



**Calestous Juma.** *Innovation and Its Enemies: Why People Resist New Technologies.* New York: Oxford University Press, 2016. 432 pp. \$29.95, cloth, ISBN 978-0-19-046703-6.

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Who knew that Thomas Edison fought the introduction of alternating current by publishing advertisements linking it to electrocution—a word that he coined—and that he then did his best to introduce the term “westinghousing” to refer to execution via the electric chair, in “honor” of his major rival, George Westinghouse? Who knew that the Ottoman Empire resisted movable type for two centuries because of opposition—not so much from calligraphers, who figured they would always have at least a niche market for their skills, but from traditional Muslim clerics who feared competition from “ignoramus” who lacked proper religious training but would nevertheless be free to write books? *Innovation and Its Enemies* is an engaging romp through these and many other stories of principled and unprincipled resistance to innovations that we now take for granted.

Harvard professor Calestous Juma recounts juicy anecdotes selected from six hundred years of resistance to such now-commonplace innovations as coffee (once attacked as “Satan’s drink”), the telephone (the “devil’s instrument”), frozen foods (“embalmed food”), margarine (“bull butter”), and most recently, “Frankenfoods.” His objective is to show “how different social systems responded to new technologies and how these co-evolved with social institutions” (p. 8). These ac-

counts are enriched by the experiences of Juma’s distinguished career, his wide acquaintance with the history of innovation, and his extensive bibliography, all of which enable him to draw parallels among the patterns of resistance to innovation in wildly diverse areas. The overall result is an amusing and instructive series of well-researched accounts that can be read with benefit and pleasure.

As Juma recounts, the owners of incumbent “legacy” technologies have placed any number of ingenious obstacles to the adoption and spread of potentially disruptive competitors by fair means or foul, and often have done their best to block them entirely. For example, readers of a certain age may remember how the laws in many states once required users to knead little tablets of food coloring into bowls of margarine in order to change its color from unappetizing white to buttery yellow, at the same time that butter manufacturers were allowed to add the same artificial color to their product without legal hindrance. Not surprisingly, these laws resulted from sustained lobbying by the American Dairymen’s Association, a trade group formed specifically for this purpose. (In an ironic bit of poetic justice, both butter and margarine were later found to pose health hazards.) This kind of hypocrisy took its most extreme form when an Ottoman sultan hanged the

first Turkish citizen to own a pair of binoculars, and then used a pair himself to spy on the nearby French embassy.

Toward the end of his book, Juma's tone of bemused tolerance changes to one of barely suppressed frustration, as he turns his attention to more recent innovations, reflecting his personal experience with the resistance to the genetic modification of food crops during his service as executive director of the Convention on Biological Diversity. Here Juma strains to maintain a dispassionate tone as he reflects ruefully on the many factors that have combined to restrict the application of these research techniques to African agriculture, where they are badly needed to increase productivity and sustainability. In sub-Saharan Africa, he laments, "products are risky even if they do not exist" (p. 5).

*Innovation and Its Enemies* is particularly strong on the political, psychological, commercial, regulatory, cultural, and public relations dimensions of the responses of incumbent technology to the threat of disruption in the examples he has chosen. It devotes somewhat less attention to economics, as for example in its treatment of the economic competition between horses, mules, and early tractors.

Juma recognizes the need to address the risks and social consequences of innovation, but his chief concern is with unreasoned opposition to promising innovations, and with the tendency of public debate on innovation to disintegrate into a contest between overselling, on the one hand, and demonization, on the other. He admonishes political leaders to take decisive action to remove unnecessary obstacles to innovation. At the same time, he quotes with approval the advice that risk should be managed through a "complex interaction of opinions, positions and interpretation of facts held by various stakeholders" (p. 289). These two ideas can be in conflict with one another.

The core issue, in Juma's words, is to "manage the tension between innovation and incumbency"

(p. 289). This is easier said than done. Creative destruction may well be a major engine of economic growth, but as Juma himself points out, the "fear of loss is one of the most fundamental drivers of concern over new technologies.... In most cases, decisions about new products are driven by perceptions of potential loss" (p. 294). These perceptions are typically clearer and stronger than the hope for uncertain future benefits.

To manage these tensions, Juma proposes an approach of "inclusive innovation." This is to be based on "innovation platforms" rather than innovative products, and on building local technical capacity to build their own innovations on these platforms. Here one thinks of the model of the system of cellphone-based mobile finance that was developed in East Africa and has spread to much of the developing world. This inclusive approach to innovation would, he argues, help to "manage risk perception and foster trust," and would help to overcome the anxieties of people who are left behind by innovation, as well as those of people who have been overly influenced by the exaggerated claims of its opponents (p. 307). Here the internet—surely the ultimate in inclusive innovation—is a worthy precedent. Still, the continued existence of the digital divide is a reminder that inclusiveness is far from a complete solution to the issues that he raises.

Juma concludes that innovation is critical to the solution of domestic and global problems. He notes that political leaders, judges, and the public need flexibility, scientific literacy and advice, and openness to continuous learning. He urges policymakers to think of themselves as managers of change, to allow innovation and regulation to co-evolve, and to "develop more appropriate approaches for supporting informed decision making" (p. 281).

One can hardly disagree. But Juma does not fully confront what is often the biggest and most fundamental obstacle to the disruptive innovations that are most urgently needed today. Such

innovations face extraordinary hurdles precisely because those who are about to be creatively destroyed use their accumulated political and economic power to protect themselves against what to them are not just perceptions of loss but are very real dangers. One can understand, for example, why an authoritarian ruler might use all the tools at their disposal to oppose the proliferation of coffeehouses in which political dissidents could meet to exchange seditious thoughts, why dairy-men might do the same to oppose cheap margarine that threatened their markets, or why the unions that represent live musicians might fight the introduction of recorded music that threatens the livelihoods of their members. Overcoming this kind of opposition is even more difficult when the ultimate drivers of innovation are not market forces, but instead are externalities and public goods like environment, security, or public health and safety, as is the case with many of the innovations that are most needed today.

Juma does not speculate how policymakers and political leaders might in retrospect have handled the genuine or imagined deleterious consequences of the disruptive innovations that arose on their watch and that are recounted in his book. He recommends evidence-based precaution as a middle ground between the over-optimism of the promoters of innovation, and the overly pessimistic approach of the Precaution Principle to block needed and desirable innovation. (Full disclosure: I have published similar arguments in favor of science-based precaution.)

But even if we set aside political pressures, what are the methods that even the wisest, best advised, and most scientifically literate policymakers could have used to address the real safety issues of the early refrigerators or, to cite more contemporary examples, the multiple problems associated with nuclear power, the ethical problems raised by synthetic biology, or the prospect of technological unemployment from driverless cars, advanced manufacturing, and artificial intel-

ligence? Even with the best scientific advice, how does anyone make purely rational judgments of the balance between risks and benefits of new technologies like gene drivers and geoengineering, whose capabilities and social impacts are still unfolding?

For the academic community, Juma's main takeaway is that the phenomenon of resistance to innovation is seriously under-researched, a point with which I heartily concur. It is exciting for readers and researchers to follow the dramatic accomplishments of successful innovators. It is much more frustrating to explore the fate of innovations that do *not* happen because they were unable to surmount the kind of obstacles that Juma explores. But these are the very innovations that we need to address today's critical problems of environment, poverty, health, safety, and security.

*Innovation and Its Enemies* is a valuable, lively, extensively researched, and immensely readable historical guide to an important subject. I highly recommend it.

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