WHO IS DEVELOPING WHOM?

Reflections on American Science Abroad

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As a historian of American technology and science, I have been struck by the lack of historical attention given to the transfer of American scientific ideas and technological artifacts to other countries, particularly less-industrialized countries.

Although by the early 20th century, researchers in virtually all fields of science and engineering participated in international scientific work, historians have been reluctant to examine the details of such encounters. While comparative work in the traditional sense of understanding multiple cultures and languages equally is still fairly unusual in history of science and technology, what I am referring to is slightly less daunting, and refers to following Americans on professional trips abroad to understand, not only what lessons they leave in host cultures, but what lessons they bring back (1).

Such sojourns, lasting a few weeks or a few years, can be illuminating in several respects. First, although scientific exchanges are premised on the belief that scientific facts are universally true, it is less clear that such facts operate in a straightforward way outside the home laboratory. Steve Shapin's recent work on 18th-century astronomy suggests this sort of difficulty. Second, scientific and engineering processes that are considered unproblematic in one culture turn out to be nearly impossible, or nearly unrecognizable, in another. Here one might recall the work of engineers and physicians working on the Panama Canal, or the creation of a space satellite system in India (2).

Within the history of agriculture, even fewer scholars have followed scientific ideas and artifacts abroad, despite the fact that agriculturalists routinely capped their professional careers with consulting for USAID, the USDA, the Rockefeller Foundation, or one of the thousands of agricultural businesses operating internationally. One of the reasons for this neglect, I think, has to do with the powerful but poorly understood "development model". According to this, American agriculture went abroad in the 1950s and 1960s primarily to help industrialize food production in less-industrialized countries. Within this model, the stories told have certain similar characteristics: most are told according to an economistic, rational-actor paradigm; the "work done" includes not just food production, but anti-Communistic pacification as well; the tenor of the

reports is upbeat, entrepreneurial, and cooperative; the science and technology taken abroad is generally unproblematic in terms of its "fit" with the local culture; and the process of development is distinctly one-way (3).

I would argue that this development paradigm has led historians to have an unreasonably narrow view of the ways in which American agriculture interacts with the less-industrialized world, ignoring other styles of interaction that are more complicated and ambiguous than the development model can accommodate. Certainly we cannot use a model developed for the 1950s to explain activities from the 1920s, yet most accounts tacitly do this. For example, by 1920 quite a number of agricultural implement manufacturers had established salesmen in parts of Africa, China, India and Russia. These salesmen spent years in these countries not just selling tractors, but establishing relationships with social and political leaders, with banking organizations, and with farmers. They learned the norms and practices of the culture, the language, the needs and desires of the leadership. They trained other men, both those from that country and those that came there from America and Europe. They socialized with other foreign businessmen living in the area (4).

Now it would seem to me that this sort of activity was extremely important in the gradual industrialization of agriculture in less-industrialized countries, despite the fact that it does not seem rooted in the quasi-philanthropic language of the development model. But historians would be remiss if they described this activity as strictly commercial, because such a description fails to capture the social and economic gridwork that later, more self-consciously developmental, experts attached themselves to when trying to industrialize a place. In other words, while many tractor salesmen (or irrigation engineers, public health officials, etc.) traveled abroad simply for commercial reasons, with no interest in the larger goals that later development specialists articulated, they were agents of industrialization all the same.

Another activity that the development model does not quite accommodate was the advisory work of American experts who were invited to less-industrialized countries to help along the process of industrialization. Such activities are generally described in terms of plain technical assistance, that is, minus the financial incentive (although such Americans were generally paid well for their trouble, they were not engaged in commerce per se) and minus the ideological cast. What the development model does not pick up is the extent to which such sojourns fit into the research interests of the American experts, and served as opportunities to expand existing research capabilities. That is, American experts who were constrained by the acreage, budget, or seasonal limitations of their home institution could expand their research activities by going abroad, insofar as there was a match between their research projects and the foreign host's needs. In this event, the actual nature of the transfer activity is reversed from the typical development model; here, one might argue, the less-industrial country is providing at least as much aid to the researcher as the researcher is providing to it.

In this paper I would like to provide an example of this reverse aid phenomena (and, to a lesser extent, of the commercial industrialization phenomena) centering on the experiences of American agriculturalists in Soviet agricultural collectivization between 1927 and 1932. While a full description of this fascinating and complex story is beyond

the scope of this paper, a few pieces of the story may help elucidate some of the ideas

machinery need the space to turn around and move continuously, but only such a large tract could financially support an investment in this expensive equipment.

In 1927, with financial assistance from the Rockefeller Foundation, Wilson acquired five farms in Montana that he turned into laboratories for studying farm management. Here he could test out his own theories and also traditional beliefs that, often, were found to be erroneous. For instance, on the basis of his Fairway Farm study, Wilson argued that while the Homestead Act designated 160 acres as the ideal size for a family farm, such a farm could not support a family in areas of light rainfall (such as Montana) where crop yields were consistently lower than in wetter parts of the country. Fairway Farms also enabled Wilson to develop empirical data correlating, for instance, farm size and machinery needs, or farm size and rainfall. Writing to his old mentor Henry C. Taylor just before he went to Russia, Wilson described the northern Caucasus as "primarily our Lone Warrior farm at Brockton expect [sic] on a 100,000 acre scale". The Brockton farm was used mostly to test different brands and types of agricultural machinery, and was in other ways the most "industrialized" of the Fairway Farms. And describing his hopes for the trip to a USDA colleague Wilson wrote "The thing of greatest interest to me is that it involves laying out a 15,000 acre tractor experimental station which would be given over entirely to experimental work in connection with tractor farming". Clearly, for Wilson this sojourn in Russia was not unconnected with his own interests and research, and indeed resonated deeply with his own visions of agricultural change.[8] Wilson believed that the problems in Russian agriculture were similar enough to Montana problems as to constitute, in effect, an extension of research already underway. This was so because for Wilson, as for other agricultural economists, agricultural problems that could be defined as discrete, abstract problems without regard to regional, climatic, or temporal specificity would be solvable by scientific and technical principles just as laboratory problems were solved. This attitude was apparent in the work plan that Wilson wrote in collaboration with Hal Ware, an experienced Russian hand, and submitted to the Soviet government before the trip itself. After considering the peculiar features of the Russian agricultural situation, Wilson and Ware argued that the Soviets should adopt virtually the same wheat growing system that Wilson recommended to Montana farmers. They made very few concessions to the fact that many facets of the system would be more difficult to accomplish in the Soviet Union (e.g., "timeliness of operations"). Rather, they presented their plan as though it were a strictly technical and nearly formulaic problem that could be solved without considering social, psychological, political, or cultural issues at all. It was clearly this seemingly objective problem-solving activity that Wilson found so appealing in the Soviet situation (9).

The heart of Wilson and Ware's report was a description of Wilson's pet project for wheat growers: the summer fallow system. This system was basically a rotational system on which land was divided up into winter wheat fields, spring wheat fields, and summer fallow fields. Wilson recommended this approach as a replacement for the continual cropping of wheat, which tended to reduce soil moisture, and he thought it was particularly effective in areas of light rainfall, such as Montana. The key features of the system were to increase the wheat acreage, to reduce the amount of planting

and plowing done each year on the farm through rotation, and to use machinery for all these operations.

According to Wilson, planting wheat according to the summer fallow method was not practical on small farms, because it required farmers to keep a large chunk of land out of production while it was "in fallow". For example, a 300-acre farm might have 100 acres in spring wheat, 100 in winter wheat, and 100 in summer fallow; the farmer would be producing on only 200 acres at a time. While the system did generate larger yields overall, a farm of that size probably could not support a Montana family in 1929. The summer fallow idea, then, was not an isolated "input" a farmer could simply adopt or not adopt. It had repercussions for other aspects of the farmers' operation.

The most important implications for the summer fallow method were in the ways farm size and farm machinery were used. Since wheat prices were traditionally lower than prices for other grains, a farmer needed to grow a lot more wheat than he would grow corn. Since in the United States wheat was grown in the arid West rather than the humid Midwest or South, midwestern farms of 160 acres were an inappropriate model for western farmers. Farmers could improve their wheat yield per acre by rotating wheat with fallow, but the farms needed to be much bigger; 700 or 800 acres would be the minimum in Montana. But of course since no farmer could adequately farm that much land by himself, particularly since wheat planting, harvesting and threshing were highly sensitive to timing, a farmer needed to invest in the new harvesting machinery. Finally, in order to pay for this expensive new machinery, farmers needed to produce as much wheat as possible, starting the logical cycle all over again (10).

For Wilson, this whole system of wheat production was an exercise in careful, systematic management. That is, the central problems of the endeavor were as much in organizing and ordering things as they were in understanding agricultural science. Along with others in the new field of farm management, Wilson was interested in redefining agricultural problems so that a problem in wheat yields was not simply a problem of poor seed and too much rain but also of proper use of machinery, labor, credit, and time. For example, since the wheat crop was split between spring and winter crops, machinery and labor use were spread out over the year rather than concentrated in one short burst of activity. Similarly, spreading the crop out over the year reduced the risk from a single weather or insect disaster. As Wilson pointed out, if the farmer was going

report was the detailed "standard seasonal program" for the four land units of 2,500 acres each, which listed what would be done to each field, when, and with what equipment from late March to early October. For instance, from June 1 to June 8 field #2 would be cultivated with the Duckfoot cultivator. It would take eight days and 147 tractor hours to accomplish this with two tractors. On June 9 the rotary rod weeder and Duckfoot would cultivate field #4, ending June 17 and spending 147 tractor hours. From Aug. 10 to Aug. 20, field #4 would be cultivated with the disc-plow; it would take 292 tractor hours, so with three machines it should take just under 10 days to complete. Obviously, the breakdown of even one machine could wreack havoc with such a precise system.

Owing to space constraints, the story of these Americans' day to day experience in bringing industrialization to Soviet peasants will be postponed for another time. Instead, I shall consider how these experiences shaped Wilson's views of American agricultural change, and thus circle back to my original thoughts. First, in a somewhat paradoxical twist, Wilson argued that since the Soviets were succeeding in their effort to industialize wheat production, and since that would generate a Soviet wheat export of 200 to 300 million bushels per year, Wilson suggested that Montana wheat farmers should consider how that would affect their own wheat operations, saying "there never was a time when our Montana wheat farmers especially should be so concerned with efficiency and lowering costs than they are at the present time". And for Wilson, that meant doubling or tripling the size of wheat farms and investing in the new farm machinery. Wilson was not alone in this assessment. As early as 1925, journalist Bruce Bliven put the equation in somewhat starker terms after visiting Ware's Russian farm: "The ignorant peasant in his village is not the only person who needs to have pounded into him the principle of large-scale, efficient and intelligent operations. Here in our own United States, most of our farms are still too small to make profitable the sort of machine operation which is most economical" (13).

Secondly, Wilson's Soviet experience seemed to make him less, rather than more, sensitive to the financial burden facing American farmers who wanted to industrialize their farms. For an American farmer, one of the biggest issues in his thinking about whether to buy tractors and combines was his ability to pay for them. The very high cost of this machinery, and the farmer's uncertainty about whether his increased production would pay for and justify his new equipment, was a serious stumbling block to the mechanization of agriculture. In the Soviet Union, on the other hand, individual farmers were not even the main unit of production; equipment was purchased by the government for the use of the collective farms. So when Americans reported that the Russians purchased $ 15 million worth of American agricultural machinery in 1929, they were reporting not that Russian farmers had been persuaded of the advantages of industrial farming, but that the Soviet government had. This difference between whether it was the farmer or the state absorbing the cost of industrializing agriculture was an issue virtually ignored by the agriculturalists who promoted large-scale farming (14).

Third, while the Soviets invited the Americans because the latter were thought to have real expertise in the subjects of large-scale agricultural production and agri-industrial management, in point of fact, American expertise in this was largely theoretical in 1929. The largest farm in America at this time was Tom Campbell's farm in Montana,

but at 100,000 acres it was a garden compared to the Soviets' 400,000 acres. And of course Campbell's farm was exceptional. Similarly, the Soviets wanted the Americans to teach them all about mechanizing farm operations, although at this time most American farms were just beginning to invest in mechanical equipment such as tractors. And the Soviets desperately wanted advice on how to organize hundreds of thousands of peasants into working and living units, trained to farm collectively and efficiently, but in this the Americans were woefully out of their league.

Indeed, as one examines the Americans' expectations and attitudes towards their Soviet venture, one is struck by how much faith they had in the power and persuasion of rational, demonstrable scientific fact. Even in the United States these plans would have been optimistic, actually, because they were based on an idealization of nature and human behavior that was unrealistic. And insofar as the plans represented what the Americans would do if they had millions of acres of flat land, lots of laborers, and a government commitment to spare no expense in meeting production goals, the plans were designed for an abstract, theoretical kind of place. Neither Russia nor America, this agricultural place obeyed the laws of physics and chemistry, recognized no political or ideological stance, admitted no legislators, lobbyists, or interested people of any kind, and in fact existed simply to enable scientists to test out their ideas.

This is not to suggest that the American agricultural experts acted in bad faith, or irresponsibly, in any way at all. Rather it is to point out that their effort was driven not by the certainty of scientific tradition, but by the uncertainty of scientific hypothesis. Aside from a handful of existing large-scale farms, and a very small pile of scientific studies, the Americans were hopeful, and at times supremely confident, that their ideas would work in the Soviet Union as well as the United States. Indeed, they seemed to think, if it is based in true scientific evidence, it should work the same way anywhere in the world.

Coming back to the original issues, then, the experiences of Wilson and Stirniman in Russia might be seen as representing something more than mere philanthropy, or mere business, or even disinterested consulting. Rather, for Wilson in particular, the lessons he took to Russia were actually theories that had been only barely tried out in America. And the lessons he brought back from Russia, which both supported and chal-

NOTES

1) An interesting recent addition to this literature is Marcos Cueto, *Missionaries of Science.*

2) Steven Shapin, *The creation of Truth*; David McCullough, *A Path Between the Seas*; Raman Srinivasan, "No Free Launch: Designing the Indian National Satellite" (unpublished ms., 1993).

3) A good example of this is J. George Harrar, Elvin Stakeman, and *Campaigns Against Hunger;* see also Vernon Ruttan; Deborah Fitzgerald, "Exporting American Agriculture: The Rockefeller Foundation In Mexico, 1943-53", *Social Studies of Science,*

4) The pages of *Farm Implement News* for the 1920s are full of small reports of the international postings of implement agents. This discussion is based on field reports written by Caterpillar agents K. G. Morton in West Africa and George Vitt in Manchuria between 1929 and 1932 (F. Hal Higgins Papers, University of California at Davis, Shields Library Special Collection, box 26).

5) A much fuller treatment of this story is my "Blinded by Technology: American Agriculture in the Soviet Union, 1927-32" (unpublished ms, 1994, available on request).

6) The M. L. Wilson Papers at Montana State University in Bozeman, Montana, a modest journalistic literature, and a few of Stirniman's speeches form the basis of my account. See also Maurice Hindus, *Red Bread* (1931), Lazar Volin, *A Century of Russian Agriculture,* and Robert Conquest, *The Great Terror* and *Harvest of Sorrow* for a real variety of interpretations of this era.

7) Historians have written little on large-scale farming during this period. See Deborah Fitzgerald, "Yeoman No More: Large-scale Farming Between the Wars", (unpub. ms, 1993); on Campbell see E. Angly, "Thomas Campbell: Master Farmer", *The Forum*, July 1931, *86*: 18-22.

8) Wilson to H. C. Taylor, 26 Mar. 1929 (Wilson Papers, box 37 of 46, file AK-4); Wilson to Lewis G. Michael, 9 Jan. 1929 (*ibid.*, box 10 of 46, file F-18); M. L. Wilson, "Research Studies in the Economics of Large-scale Farming in Montana", *Agricultural Engineering*, Jan. 1929, *10*: 3-12.

9) H.M. Ware, M. L. Wilson, and Guy Riggin, "Outline Report of Plan", etc. (n.d. but February 1929; Wilson Papers, box 10 of 46, file F-22).

10) Wilson, *ibid.* Some difficulties, such as too much rain, were beyond even Wilson's control. But when fields were too wet for tractors to pull planters in 1931, Stirniman persuaded the Soviets to provide him with a bombing plane so that he could sow the wheat from the air, a trick that had worked in California. See Henry Wales, "Russia to Sow Wheat From a Bombing Plane", *Chicago Daily Tribune*, 22 May 1931.

11) Ware, Wilson, and Riggin, "Outline Report", pp. 2-3.

12) Wilson, Ware and Riggin, "Outline Report", p. 5.

13) Wilson to C. S. Noble, 6 Nov. 1929; Wilson to J. V. Bennett, 8 Nov. 1929, and Wilson to E. C. Leedy, 15 Nov. 1929 (all in Wilson Papers, box 10 of 46, file F-19); Bruce Bliven, "Mr. Ware and the Peasants", p. 234; Walter Pitkin, "The Great Dirt Conspiracy", *The Forum*, Aug. 1931, *86*: 118-123, on p. 119.

14) See for example, Wilson to van Golovnin, 6 Nov. 1929 (F-19).

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AU XX^{E} SIÈCLE

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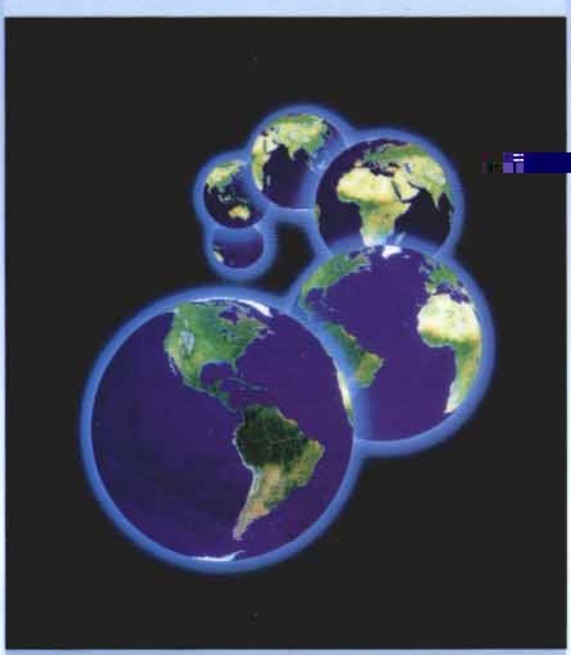
DE ROLAND WAAST



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