneer Netscape Communication got thing rolling by allowing some of its programs to be used and modified by others free of charge.

An even bigger breakthrough for open source software came in 2000, when IBM announced that it would invest $1 billion in the Linux ecosystem. That sent a strong signal to corporations that Linux was going mainstream. Within a few years, Linux had become the operating system on more than 20 percent of server computers, according to tech market researcher IDC. “There’s no doubt that IBM was Linux’s biggest coup,” wrote Linus Torvalds, the program’s creator.

This represented a huge cultural shift for IBM. In the 1960s and ‘70s, the company had built a leadership position in business computing based on proprietary technology. In the late 1990s, some IBM executives worried that Linux would eat into the company’s server business. But the company’s leaders had learned the lesson of the near-death experience. They concluded that Linux was going to succeed sooner or later, and rather than trying to resist it, IBM should build a business around it. “At the time, IBM was still viewed by some as old and stodgy. This gave us the opportunity to differentiate ourselves and be seen as forward thinking,” recalled Robert LeBlanc, a
senior vice president at IBM’s investments paid off quickly through sales of software and computing systems. IBM has also contributed significantly to other open source projects, including Eclipse, a framework for development complex software applications quickly, which IBM created and then handed to the open source community. IBM’s involvement in open source software continues to pay rich dividends. “Open source will only grow,” said Robert Sutor, IBM’s vice president for open systems and Linux. “More and more of the core infrastructure of corporate computing will be open source. Proprietary innovation will come at the top.”

4. Conclusion: Open Collaboration Across Global Systems

New methods for creating value are not just more abundant today, but also more necessary, as challenges and opportunities have become vastly more complex. The explosion of data from both natural and human-made systems is revealing what complexity theorists call “Systems of Systems.” This new world is a vast network of interdependencies, and the only way to address it successfully is through multidisciplinary approaches, which can generate innovations that no single industry or scientific discipline could produce by itself. Already, this kind of knowledge sharing is having an impact on the economy. Multifactor productivity, which includes the use of technology, organizational improvements and globalization of work, accounted for roughly one-half of productivity growth in the United States from 1995 to 2007. This is the foundation of the twenty first century knowledge economy.

“The big payoff will be an acceleration of Innovation as we develop the ability to combine different areas of R&D—IT with biotech, biosciences with energy, energy with nanotechnology,” said Michael Mandel, an economist and Innovation expert at Visible Economy. One example of this is a collaboration between IBM and pharmaceutical giant Roche to develop a process for reading and sequencing human DNA quickly and efficiently. The process combines nanotechnology, data analysis and genetics. If successful, it could make it possible to inexpensively sequence the entire genomes of large numbers of individuals, greatly improving doctors’ abilities to treat diseases.

The organizations that evolve to meet these challenges will create value differently from the empire builders of the railroad age, the Big Three Detroit automakers of the mid-twentieth century and even the fast-moving Silicon Valley outfits of the personal computer era. It’s likely that they’ll readily from alliances and share technologies. They’ll compete some days and in some ways, and collaborate in others. In form, they may be amalgamations of a variety of enterprises: public and private, for-profit and nonprofit, small entrepreneurial outfits and giant corporations, established organizations and ad hoc communities that take shapes to capture an opportunity and then dissipate. The iconic next-generation organization may, in fact, be a network of alliances rather than a mighty monolithic corporation like those that ruled in the middle of the twentieth century.

References