Acknowledgements
I would like to thank the International Research and Exchanges Board, the German Marshall Fund of the United States, and the American Council of Learned Societies for financially supporting the earlier parts of this project; the National Research Council of the U.S. National Academy of Sciences for travel support for research on the post-1989 period; and the U.S. National Science Foundation (Grant No. 0129823) for travel funds to newly opened archives. Thanks also to the few colleagues at the Harvard Business School in the early 1980s who supported my crazy notion of studying a "dying" industry in a communist country of all places: William Abernathy (d. 1983), Kim Clark and Alfred Chandler. HBS's Research Division enabled me to learn first hand about the industry and technology in textile plants in North Carolina, at the American Textile Manufacturers Exhibition (ATME) in Greenville-Spartanburg, and at North Carolina State University. For access and insight over the years, thanks also to the players still living, among them Josef Ripka and Zdeněk Maršíček, formerly of the Cotton Research Institute (VÚB); to Václav Fišer, its current general manager; and to Václav Klička, current CEO of Rieter CZ, who provided some of the photographs. Special gratitude for careful critiques of my work go to Jaromír Kašpárek, yarn and fiber scientist at the Cotton Research Institute from 1963 to 1990, and George Worrall, with Courtaulds Ltd. from 1957 to 1990. For over a decade of reminders regarding the importance of this work, *vielen Dank* are due Stephan Lindner of the Deutsches Museum, who led me to many sources cited here. Johan Schot of the Foundation for the History of Technology and Tom Misa of the Illinois Institute of Technology provided material, moral, and intellectual support. The Russian, East European and Central Asian Studies Program of the Ellison Center at the University of Washington offered library support and a collegial environment. Several colleagues, including Phil Scranton, Elisabeth van Meer, and Brad Abrams, helped me focus this chapter in a manageable way. John Staudenmaier taught me to trust my voice and get on with it! Thanks also to *T&C*'s anonymous reviewers and editor Reed Benhamou for raising the bar.

© The Johns Hopkins University Press 2007

Innovation and Technology Transfer during the Cold War: The Case of the Open-End Spinning Machine from Communist Czechoslovakia

Karen Johnson Freeze

In 1980 spinners in the Hanes Knitwear plant in Winston-Salem, North Carolina, cheered the dismantling of the labor-intensive ring spinning machines whose configuration had led to back strain for generations of workers (fig. 1). No longer would they have to bend down to doff yarn bobbins from low spindles, nor reach high to change the roving bobbins. These new machines would spin yarn upwards, from large cans onto huge spools that had to be changed only a few times in each shift, and they could be serviced from a standing position. They would also produce less dust.[1] Plant managers were equally enthusiastic—the replacement equipment would triple productivity.

The machine that promised to change the lives of Hanes textile workers, as it had for thousands of others throughout the textile world, was the open-end (OE) spinning machine[2] developed in post-Stalinist Czechoslovakia[3] to meet the needs of textile-starved postwar Europe. Called the BD 200—from bezvřetenové dopřádání (spindleless spinning)

[1] Vernon Carson, a senior textile equipment engineer at Hanes Knitwear and son of one of these spinners, was recalling his mother's joy at no longer having to stoop to repair broken threads or doff the bobbins from the spindles of the old ring spinning machines (Carson, 22 April 1983, Winston-Salem, N.C.). All interviews by the author are cited as follows: name (date, location). W. Klein asserted later that "Manual doffing is unattractive work. . . [which] usually has to be carried out in a bent posture. Nowadays, it is scarcely possible to find people in industrial countries prepared to do such work." (W. Klein, A Practical Guide to Ring Spinning. Short Staple Spinning Series, vol. 4 (Manchester, 1987), 25.

[2] Such equipment can be called both "open-end" spinning (because the fibers are separated completely from each other, end-to-end, inside the rotor before being twisted together into yarn as they emerge) and "rotor" spinning (because the core of the spinning unit is a rotor). It took some years before "open-end spinning" became an official patent and industry category; early efforts were designated in patent records as "continuous spinning," because they spun directly from sliver (the delicate, continuous, rope-like strands of parallel fibers, two to three centimeters thick, produced in the carding and drawing processes), and omitted the entirely separate processes of roving (pre-spinning from sliver) and winding the spun yarn from small bobbins onto large spools, or packages. For a clear technical description of open-end spinning, see W. Klein, New Spinning Systems, Manual of Textile Technology. Short-Staple Spinning Series, vol. 5 (Manchester 1993).

[3] Nomenclature in Central and Eastern Europe is a sensitive issue. Czechoslovakia came into existence in 1918 as a union of the Czech lands (Bohemia and Moravia, part of the Austrian half of the Austro-Hungarian [Habsburg] empire) and Slovakia (part of Hungary). After World War II, it enjoyed free elections through 1946, when its people gave the Communist Party a thirty-eight percent plurality that prepared the way for the communist takeover in February 1948. Stalin died in 1953; post-Stalinism is usually dated from 1956, when Nikita Khrushchev condemned his predecessor's actions and launched reforms. In 1960, Czechoslovakia became the Czechoslovak Socialist Republic (ČSSR); and on 1 January 1993, it split into two countries, the Czech Republic and Slovakia. Because the technology discussed here was developed in the Czech part of the ČSSR, primarily by Czechs, I often use "Czech" as an adjective and ethnic designator; whenever the subject has more to do with the state—e.g., economy, politics, trade, nationality—I use "Czechoslovak." Since the region (Central Europe) was commonly called "Eastern Europe" during the Cold War, I also use that term.

© The Johns Hopkins University Press 2007

and the machine's 200 "heads" or rotor spinning units—it had the market to itself for nearly four years after its debut in 1967 (fig. 2). The BD 200 brought not only recognition to the Czechoslovak state, but also hundreds of millions of dollars in hard currency through sales of machines and licenses. Even after 1976, when it lost its leading position in the West, the BD 200 continued to dominate the industry, either directly or through licensees. A decade later, the machines constituted over three-quarters of all OE installations worldwide. By 1987, they were represented in fifty-five countries, and have continued to be sold and resold throughout the developing world.[4]

The BD 200 is a significant example of how a radical innovation can permeate and change an entire technological system. It pushed out a reverse salient (slow spinning technology that could not keep up with faster weaving and knitting machines); simplified manufacturing processes and lowered costs; roused competitors; forced improvements to old (ring spinning) technology; and stimulated research and development that led to breakthroughs in both product and process. Along the way, it changed the workplace for good and for ill—improving conditions and increasing profits, but contributing to technological unemployment.

This study of revolutionary BD 200, which emerged from an entirely different context than market capitalism, not only sheds light on technological development in the Soviet-dominated command economies of Eastern Europe. By examining the successful "reverse technology transfer" this machine represents, it also brings those economies into the discourse on innovation and diffusion.[5]

The success of the BD 200 does not conform to typical expectations of industry in Soviet Bloc countries. Glimpses of their ubiquitous shortages, poor quality consumer goods, fumbling bureaucracies, and primitive factories contributed to a picture of inept research and development and inadequate manufacturing capacity. These assumptions were strengthened by the isolation of these countries behind the Iron Curtain; it was easy to forget that some had presented a very different picture before the war—Czechoslovakia, for example, had been the sixth most industrialized country in the world, equal to any in continental Europe. Moreover, the crumbling infrastructures and environmental degradation revealed after 1989 made it difficult to believe that the educational level in these countries, especially in science and technology (regardless of their prewar level of development), had been very high indeed. Researchers are slowly discovering the myriad achievements of these former communist countries, but they are also finding that most of these innovations remained in the laboratory or, at best, in the prototype limbo of a now-

---

[4] Countries with BD 200s, 1974–87, are listed in Vilém Fišer, "Technologický servis," in Jaromír Kašpárek et al., eds., <u>40 let VÚB, Ústí nad Orlicí</u> (Ústí nad Orlicí, 1989), 155–58. The quantitative side of this story, complicated by fluid statistical standards, is beyond the scope of this article. Overall, OE machines of all manufacturers accounted for over half of worldwide spinning capacity by 2002.

[5] The BD 200 illustrates some of the recent thinking about innovation and diffusion; see Johan Schot, "Technology in Decline: A Search for Useful Concepts. The Case of the Dutch Madder Industry in the Nineteenth Century," <u>British Journal for the History of Science</u> 25 (1992): 5–26; Nathan Rosenberg, <u>Inside the Black Box: Technology and Economics</u> (Cambridge, MA, 1982), especially "Learning by Using" (chap. 6). Rosenberg on Marx (chap. 2) reminds us not to disregard what Marx actually said about the topics we study, such as technology. See also Loren R. Graham, <u>What Have We Learned about Science and Technology from the Russian Experience?</u> (Stanford, 1998).

© The Johns Hopkins University Press 2007

forgotten testing room. In general, the system simply precluded their successful commercialization.

My research, launched in 1982, reveals how the BD 200 could emerge under conditions normally inimical to innovation and indifferent to market forces.[6] On the basis of archival sources, extensive interviews, primary published and unpublished documents, and secondary literature, I argue that the success of the BD 200 can be attributed in part to effective project management practices that would later become de rigueur in the West. However, it cannot be understood apart from the specific historical, political, and economic context of Cold War Europe and communist Czechoslovakia in the 1960s. I also argue that the eventual decline of the BD 200 in the world marketplace (a subject beyond the scope of this article) can be explained by fundamental—and damaging—changes in these very practices, conditioned by a changing historical context.

Historiographical Survey

Overall, few scholars have examined the social and cultural context of technological innovation within the Soviet Bloc,[7] not least because the relevant archives were closed to researchers until the 1990s. The German Democratic Republic (GDR) is an important exception. The work edited by Johannes Bähr and Dietmar Petzin, which focuses on the two Germanies in the 1960s, asks of the East German experience, "Was it a bad start or a bad run?" and concludes that it was a bad run. Of particular interest to the Czech case is the chapter by Susanne Franke and Rainer Klump, whose comparison of printing equipment manufacturers in East and West Germany finds that the centrally planned economy helped the East German firm take the lead in the new offset technology,

---

[6] This article is based on research conducted from 1982 to 2006. Most interviews in the early 1980s were accompanied by a "minder," but once my hosts determined that I wasn't an industrial spy, they were generally eager to share their stories about this exciting time in their careers (although saying nothing to reflect poorly on the Communist Party or the management of research institutes or plants). Interviewees included the former directors and research staffs of the Cotton Research Institute (Ústí nad Orlicí); the Institute for Textile Technology of Elitex, Concern for Textile Machinery, the Textile Faculty of the Technical University of Liberec, and the State Textile Research Institute (Liberec); the Wool Research Institute, the Knitting Research Institute, and the Institute for Non-Woven Textiles (Brno). After the Velvet Revolution of 1989, most of these research institutes were closed or privatized, and access to their successor institutions was generally less restricted; interviewees, perhaps biased in a different direction, became more candid; and archives (however fragmented and disorganized) became more accessible.

[7] For works by economists, see J. Wilczynski, Technology in Comecon. Acceleration of Technological Progress through Economic Planning and the Market (New York, 1974); Friedrich Levcik and Jiri Skolka, East-West Technology Transfer. Study of Czechoslovakia. The Place of Technology Transfer in the Economic Relations Between Czechoslovakia and the OECD Countries (Paris, 1984); Helgard Wienert and John Slater, East-West Technology Transfer: The Trade and Economic Aspects (Paris, 1986); Kazimierz Z. Poznanski, Technology, Competition, & the Soviet Bloc in the World Market (Berkeley, 1987) and "The Environment for Technological Change in Centrally Planned Economies" (Washington, D.C.: The World Bank Staff Working Papers, no. 718, 1985). Jan Monkiewicz and Jan Maciejewicz, Technology Export from the Socialist Countries (Boulder and London, 1986), analyze the licensing activity of several Soviet Bloc countries; they suggest that sales of Czechoslovak technology were far too low, given the amount of research and development taking place in the country, and fault the state trading system.

© The Johns Hopkins University Press 2007

but that market forces (and the emerging electronics industry) eventually enabled the West German firm to overtake its Eastern competitor. Raymond G. Stokes, in a pioneering study in English, blames poor performance in the GDR on an incentive system that valued innovations by quantity rather than significance.[8] Sociologist Ivan Tchalakov has examined several Bulgarian innovations, including computer memory storage; Valentina Fava has studied the Škoda Auto company in Czechoslovakia.[9]

In the 1980s, however, it was rare that Eastern European technology was considered significant for the West.[10] Few people had read John Kiser's reports to the U.S. State Department on technology transfer from the Soviet Union and Eastern Europe; the latter noted Czech inventions, including textile machines, that competed successfully in world markets. Their importance was confirmed by Western textile trade journals of the period.[11] Jürgen Ripken's well-researched book (1981) on open-end spinning addressed the threat of the Czechoslovak machines to West European textile machine producers, who were still trailing the Czechs in the worldwide OE marketplace.[12] Zdeněk Maršíček, an insider from the Cotton Research Institute, birthplace of the BD 200, completed a doctoral dissertation in 1988 that examined the history of the BD project within the framework of innovation management.[13] More recently, the development of open-end spinning has

© The Johns Hopkins University Press 2007