INNOVATION: SAMPLING CURRENT CONSTRUALS

*What innovation is; what it does; what it might do*

Essay written for part fulfilment of STS seminar 6312, ‘Political Economy of Technoscience’

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***Abstract.***  *I briefly survey some recent academic texts on innovation. I examine their definitions of the term and explore these definitions’ consequences for the characteristics of innovation. I conclude by touching on possible new emphases in innovation study.*

**1 / WHAT INNOVATION IS**

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OCRATES famously refused to debate undefined terms; yet a strictly Socratic approach to recent academic discussions of innovation might shut down debate on the topic altogether. For example, Fagerberg & Verspagen (2008; *see* Bibliography) are punctilious in defining such concepts as *scientific field; active populations* within such fields*; units of analysis; strong ties* defining technoscientific groups*; cognitive communities; inverse Herfindahl index; co-workers; co-authors;* and *frames of reference.* But *innovation* itself, in a paper entitled *Innovation Studies*, is left undefined (1).

Nor are these authors unique in orphaning their key term. Hopkins *et al.*, citing Powell *et al*., define *new entrants, therapeutics*, and *venture-capital funds*, and describe a “networked mode of innovation as a defining feature of the biotech sector”, but neglect to define *innovation* itself (2). Even an author as careful as Godin (2006) manages to skirt the problem, defining ‘research’ in some detail (3) but limiting his explicit understanding of innovation to vague terms like ‘commercial production’ – as if the graveyards of industry were not choked with material mass-produced but never sold (4).

1. For want of more persuasive exemplars I myself have defined innovation as ‘the widespread provision of a product or service that incorporates nonnegligible technological advances or refinements’ (Atkinson, W.: National Speakers’ Bureau, Global Speakers’ Agency, various venues 2002-2011). Briefly unpacking the definition: ‘widespread’ because even a major invention is not innovative unless it permeates society; ‘provision’ because an invention cannot become an innovation until it is offered for general sale. ‘Product or service’ is strictly speaking a redundancy, as a product may be ontologically (nominalistically) considered as the instantiation in materiality of specific services – e.g. an automobile provides status, transportation whose destination and timing are user-determined, etc. ‘Significant’: a new colour of light bulb may sell well, but it is not an innovation. ‘Technological’: technologies may include techniques and approaches as well as materialities: see above note on ‘product or service’ and p.3 below. Small ‘advances’ (e.g. the Tesla electric car) may be considered to exist at opposite ends of a spectrum of degree from ‘refinements’ that are also incremental but smaller still; as Marx noted, sufficient quantitative change is qualitative change. The great advances – fire, weaponry, print, mathematical and phonetic semiotics, steam, computers – transcend small-step tinkering: in our age, the iPhone’s disruptive effects stem not from the sum of its technical specifications but from Steve Jobs’s revolutionary insight that all hardware and software engineering must be subordinated to a user interface of maximum simplicity.

2. Hopkins (2013) *passim*

3. Godin (2006) esp. pp.651-655

4. The Ford Edsel comes to mind.

*Innuendo* Schumpeter, Godin also introduces, but still does not strictly define, two subcategories of innovation: *initial* innovation, and an ‘imitation/diffusion’ process that, one must infer, occurs subsequent to the initial component (5). Yet the interrelationship of these subcategories remains undercharacterized. Even allowing for the limiting rhetorical case, *viz*. that an excessively detailed definition closes off debate since there is nothing more to be said, Godin uses in a continual and familiar way a key term that he still leaves undefined. Nor are these modern authors the sole offenders. In recent history, the American boffin Bush does not even list ‘innovation’ in the index of his seminal book *The Endless Frontier* (5a). Similar ellipses occur in Edwards (1950), written at the supposed apex of the linear model (LM), and Storey (2004) (6).

Common usage of the term ‘innovation’ is of no help. Webster’s New Collegiate Dictionary for example defines it as ‘Act of introducing something new or novel (7) as in customs, rites, etc.; also, a change effected by innovating; a novelty added or substituted.’

If the situation is lax in the Academy, it is even more troublesome outside. Consider this statement, which leads off a press release from the Information Technology Association of Canada:

Innovation is the lifeblood of any business . . . [T]his means developing or embracing ICT solutions that drive efficiency, differentiate a product or service from the competition, and benefits [*sic*] the end user in a truly meaningful way (8).

By what authority is this statement true, unless that of conventional wisdom? It is motherhood prose, boiling down clichés into semantic mush. But a single exception disproves the rule of innovation’s universal desirability. ‘Silent gardening’ is a rapidly expanding feature in upscale residential neighbourhoods. It eschews leaf blowers for brume rakes, and two-cycle gasoline lawn mowers for hand-pushed machines. In so harking back to a bygone age it reduces pollution from noise, noxious particulates, and greenhouse gases. Yet it is debatable if this reversion to an older, slower, quieter, more labour-intensive, *less* *productive* style of work is indeed an innovation, unless one’s definition of innovation be extended to all change, even reversive.

5. Godin op.cit. p.655

5a. Bush, V., *Science: The Endless Frontier*. Washington DC: [US] National Science Foundation, 1945/1960

6. A compendium with the term Innovation in its very title. For more on the LM see below, p.4

7. WNCD 1961 edition p. 433B. Note the adjectival distinction: cf. French neuf [new in context] vs. nouveau [wholly new]. In addition, the definition is logically inadmissible (circular) because it employs the term defined.

8. ITAC Ingenious Awards, email (listserv) announcement, 2015 May 07.

The upshot is that we are left attempting to assess current views on innovation without a solid knowledge of what most writers, academics and nonacademics alike, understand and mean by the term. This in turn robs their statements on innovation’s causes, characteristics, and effects of much of their intended meaning. Socrates did not say *Play it close to the chest*.

Of current academic and demotic authors, Hawkins (2012) may define innovation in the most rigorous way –

In common use, the term “innovation” is used interchangeably with “invention” and applied indiscriminately to any kind of change. It is often used synonymously with technology. In common use, finer distinctions are of little consequence. On the other hand, economists generally maintain that only the commercial application of an invention constitutes an innovation. But this is overly restrictive. Many economically significant innovations, e.g. innovations in organization, governance and professional practice have no essentially commercial characteristics and most are never traded as goods and services in their own right. Moreover, innovations do not have to be based on inventions at all, and they occur commonly in every sphere of human activity (10).

Hawkins’s thoroughgoing definition, which is not incompatible with my own usage (1), extends the mantle of innovation to process as well as product. This is a useful insight; the mediaeval introduction of double-entry bookkeeping (say) was innovative in ways that centuries later are still profound. I would dispute, however, Hawkins’s contention that such immaterial innovations, while “economically significant . . . have no essentially commercial characteristics and most are never traded as goods and services” (10). The present plethora of accounting and tax-filing software contradicts that assertion. Perhaps any good idea can sooner or later become a monetized innovation.

From definitions Hawkins proceeds to examine innovation’s political attractiveness. He cites Schumpeter’s contention that technical change is a *sine qua non* of growth, and then shows how this “remarkably resilient and reliable” idea has become conventional wisdom among the world’s governments (11) – the birth of motherhood, so to speak.

If academic authors have not achieved a consensus on the *denotation* (*i.e.* lexicography) of the term ‘innovation’, they are at least more circumspect than nonacademics in the term’s *connotation* (*i.e.* its affect). To civil servants and politicians throughout the world, innovation ranks with the Sangraal; it is assumed to be good, and its absence assumed to be bad –

10, 11. Hawkins (2012), p.9

 [T]he link between innovation and growth leads governments to link the international competitiveness of national industries with their ability and propensity to innovate . . . if this theory is correct, and there is a lot of evidence that it is, governments should . . . create sustainable competitive advantages for industries within their jurisdictions (12).

Hawkins’s narrative parallels the conceptual progression from innovation theory to innovation policy. Here the world’s national governments (13), led by the wealthier nations and imitated by nearly all others (14), attempt to apply what began as a strictly academic understanding. Not coincidentally, this process itself recapitulates what Godin (citing others) terms the linear model of innovation (LM). Its paradigm, at least as early as Bush (1945), is “Basic research → Applied research → Development → (Production and) Diffusion.” The LM’s implication is that innovation occurs inexorably and sequentially, following a comprehensible set of rules (15).

**2 / WHAT INNOVATION DOES**

This section samples some current views on innovation’s actual functions, together with a few of its imaginaries. I stress again that such exposition cannot but be hindered by the lack of definitional clarity on how innovation studies’ subject is construed. Not only must such ambiguity blur or even suppress ideas about innovation, even to their authors; it must also inhibit the commensurability of ideas across papers.

Despite this caveat, and despite the academic literature’s diversity of concepts, assumptions, and approaches, certain shared themes do appear to emerge from the literature as a whole. I shall examine these themes, beginning with a sketch what seems to me to be the main points of each of my selected authors (16).

12. Hawkins *op.cit*. p.9

13. As well as some supranational hegemonies such as the European Union.

14. The few exceptions to this general truth include isolationist thugocracies such as North Korea, whose leadership cannot promote innovation without also encouraging free thought, labour mobility, and capital flow.

15. Godin *op. cit*. p.639. As Godin persuasively argues, the consensus model for the innovation process *per se* (at least outside the Academy) is the LM. However, the term ‘innovation’ in his 2006 paper is conspicuous by its absence.

16. For full author names and specifications of all cited works, see Bibliography.

**BIRCH** seeks a restructured STS that is radically more involved with the world, particularly its socioeconomic attributes, and less obsessed with abstract theory. This is, in Steve Fuller’s term, an *engaged* STS. To this end, Birch proposes that STS explore its affiliated or ‘cousin’ studies such as materiality, anthropology (perhaps via the ethnographic techniques effectively displayed in the later chapters of Callon (1998)), and innovation studies. Innovation in its fullest (*i.e.* supratechnical) sense nicely instantiates Birch’s core definition of the political economy of technoscience: ‘the ways that the economy is ethically, socially, and politically organized . . . [and] how this shapes technoscience and is constituted by technoscience in turn” (17).

**FAGERBERG and VERSPAGEN** report the disproportionate representation of economists among innovation scholars, a situation that is a two-edged sword. While it has catalyzed vigorous geographical centres of innovation study, it has also perpetuated the grip on such study of classical economics, whose rarefied mathematics often complicate rather than clarify the process of innovation, by downplaying social factors. (It is interesting that the authors base their conclusions on original polling information that they obtain and analyze; this suggests that they frame their discussion consistent with the LM as characterized by Godin, who ascribes the LM’s success at least in part to its ability to provide corroborating statistical data (18).)

**GODIN**’s exposition of the LM of innovation, both its characteristics and its recent historical origins, shows how the LM has tended to exclude alternative models of how innovation occurs. It does, however, at least when buttressed by statistical evidence generated over the last half-century by the Academy, show how the simplicity of the LM’s core concepts continues to dominate extra-academic consciousness, particularly in popular, political, and bureaucratic statements. One sees here the biological founder principle, by which a less competitive species continues to dominate an ecosystem even after better-adapted competitors evolve, merely by having been first on the scene (*cf*. Bell Telephone, Microsoft, and fossil fuels).

**HALLIWELL and SMITH** compare the role of public institutions in delivering innovation between two similar but nonidentical state configurations, New Zealand and Canada. They conclude that these two smallish Commonwealth countries have steadily required a greater likelihood of commercial payback from basic research, in which curiosity-based motivation had

17. Birch (2013) p.2. Developing new case histories in this area might well be useful.

18. Godin p.639 (*Abstract*), 641

for the previous century been sacrosanct. While dealing with a sample of two, and thus not achieving statistical rigor, the authors do show that the recent concerted neoliberal attack on non-market institutions (especially governments and NGOs) has affected, and is still affecting, sovereign nations in surprisingly similar ways. The neoliberal catechism has helped determine today’s conventional wisdom (*see* below, III, p.8).

**HAWKINS** decries governmental policy efforts within Canada to foster companies that create technology *de novo*, at the expense of larger, more viable companies that could become larger and more profitable by importing and applying technology created by external companies.

Hawkins proposes (19) that the Academy establish a consensus incorporating policy recommendations based on the most up-to-date and rationally defensible innovation studies. This in turn would pressure Canada’s federal, provincial, and municipal governments to move from trying to create new hi-tech hubs (such as Toronto’s on-the-ropes MaRS) toward encouraging technical innovation among existing industries, particularly the large mining and forestry industries that remain the backbone of the Canadian economy.

**MAZZUCATO** explores the fraught role of P3 (public-private partnerships) in modern innovation, revealing its generally unjustified neoliberal assumptions – *e.g*. that the private sector is always more efficient, or that innovation is best effected through private capital rather than tax-supported public funding. In key areas such as microelectronics and biotechnology, says Mazzucato, private companies “have ‘surfed the wave’ rather than created it” – profiting from public investment rather than pre-empting it.

**MORRONI**, a professor of economics at the University of Bergamo, Italy, looks at innovation specifically as embodied in production processes. He allows however that “the concept of innovation is much broader than that of technical change . . . [T]hough it usually involves a change in production techniques, [innovation] *may be* *related to changes in market conditions, which have no influence on production processes*” (20). Given Morroni’s near-obsessive focus on incremental technical innovation on the factory floor, this is a handsome admission.

19. One has to say naïvely: my own direct experience with Canada’s basic industry (steel, forest products) strongly suggests Hawkins’s suggestion is dreaming in colour. (See below, p.8 (IV))

20. Morroni (1992) pp.17-18; Italics mine. Unfortunately Morroni immediately segues into *hommage à Schumpeter* rather than rigorously thinking things through for himself.

**ROGERS** in his classic book (first published at the same time as *The Structure of Scientific Revolutions* and like Kuhn’s equally well-known book still in print) uses case-history techniques to examine why some innovations succeed and others fail. For example, as simple and beneficial an innovation (21) as purifying water by boiling, despite intensive lobbying by well-meaning outside experts, never took among the Andean villages because of nontechnical factors. Villagers saw government health workers as outsiders; neither recognized nor accepted germ theory; and considered water thirst-quenching only when it was cold. Sociology, in the form of traditional inertia, trumped technoscience.

**STOREY** has compiled an impressive array of academic papers examining all aspects of technical innovation. Perhaps the key element common to most of these papers is expressed by Tushman and Rosenkoff in their paper *Organizational Determinants of Technological Change*:

[C]hoices among technological options cannot be made solely with reference to technology . . . We need to know more about how interactions between [*sic*] competing organizations, professional societies, suppliers, customers, and governmental units shape technological evolution” (22).

**3 / ANALYSIS: INFERENCES and GENERALIZATIONS**

**I / Innovation study is hampered by a plethora of definitions.** Further progress in innovation studies, culminating in Hawkins’s artlessly idealistic proposal that Canadian academics forge a united front influencing governments to modernize their innovation policies, may hinge on the Academy’s first smithing out a definitional consensus.

**II / Innovation is economically vital.**  No writer, academic or non-academic, disagrees on this. Whether it is in incremental innovation that cuts costs and increases productivity, or transformative technologies that forever change our way of accomplishing certain ends, innovation is a major factor in the economic health of the world as a whole, as well as in that of its constituent nations. This truism may apply especially to smaller nations like Canada that, while blessed with natural resources, depend on exports to stay prosperous (*cf*. Halliwell and Smith).

21. Rogers pp. 1-5. Again we are troubled with definitions. Even had it succeeded, would this technique actually have constituted an innovation?

22. Story (2004) p.377 (p.343 in original journal: *Research in Organizational Behavior*, Vol.14 (1992)). It seems probable that the authors’ term ‘technological evolution’ is cognate with ‘innovation’, though they never explicitly say so.

**III / Innovation is not the sole determinant of economic viability.**  As several scholars (*cf.* Birch, Morroni, Storey) demonstrate, although innovation is economically necessary it cannot by itself ensure economic success. This implies that academic innovation studies should loosen the present dominance by economists, whose theoretical work is insufficient even if one admits its necessity (*cf*. Fagerberg and Verspagen). Governments that neglect influences beyond the strictly technical, especially social factors, may act counterproductively and end by inhibiting rather than encouraging beneficial innovation. They will, for example, confuse innovation with politics and muddy the water by playing favourites (*cf.* Bombardier, Telidon, Nortel). As well, noninnovative actions – those that reject the technically new, or even set themselves counter to it – may have a surprisingly robust value in larger society.

Consider a limiting case. It is problematic whether a nation whose factories were wholly robotic could prosper; for despite achieving the highest possible levels of ‘technical evolution’, it would employ trivially few of its citizens. Perhaps the very term ‘productivity’ is neoliberal code for maintaining a large pool of the unemployed, which drives down wages to the short-term benefit of capital.

While innovation is useful, then, perhaps even indispensable, it is not omnipotent. The human-powered landscape company and the craft brewery have their place in larger society.

**IV / Innovation may be productive through its users as much as its originators.**  This is Hawkins’s chief point, and is worth further exploration. Hawkins might, however, consider the dismal record of innovation among Canada’s big resource industries, whose view of innovation has long been: *In good times we don’t need it, in bad times we can’t afford it*. Hawkins’s proposal, like Wilde’s description of a second marriage, seems the triumph of hope over experience.

##

***BIBLIOGRAPHY***

Birch, K., ‘The Political Economy of Technoscience: An Emerging Research Agenda*.*’ In *Spontaneous Generations*, Vol. 7 No.1,

Bush, V. *Science: The Endless Frontier*. North Stratford, NH: Ayer Co. (1945/1960)

Callon, M.: *The Laws of the Markets.* London: Blackwell, 1998

Edwards, R.: *Co-Operative Industrial Research.* London: Isaac Pitman & Sons, Ltd., 1950

Fagerberg, J. and Verspagen, B. ‘Innovation studies - The emerging structure of a new scientific field.’ In *Research Policy* 38: 218-233 (2009)

Godin, B., ‘The Linear Model of Innovation’. In *Science, Technology, and Human Values* 31 (6): 639-667

Halliwell, J. and Smith, W.: ‘Paradox and potential: Trends in science policy and practice in Canada and New Zealand.’ In *Prometheus* 29(4): 373-391 (2011)

Hawkins, R., *Looking at Innovation from a Uniquely Canadian Perspective*. Ottawa: ISSP, 2012

Hopkins, M. *et al.*, ‘Buying big into biotech: scale, financing, and the industrial dynamics of UK biotech 1980-2009.’ In *Industrial and Corporate Change* 22(4): 903-952 (2013)

Mazzucato, M. (2013) *The Entrepreneurial State*. (Ch.2). London: Anthem Press, 2013

Morroni, M.: *Production process and technical change.* Cambridge: CUP, 1992

Rogers, E., *Diffusion of Innovations (4th Edition).* New York: The Free Press, 1995

Sahal, D., *Patterns of Technological Innovation.* Don Mills ON: Addison-Wesley Publishing Company Inc., 1981

Storey, J. (ed.): *The Management of Innovation.* Cheltenham UK: Edward Elgar, 2004

Zachary, G. P. *Endless frontier: Vannevar Bush, Engineer of the American Century*. 1999