CHAPTER ONE

The Revolution in Logistics

"America's Last Dark Continent"

> Techniques will not be discussed because the basic problems are not technical.
>
> —Peter Drucker, "Physical Distribution"

The simple little diagram shown in Figure 3 changed the world. With its childlike simplicity of rectangles and relationships, this 1970 representation of an "Alternative Orientation to Integrated Distribution Management" announced the birth of a field that would transform the global space economy in the decades to come. The diagram remained buried for more than forty years in the archives of the *International Journal of Physical Distribution*—an obscure outlet with a small professional circulation that no longer publishes under the same name. This diagram has rarely even seen the light of day since it was originally published, and even then it has received the scrutiny of only a small cadre of specialists. This diagram never had a wide circulation and did not travel the globe; its power—its work in the world—was of a different order. In fact, it was not so much the diagram that changed things as the profound conceptual shifts it captures and concretizes. It is precisely these shifts that make the diagram worth digging out of the 1970s and dragging into our present, as it captures the core kernel of the logic driving the *revolution in logistics*.

Arguably the most underinvestigated revolution of the twentieth century, the *revolution in logistics* was not the upheaval of one country or political system but a revolution in the calculation and organization of economic space. With the revolution in logistics, a new means of calculating costs and benefits was widely adopted—initially by larger corporations

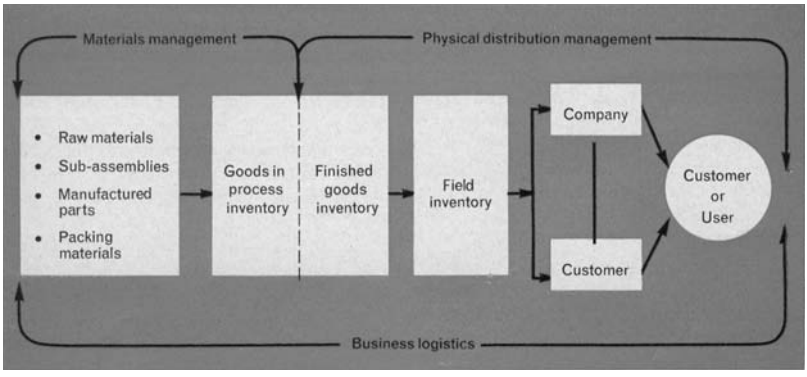

FIGURE 3. "Alternative Orientation to Integrated Distribution Management." Source: LaLonde, Grabner, and Robeson 1970.

and eventually by virtually all the rest. This kind of calculation offered a new logic for how, and so *where*, to do business. This diagram, and the revolution that it announced, combined the stagnant fields of physical distribution and materials management—the former holding jurisdiction over the distribution of goods after production and the latter's authority bounded by the production process—to create a new umbrella management science. No longer a problem locked in discrete segments of supply chains, this new science would elevate its authority to the management of circulation across the entire system of production and distribution. This new science was called "business logistics."

From its long history as a military art of moving soldiers and supplies to the front, logistics was transformed into a business science in the years after World War II. With the introduction of the language of business logistics, the corporate focus on the cost of distribution in discrete segments of supply chains was transformed into a concern with value added in circulatory systems that span the sites of production and consumption. The shift from cost minimization *after production* to value added *across circulatory systems* entailed the ascent of logistics to a strategic role within the firm. Logistics revolutionized was also logistics globalized, with profound implications for how material life is made and sustained. More specifically, the revolution and globalization of logistics gave rise to transnational networks of cargo flow that are increasingly governed through the frame of security. At the same time, the revolution in logistics hardly marked its "civilianization" but rather a different, even deepened entanglement of the just-in-time geographies of production and destruction. These transformations in the field have propelled logistics from a discrete and specialized

military art to a ubiquitous science of circulation. With surgical precision, this diagram thus captures a leap in the calculation of economic space, a leap that has hardly been acknowledged to exist, even as it underpinned the globalization of production in the second half of the twentieth century.

Despite decades of debate about the production of space (Lefebvre 1984), conceptions of "spatiality" (Soja 1989), and the interdisciplinary "spatial turn" across the social sciences and humanities (Gupta and Ferguson 1992), space is still often naturalized in such a way as to preclude a set of pressing intellectual and political problems at the core of our present. It is this persistent, even stubborn assumption about the givenness of space that has allowed profound transformations in how we think, calculate, and organize economic space to remain hidden in plain view, untroubled. Yet to appreciate the significance of this diagram and the revolution in logistics that it graphically renders, we must take a different tack. This chapter tracks the profound transformation in calculative knowledge of space and economy in the three decades after World War II. It demonstrates the tremendous amount of intellectual labor—the years of research, debate, conferences, books and journal articles, and experiments—that enabled the rise of business logistics. It also tracks the labor of professionalization—the establishment of degree programs and research institutes, the initiation of trade journals and professional associations, and the creation of new corporate structures to reflect the rising power of logistics within the firm and within the economy. However, alongside this professional discourse and professionalized practice, this chapter also maps some of the broader political projects, logics, imaginaries, and interests that prompted and sustained the creation of this "clean" new science. Situating the rise of this management science in the context of persistent colonial and imperial politics and acute class and labor struggles within the United States, this chapter traces the transformation of the political, economic, and spatial logics of American-led imperial power and so sets out the social life of this powerful technoscience.

"Cold Calculation": Logistics at War

Historically, logistics meant something quite different than it does today. Its genesis was not as civilian science but rather as military art. There is only a paltry body of historical scholarship on the logistics of warfare. Military writers are typically oriented toward the monumental rather than the mundane, drawn to the most sensational aspects of organized violence. Logistics, in contrast, has figured precisely as the residual and uncomplicated, even bureaucratic tasks that need doing once the sexy work of

strategy is done. Writing in 1917, Lt. Col. George C. Thorpe suggested that "strategy is to war what the plot is to the play," while "logistics furnishes the stage management, accessories, and maintenance." Thorpe saw the audience "thrilled by the action of the play and the art of the performers" while overlooking the critical but "cleverly hidden details of stage management." A masculine bravado typically characterizes the writing of military history. In Martin Van Creveld's (2004) words, the fact that "this kind of calculation does not appeal to the imagination" may be why "it is so often ignored by military historians" (1–2). Van Creveld (one of the very few historians of military logistics) notes that for every book on the topic there are hundreds on strategy and tactics (233). Yet as he argues and countless practitioners confirm, successful military campaigns require "not any great strategic genius but only plain hard work and cold calculation" (1). Logistics remains largely overlooked despite the fact that "logistics make up nine tenths of the business of war, and that the mathematical problems involved in calculating the movements and supply of armies are to quote Napoleon, not unworthy of a Leibnitz or a Newton" (233).

If we shift our attention from scholars of war to its practitioners, a different story emerges. Here we see the importance of logistics reiterated over and over again, yet often only in fragments of quotes and literary records. An entire history of the organization of ancient Chinese warfare remains to be written. Today we have only hints of the central role that provisioning played in ancient China well before the language of logistics was even invented. Sun Tzu's writings helped to shape a new form of warfare, defined by a deliberate art of war and a professional cadre of military officers, which together replaced the older emphasis on charismatic leadership (Wilson 2008, 362). Assessing the very practical costs and needs of waging successful military campaigns, Sun Tzu (1980, 72) writes, "Generally the way of employing the military is this: 1000 fast chariots, 1000 leather carriages, 100,000 sashes and suites of armor, transport and provisions for a 1000 li [about 500 kilometers], then total expenses, the employ of liaisons and ambassadors, glue and lacquer materials, contributions for chariots and armor, amount to 1000 gold pieces per day. Only after this can 100,000 troops be raised." The language of *logistics* came later. Its etymology is often traced to the Greek *logistikos,* meaning "skilled in calculating." Supply lines were a key consideration in military strategy for the Greeks and Romans, with fodder for animals a defining feature of the organization of war. Donald Engels (1980, 119) goes so far as to argue, "Supply was the basis for Alexander [the Great]'s strategy." This strategy revolved largely on his efforts to reduce the number of horses on campaigns and instead have troops carry as much of their

equipment and provisions as possible. Nevertheless, Engels estimates that more than 1,000 horses were required simply to carry grain as fodder for the estimated 6,000 cavalry horses and 1,300 baggage animals that supported Alexander's campaigns. This created a situation where, according to McConnell, Hardemon, and Ransburgh (2010, 173), "strategy had to be adapted to account for horses' needs." Indeed, logistics was such a central force in the success or failure of campaigns that Alexander is reputed to have said that "my logisticians are a humorless lot . . . they know if my campaign fails, they are the first ones I will slay" (JAPCC 2011, 3).

The Roman Empire's military might was also largely underpinned by the cold calculation of logistics. Jonathan Roth (1999, 279) explains how "the Roman's success in conquering and maintaining their enormous empire lay partly in their military culture, their weapons and their training," and no doubt these are the elements that dominate popular conceptions of Rome's imperial power. However, "Rome's ability to provision large armies at long distances was, however, equally, of more importance to its success" (ibid.). The Romans used logistics "both as a strategic and a tactical weapon"—in fact, "the necessities of military supplies influenced and often determined the decisions of Roman commanders at war" (ibid.). If careful attention to the movement of men and materials and the provisioning of armies and animals was the basis for the strength of the Roman Empire, then logistical failure has also been blamed for the empire's decline. One recent major study argues that increased warfare and a growing number of invasions during the reign of Marcus Aurelius undermined the integrity of agricultural production and food supplies, gradually undermining the integrity of the empire itself (Thomas 2004).

The modern military face of logistics first took shape through Napoleonic warfare. Logistics was one of the three "arts of war" of the geopolitical state along with the better-known arts of "strategy" and "tactics," and it was essential for the building of national and colonial power. Napoleon is often quoted for saying, "An army marches on its stomach," signaling the key role of supply lines for war. In fact, providing sustenance for troops was such a problem that in 1800 Napoleon called for a whole new approach to food preservation. He offered a large monetary reward to the inventor who could design an effective system for conserving soldiers' rations. This was the context for Nicolas François Appert's invention of metal canning techniques.

Military strategists on both sides of the Napoleonic wars devoted increasing attention to logistics. Carl von Clausewitz ([1873] 2007, 78) is known to have said, "There is nothing more common than to find considerations of supply affecting the strategic lines of a campaign and a war."

In his lectures and writings, Clausewitz placed significant emphasis on the problem of "friction" for war fighting. Influenced by the physical sciences of his time, friction became a core concept for his theories. In fact, in his *On War,* friction is what makes seemingly simple tasks difficult. It is, Clausewitz writes, "the only concept that more or less corresponds to the factors that distinguish real war from war on paper" (119). Clausewitz proceeds to outline the wide range of minute problems, challenges, delays, and disruptions that characterize the everyday of warfare. These problems are inherently in the domain of logistics:

> Everything in war is very simple, but the simplest thing is difficult. The difficulties accumulate and produce a friction, which no man can imagine who has not seen war. Suppose now a traveler, who, towards evening, expects to accomplish the two stages at the end of his day's journey, four of five leagues, with post horses, on the high road—it is nothing. He arrives now at the last station but one, finds no horses or very bad ones; then a hilly country, bad roads; it is a dark night, and he is glad when, after a great deal of trouble, he reaches the next station, and finds some miserable accommodation. So in war, through the influence of an infinity of petty circumstances, which cannot properly be described on paper, things disappoint us, and we shall fall short of the mark. (50)

The extent to which problems of friction were directly matters of logistics is clear when Clausewitz writes, "The whole of military activity must . . . relate directly or indirectly to the engagement. The end for which a soldier is recruited, clothed, armed, and trained, the whole object of his sleeping, eating, drinking, and marching is simply that he should fight at the right place and the right time" ([1873] 2007, 38). This was a moment when notions of "species survival" framed the warring state. Clausewitz and Darwin both saw competitive struggle as the driving force of their social and natural worlds, with states and species, respectively, the agents of change (see Cowen and Smith 2009). German geopolitician Friedrich Ratzel deepened this discourse. Trained in zoology, Ratzel not only published a book on Darwin but came to invest his nation-state with a broadly Darwinian organicism and teleological drive for growth. Ratzel's concept of *Lebensraum* placed "Darwinian natural selection in a spatial or environmental context" (Smith 1980, 53).

Military strategists fighting with Napoleon, like the nineteenth-century writer Antoine-Henri Jomini, also devoted significant attention to logistics. Far from an afterthought, Jomini argued that logistics would occupy a leading position in the organization and execution of strategy and

tactics. Jomini ([1836] 2009, 189) emphasized that logistics was dedicated to the important but unglamorous work of getting "men and materials" to the front. He furthermore makes a case for the ascending importance of logistics to warfare, arguing that "if we retain the term [logistics] we must understand it to be greatly extended and developed in signification, so as to embrace not only the duties of ordinary staff officers, but of generals-in-chief." Jomini asserted the growing importance of logistics in warfare as early as the 1870s, though it was really with the development of the petroleum-fueled battlefield that logistics became the driving force of military strategy. In addition to Jomini's formulation of "men and materials," we should emphasize that logistics has also always been centrally concerned with getting the *fuel* for men, animals, and machines to the front as well. In fact, the transformation in how war was *fueled* was definitive in the rise of logistics from a residual to a driving force in modern warfare.

Despite the long and important history of military innovations in the logistics of war, Van Creveld (2004, 233) argues forcefully that the most significant shift in the field took place not with Alexander or Napoleon but with the rise of industrial warfare fueled by petrol, oil, and lubricants (POL). It is with the rise of POL that "to a far greater extent than in the eighteenth century, strategy becomes an appendix to logistics." Manuel De Landa (1991, 105–6) concurs and suggests that logistics began to *lead rather than follow* strategy and tactics during World War I. For De Landa, this was one important implication of POL warfare and the ways it made the military critically dependent on supply lines. Nevertheless, while it was during World War I that POL began to reshape the nature of warfare, livestock continued to play a definitive role, and fodder remained an enormous logistical problem. The greatest volume of material shipped during World War I from the United Kingdom to France was not munitions (5,253,538 tons) but rather oats and hay for horses (5,438,602 tons; Goralski and Freeburg 1987, 282). If World War I marked the beginnings of the first massive experiment in POL warfare, then World War II saw the logistics of industrial warfare take center stage. Leaders from all sides extolled the definitive role of fuel in shaping the form and outcome of war. Commenting on the Allied operations, Churchill exclaimed, "Above all, petrol governed every movement" (cited in Goralski and Freeburg 1987, 284). Stalin offered similar reflections on the war: "The war was decided by engines and octane" (ibid., 68). Even as Germany entered the war still reliant on horse-drawn transport, Adolf Hitler quickly learned the definitive role of petrol: "To fight," he exclaimed, "we must have oil for our machine."

Critical in all this is the way in which the shifting technologies of violence reorganized the relationship between means and ends, and this was

increasingly recognized within the heart of the U.S. Empire. As Fleet Admiral Ernest King would stress in his 1946 report to the Secretary of the Navy, World War II was "variously termed a war of production and a war of machines," but "whatever else it is . . . it is a war of logistics" (cited in "Logistics and Support" 2005). Just a year later, U.S. historian Duncan Ballantine (1947) reiterated the importance of logistics to the outcome of World War II, particularly for naval forces. The lesson from the "Second World War suggests that the naval commander must be indoctrinated in the problems of providing as well as making use of the means of warfare." Logistics, he explained, "is not something distinct from strategy and tactics, but rather an integral part of both." He cautioned against making a "specialist of the logistician," insisting instead that "logistics is part of the exercise of command." And indeed, on his way to the president's office, Dwight D. Eisenhower concurred, "You will not find it difficult to prove that battles, campaigns, and even wars have been won or lost primarily because of logistics" (Hawthorne 1948, xii).

While admitting that he might be making a "slightly exaggerated statement," Admiral Lynde McCormick of the U.S. Navy suggested "that logistics is all of war-making, except shooting the guns, releasing the bombs, and firing the torpedoes" (cited in Roloff 2003, 110). In the estimation of historians and theorists who have dwelled on the problem of logistics, McCormick's comments are prescient. In fact, De Landa (1991, 105) goes so far as to assert, "Modern tactics and strategy would seem to have become a special branch of logistics." While logistics had long been critical to warfare, with the rise of industrial war, military logistics has come to lead strategy and tactics: it has gone from being the *practical afterthought* to the *calculative practice that defines thought*. Changes in the material form and social organization of fuel saw logistics gradually become *the how that shapes the what*.

Cold *War* Calculation: McNamara and Management

During and after World War II, the field of logistics drew increased attention from forces beyond the bounds of the military. Business interest in logistics "commenced during World War II when immense quantities of men and material had to be strategically deployed throughout the world" (Miller Davis 1974, 1). Social and industrial technologies that were designed to support the American battlefield during and after World War II were critical. The U.S. military played a key role in the development of just-in-time techniques, first through the training of workers in occupied Japan to meet U.S. procurement needs and then by diffusing these

techniques through contracting for Korean War supplies (Reifer 2004, 24; Spencer 1967, 33). The standard shipping container, another U.S. military innovation, has been repeatedly dubbed the single most important technological innovation underpinning the globalization of trade (Levinson 2006; "Moving Story" 2002; Rodrigue and Notteboom 2008). While it was not until the Vietnam War that the military use of the shipping container entrenched its standardized global form (Levinson 2006, 8, 178), experimentation with a container that could be transferred across different modes of transportation took place during World War II as a means to reduce the time and labor involved in transporting military supplies to the front. These specific technologies, alongside calculative technologies of managing complex forms of circulation and distribution, lured civilians in. Indeed, Grant Miller Davis (1974, 1) suggests that "entrepreneurial concern with the monetary and strategic value of logistics expanded rapidly during the late 1950s and early 1960s."

But when did logistics become a problem to be solved in the world of business management, and what problems did proponents seek to resolve by using military methods to rethink space and economy? What kinds of connections can be drawn between the history of logistics as an art of the geopolitical military and its more recent life in organizing global corporate supply chains?

Edward Smykay and Bernard LaLonde (1967, 108), two crucial players in the rise of business logistics, assert, "No one really knows when it was first recognized that the business firm had a logistics problem." They suggest that "since roughly 1960 the academic world has experienced a steady addition of writing in logistics-physical distribution," and that alongside this expansion of academic interest, "American business has experienced literally a 'revolution' in the organization and methods used to handle this important function." By applying the new methods of logistics, businesses were learning that "considerable costs can be saved, customers can be better served and the firm can more effectively play its role in society." As late as 1954, it was still possible to diagnose "a great deal more attention" being paid by business "to buying and selling than to physical handling," as Paul D. Converse did in his lecture to the Boston Conference on Distribution. Converse went so far as to suggest that "the physical handling of goods seems to be pretty much overlooked by sales executives, advertising men and market researchers . . . Problems of physical distribution are too often brushed aside as matters of little importance" (Converse 1954, 22, quoted in Bowersox 1968, 63). He described the same neglect of physical distribution in business magazines, which in his words devote "relatively little space to physical distribution." Yet,

only a decade later, physical distribution could no longer be defined as an overlooked field; by the mid-1960s, the revolution was well under way.

In fact, it was on April 6, 1965, that management guru Peter Drucker would confidently assert, "Physical distribution is simply another way of saying 'the whole process of business.'" In a lecture to the newly formed National Council of Physical Distribution Management, Drucker argued that physical distribution was "today's frontier in business" (quoted in Mangan, Lalwani, and Butcher 2008, 338). The promise of physical distribution for Drucker (1969, 8) lay precisely in the fact that "the only model of a business we can so far truly design—the only operational system, in other words—is that of the business as physical distribution, as a flow of materials."

Not only was there a flurry of new writings on the topic, but there was also a surge of institution building in the field at this time. The growth in the power of logistics' technoscientific knowledge occurred alongside the rise of logistics as a social and institutional force, particularly visible over the last twenty years. Logistics firms are increasingly acting as full-service-systems managers of global supply chains. During this time, new associations sprouted up for logistics professionals, and enrollment leapt in a growing number of professional and academic programs. Trade magazines that formerly catered to shipping, distribution, or materials management now orient themselves to "logistics professionals," while firms that once specialized in shipping, distribution, or even manufacturing increasingly assume new corporate identities as logistics firms. Supply Chain Management is a mainstay in business and management schools, sometimes even replacing traditional economics departments (Busch 2007, 441).

The American Management Association was a "pioneer group" in the early development of business logistics. In 1959, they held a seminar on "Management of the Physical Distribution Function." Four years later, the National Council of Physical Distribution Management was founded, with more than "300 top executives and analysts . . . not only interested in the subject but actively engaged in physical distribution programs."[1] The universities also started to institutionalize logistics: the University of Michigan created the first distribution and logistics program in 1957, and increasing numbers of schools and students have followed suit since. A number of new trade magazines were also founded at this time, including *Distribution Age, Handling and Shipping, Traffic Management,* and *Transportation and Distribution Management.*

The founding of the Logistics Management Institute (LMI) in 1961 was a crucial event in the history of business logistics. After taking office earlier that same year, Secretary of Defense Robert S. McNamara began advising President Kennedy on the need for a federal institution

devoted to the study of logistics. In a memo to the president, McNamara reported that the Department of Defense was encountering serious problems in procurement, logistics, and relations with the defense industry. McNamara argued that the LMI would produce the "same type of fresh thinking on logistics that is being provided by groups such as Rand on technical and operational matters" (LMI n.d.). He explained, "We can achieve major breakthroughs in logistics management where we spend half of the Defense budget by sponsoring the establishment of a special, full-time organization of highly talented business management specialists." The LMI was created a few short weeks later, with a powerful board that included an assortment of high-ranking military officers, Charles H. Kellstadt (former chairman of Sears, Roebuck, and Company) as chairman, Peter Drucker, Dean Stanley E. Teele of Harvard University, and Professor Sterling Livingston of the Harvard Business School. Today the LMI remains dreadfully understudied with a research staff of more than six hundred members and contracts with almost every part of government and, increasingly, the private and third sectors. The founding of the LMI was both an element in this retooling of logistics and a symbol of its growing influence.

A Science of Systems

What can now be identified as the era of the "revolution in logistics," the 1960s was a time of tremendous experimentation (Bonacich 2005; Poist 1986). The timing of this rising concern with logistics in business management can be explained in part by the wartime display of complex logistics planning and operations. But there were other practical factors that propelled logistics to the center of attention in business management in the postwar years. Quantitative techniques and the computers on which they relied were key (Stenger 1986). According to Donald Bowersox (1968, 64), neither computers nor quantitative methods "were to be denied the fertility of physical distribution applications." The "prolonged profit squeeze of the early 1950s," culminating in a recession in 1958, prompted big business in the United States to search for cost savings in their operations. At this time, logistics was identified as the solution to complex problems. Reflecting on this development of logistics as it transpired, Smykay and LaLonde (1967, 108) wrote, "The time is right, the harvest is full, and only awaits the picking."

It is not only the expansion of logistics research but the radical shifts in its theory and practice that were so important at this time. Transformation in the corporate spatial practice that marks the revolution in logistics occurred through thinking and calculating space anew. By the end of the

1950s, two highly influential articles helped to shift emphasis in the field from transportation, physical distribution, and what was known as "rhocrematics" (Brewer and Rosenzweig 1961; Bedeian 1974) to logistics (Lewis, Culliton, and Steel 1956; Meyer 1959). These articles emphasized that the stakes were much higher than just the isolated movement of goods out of the factory. Rather, they emphasized the opening up of a new space of action—the rationalization and deliberate management of spatial organization within the firm and beyond. But important as these early papers were, they still operated on the assumption of cost minimization. By the early 1960s, cost minimization had been replaced with a model that emphasized value added. The nature of this shift is subtle but substantial. As W. Bruce Allen (1997, 114) explains, "The typical analysis would be: x tons of widgets must be shipped from A to B; what is the cheapest full-distribution cost mode to ship by? A profit maximizing approach would ask questions of whether x was the best amount to ship and whether to ship from point A to point B was the proper origin and destination pair." The shift to a profit-maximizing approach was an important consequence of the introduction of systems thinking into the field of distribution geography in the early 1960s. It was the shift to a systems approach to logistics problems that revolutionized the field. With systems analysis, logistics and distribution were conceptualized wholly differently:

> In traditional orientations to business operations, the end of the production line, as they put it in the paper industry, is at the dry end of the machine. Physical distribution perspectives, however, throw entirely new light on the question, "Where does the production line end?" In the view of physical distribution managements, the end of the production line is at the point where the consumer actually puts the product to use. The petroleum industry is a good case in point. Gasoline sold at the pump is really the end of the whole process of products and distribution. Yet no one actually sees the product even when it is finally delivered to the tank of the car. (Smykay and LaLonde 1967)

Without a doubt, the single most important shift that took place in logistics thought and practice in the early postwar period was the introduction of a "systems perspective" (Smykay and LaLonde1967; LaLonde, Gabner, and Robeson 1970). Leading practitioners commenting on the evolution of the field at the time and more recently identify the profound impact of a broad paradigm shift toward a systems approach (Bertalanffy 1951; Johnson, Kast, and Rosenzweig 1964; Poist 1986). Until that time, the field was known as "physical distribution management," defined by the American Marketing Association in 1948 as "the movement and handling of goods from the point of production to the point of consumption or use" (cited

in Haskett, Ivie, and Glaskowsky 1964, 7). Until the introduction of a systems approach, physical distribution was concerned exclusively with the movement of finished products. Upon its formation, the National Council of Physical Distribution Management defined the field as the movement of "the broad range of finished products from the end of the distribution line to the consumer, and in some cases . . . the movement of raw materials from the source of supply to the beginning of the production line" (cited in Smykay 1961, 4). Key here is the sharp separation between concerns and processes of production and distribution.

Yet, as Smykay and LaLonde (1967, 17) explain, "under the systems concept, attention is focused upon the total action of a function rather than upon its individual components." A systems perspective gave rise to a new approach known as "integrated distribution management," a new name for the field of business logistics and, importantly, a rescaled space of action. Distribution was increasingly understood as an element of the production process rather than a discrete function that followed. Firms like Lockheed and Boeing began incorporating logistics calculation into production flow at this time, further breaking down any distinction between production and distribution (Miller Davis 1974, 1). As the simple orange diagram this chapter opened with suggests, business logistics brought the entire system of production and distribution into focus. As Ronald Ballou (2006, 377) explains, the introduction of the name *business logistics* was an attempt both to distinguish the field from military logistics and also, importantly, "to focus on logistics activities that took place within the business firm." The implications of these shifts are profound; by the end of the revolutionary 1960s, business logistics was defined as "a total approach to the management of all activities involved in physically acquiring, moving and storing raw materials, in-process inventory, and finished goods inventory from the point of origin to the point of use or consumption" (LaLonde, Grabner, and Robeson 1970, 43; see also LaLonde1994). As Miller Davis explained in 1974, intrafirm activities

> form a total system. That is to say, purchasing, inventory control, material handling, warehousing, site determination, order processing, marketing, and other functional activities within the modern firm have common relationships that must be perceived, identified and treated as an inclusive unit. (1)

The Logistics of the Revolution in Logistics: Total Cost

While systems analysis is recognized as pivotal to the transformation of the field, the sources of this thought are explicitly and conspicuously

absent in industry accounts. When logisticians and supply chain managers tell their history, they inevitably highlight the impact of systems approaches and underspecify their genealogies. As Bowersox (1968, 64) explains, "It is difficult to trace the exact origins of the systems approach to problem solving." In fact, it is both systems thought and "total cost analysis" that are highlighted in these early discussions of "integrated physical distribution." Writers cite the importance of both in the emergence of integrated distribution management, yet the latter fades quickly into the background, and the connection between them remains unexplored. In practice, it would seem that total cost analysis was the applied means through which systems thinking entered the field.

The connections become clear if we trace the operation and effects of "total cost." Total cost analysis aims to account for the actual costs of distribution across all the activities of the firm in contrast to the delimited segment of activity traditionally associated with the field. In a highly influential 1965 paper, Richard LeKashman and John Stolle of the firm Booz Allen Hamilton explain, "The real cost of distribution includes much more than what most companies consider when they attempt to deal with distribution costs" (1965, 34). These authors argue that costs that "never appear as distribution costs on any financial or operating report, but show up unidentified and unexplained at different times and in assorted places—in purchasing, in production, in paper-work processing—anywhere and everywhere in the business," are in fact "all intimately interrelated, linked together by one common bond. They all result from the way the company distributes its products" (LeKashman and Stolle 1965, 33). Only four years later, Peter Drucker estimated that the total cost of physical distribution accounted for as much as 50 percent of the total costs of the entire production and distribution process. Key here is that a wide range of functions previously understood to be distinct from distribution were now part of its total cost, including inventory carrying and obsolescence, warehousing, transportation, production alternatives, communications and data processing, customer service, alternative facilities use, channels of distribution, and cost concessions. Total cost analysis accounts for distribution costs embedded into other functions and "disguised" (LeKashman and Stolle 1965, 37), thus one practical impact of total cost analysis was to break down any hard distinctions between production and distribution.

Figure 4, which appeared in the 1965 article by LeKashman and Stolle, communicates two key lessons about total cost. The first and perhaps most obvious is the incredible amount of data that would be required to perform total cost analysis. Such elaborate calculations would be impossibly labor intensive without the advent of computers, nonlinear programming,

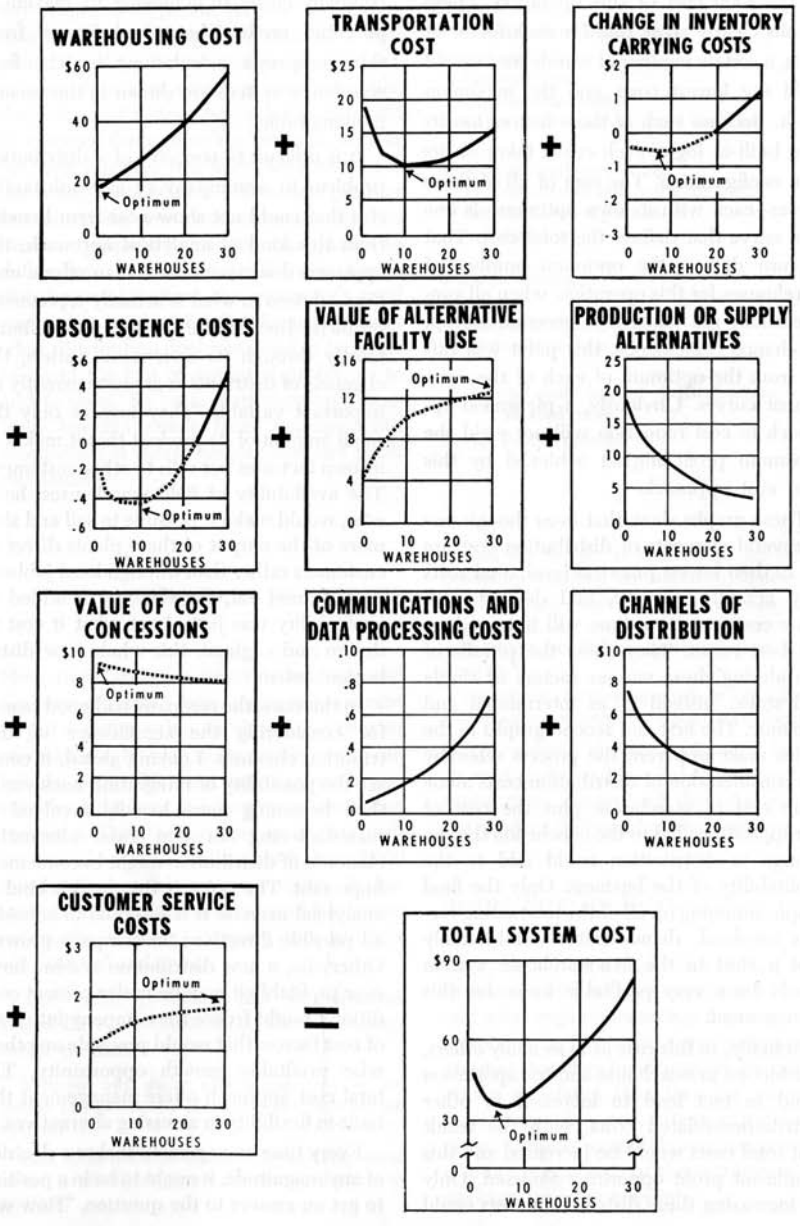

FIGURE 4. Total cost approach. Source: LeKashman and Stolle 1965, republished with permission of Elsevier; permission conveyed through Copyright Clearance Center Inc.

and simulation modeling. In fact, LeKashman and Stolle cite three reasons firms had not already adopted a total cost approach to distribution: first, because of the deeply embedded and intertwined nature of distribution costs in other activities; second, because of the traditional orientation of accounting departments toward production and finance; and third, the reason that they understand to be definitive. They explain, "The major reason why these distribution-related costs have continued to rise and to depress profit margins throughout our economy" is because "even a relatively simple problem in distribution system design can involve hundreds of bits of information that interact in thousands of ways. So there was no way of dealing with the distribution cost complex" until techniques and technologies were designed to help (1965, 37). The wider availability of these technologies helps explain the timing of the rise of total cost.

Writing in the late 1960s, Edward Smykay and Bernard LaLonde (1967) argued that computer technologies competed with physical distribution for the attention of business management at this time, yet it is clear that the latter was the domain for the application of the former and that the interest in physical distribution was inextricably tied to the transformative capacities of computer technologies.

At least as important as the rise of computer technologies that enabled new kinds of cost calculation, the collection of charts in Figure 5 reveals that a total cost analysis itself identifies for a firm the "opportunity to increase its profits that it could not have identified or taken advantage of in any other way" (LeKashman and Stolle 1965, 38). Total cost analysis produced new sources of profit with very different kinds of effects on corporate strategy, and this strategy was inherently spatial. Whether a firm invested in more warehouses, changed the location of production, or invested in more transportation infrastructure would all be decisions made relationally in the broader interest of total cost, or overall profitability. Total cost analysis would often yield counterintuitive decisions regarding location. In one example that LeKashman and Stolle provide, they insist that "only the total cost approach could have established, for example, that the earnings of this business could be increased by supplying its customers in the Dakotas from a plant in Ohio rather than from a much nearer facility in Illinois. Yet when total profits were calculated, this turned out to be an element in the most profitable use of the existing facilities of this company" (1965, 43; see Figure 5). Because of the "interdisciplinary" nature of the analysis, senior executive support was necessary to undertake total cost analysis, thus propelling logistical questions to a much higher level of management. In fact, with the adoption of total cost, corporate strategy became ever more defined by logistics.

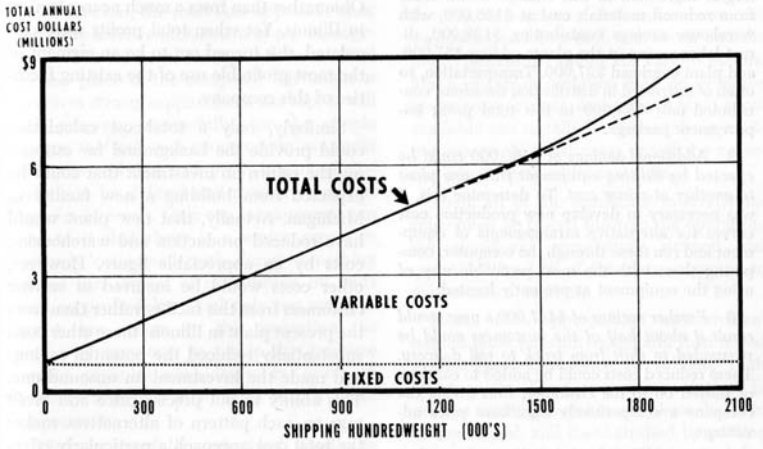

FIGURE 5

Total Plant and Warehousing Cost, Five Plants

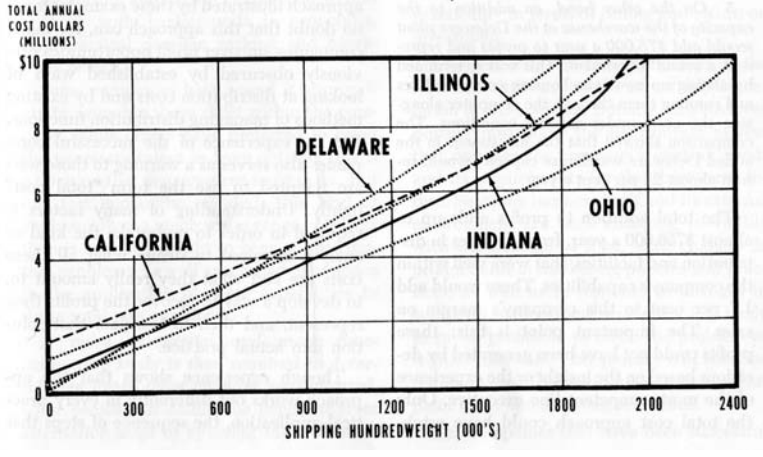

FIGURE 5. Total plant and warehousing cost, five plants. Source: LeKashman and Stolle 1965, republished with permission of Elsevier; permission conveyed through Copyright Clearance Center Inc.

Total cost analysis was thus crucial to the revisioning of the field during the 1960s and was a practical means through which systems approaches entered the field. This latter claim has significant implications, as it means that the source for systems thinking in early logistics thought also becomes clear. Total cost analysis was developed by researchers at the RAND Corporation as part of their post–World War II operations research. In fact, the total cost concept and total cost methods stem directly from RAND's work on Air Force weapons systems in the 1950s (see Fisher 1956). This suggests not any simple militarization of business but rather a more complex entanglement of market and military.

The rise of integrated distribution management meant that cost minimization was gradually replaced with a model that emphasized value added (Allen 1997). Logistics was transformed from a least-cost analysis of discrete segments of distribution into a science of value added through circulatory systems. The revolution in logistics saw transportation conceptualized as a vital element of production systems rather than a separate domain or the residual act of distributing commodities after production; it thereby put the entire spatial organization of the firm, including the location of factories and warehouses, directly into question. From this point onward, logistics became a "science of systems," and its more circumscribed concern with distribution transformed into an umbrella science of spatial management. In the words of two of the most important early figures in the field, "'Where does the production line end?' In the view of physical distribution management, the end of the production line is at the point where the consumer actually puts the product to use" (Smykay and LaLonde 1967, 98).

Social War and Technological Change

By reframing the way that economic space was conceived and calculated, the science of business logistics was critical in the remaking of geographies of capitalist production and distribution on a global scale. Business logistics helped build a global social factory. Rethinking "the system" in this way facilitated relocation and reorganization of the component parts of the supply chain, not just from Illinois to Ohio, but around the world. Of course, there was much precedent for the increasingly transnational organization of production and circulation, not only in the experiences of colonial trade regimes such as those in cotton, fur, and tea. A more recent and much more directly relevant event that fed immediately into the revolution in logistics was the American military's adoption of the shipping container for supplying the war effort. Initially developed to solve the logistical challenges of the U.S. military during and after World War II, the container would eventually help to transform the organization of civilian

life. While there were earlier experiments with container technologies, it was the U.S. military's use that led to its development and standardization. More than fifty years after its introduction as an efficient means of moving military equipment to the front, the container has been celebrated as the single most important invention in the economic globalization of the decades that followed (Levinson 2006; "Moving Story" 2002; Rodrigue and Notteboom 2008). Containerization radically reduced the time required to load and unload ships, reducing port labor costs and enabling tremendous savings for manufacturers, who could reduce inventories to a bare minimum. Containerization was thus a necessary underpinning for the rise of just-in-time (JIT) production techniques. For JIT to become a globalized system, inputs and commodities had to be coordinated and transported quickly and reliably across space. U.S. military procurement laid many of the infrastructural foundations for this work during the Korean War (Reifer 2004, 24). With the military's use of containers to manage massive supply chains during the Vietnam War, container shipping became firmly entrenched (Levinson 2006, 8, 178).

If containerization was a technology that saw much of its early development in American wars abroad, the introduction of the standard shipping container was also part of a growing social war on transport workers at home. Much of the cost savings that came with containerization came directly from the reduction in workers' time needed to unload and reload ships. Struggles over containerization in ports in the United States and abroad were often explosive, animated not only by the specific question of the container but by the rights of workers to participate in decisions regarding the planning and management of technological innovation in their workplaces. From the perspective of owners and managers, time was of the essence. Slashing labor time by mechanizing port work was one direct outcome of containerization, but technological change also provided an opportunity to undermine the strength of organized labor, and so the conditions of work, and assert greater control over the flow of goods. There is a range of different experiences of containerization that vary with the strategies unions adopted—in some cases to fight against it, and elsewhere to fight for some control of this technological transformation (Bonacich 2005; Lim 2011; Reifer 2004). We return to these struggles over labor and logistics in chapter 5 and see how protecting the flow of cargo in the interests of efficient supply chains has in recent years come to be treated as a matter of national security (Amoore and De Goede 2008; Cooper 2006; Rice and Caniato 2003), with devastating consequences for transport workers. However, another aspect of this domestic social war on transport workers that was crucial for the revolution and constitutive of the globalization of trade requires brief scrutiny here: *deregulation*.

If containers were a physical technology that transformed both the social and spatial organization of trade and provided the opportunity for an attack on the strength of organized labor in the ports, then deregulation was a social technology with similar effects across many modes of transportation. The push for deregulation in the transport sector really emerged in force in the 1950s when "those with foresight planted a seed that the field of transport and logistics was important" (Allen 1997, 119). President Truman's 1955 Week's Report, and two reports commissioned under President Eisenhower, the 1960 Mueller and Doyle Reports, all advised that transport regulation was "holding back the economy" and recommended deregulation (Arthur 1962; Allen 1997). Presidents Kennedy and Johnson made similar assessments. Advocacy for deregulation was bipartisan. As Allen (1997, 108) explains, "The seed was planted—the rules didn't have to be the rules. Firms might compete on the basis of transportation." Fueled by the recession of the 1970s, the oil embargo, and rising inflation, which intensified concerns for cost control and competition, the lobby for deregulation gained strength. Following the lead of the Nixon and Ford administrations, Carter took on the cause and ran his 1980 reelection campaign on the grounds of fighting regulation to control inflation (Allen 1997, 108). While regulation in transport history may be more productively seen as a long history of reregulation, 1980 marked an important moment. Indeed, as James MacDonald and Linda Cavalluzzo (1996, 80) explain, "Between 1975 and 1983, Congress fundamentally altered the system of transportation regulation in the United States," with profound implications for owners and operators. With ideological fervor appropriate for reflection on a moment of ascendant neoliberalism, Clifford Lynch (1998, 3) exclaims, "The year 1980 brought with it the opportunity to do all these things. It was during this year that the transportation industry in the United States was deregulated. After over 100 years of outmoded and often inequitably applied laws, the nation's carriers were at last free to operate in a free-market environment. They were free to be creative and innovative. Most importantly, their customers were free to behave competitively." Just a few years later, the National Council of Physical Distribution Management changed its name to the Council of Logistics Management. In a 1985 editorial piece, they explain how "physical distribution's role in industry has changed dramatically, particularly since the advent of deregulation." The name was changed to recognize that *logistics* was the most encompassing term that described the management of firms' acquiring and distributing activities over space (specifically to include both inbound and outbound materials as well as management of the work itself). Indeed, they suggest that "the move to

'logistics' is a very positive step as it connotes a much broader range of activities than 'physical distribution' does. Communications, information flows, and data interchange are compelling managers to integrate the total materials/finished product cycle much more closely than ever before" (Cutshell 1985, 7). But the professional association also marks that the name change was "a move designed to expand its participation and concerns beyond national boundaries" ("NCPDM" 1985).

In contrast to the simple assessment of deregulation enhancing the "freedom of customers," a more careful examination reveals that deregulation was a complex process that took shape quite differently in different sectors of the transportation industry. As James Peoples (1998, 128) explains, "Deregulation has radically altered labor relations in the trucking, railroad, airline, and telecommunications industries, but what is interesting is the differing approaches to reducing labor costs that were used in each industry." Indeed, there were some common outcomes: deregulation of the U.S. transport sector had devastating consequences for workers, and on the whole it oriented the industry toward the transnational shipment of goods in place of a purely national focus. But the particular ways in which deregulation did its work and the specific outcomes vary. In the rail sector, MacDonald and Cavalluzzo (1996, 80) demonstrate that despite the fact that the 1980 Staggers Rail Act made virtually no direct mention of labor, it nevertheless led to a "dramatic decline in employment," the gradual erosion of wages, and the decline of the strength of unions' bargaining power. This was because the cost savings "resulted from a reduced demand for labor associated with changes in shipment methods" (ibid.). This is significant because rail is the one sector that had high rates of unionization and maintained them throughout the period of deregulation (Peoples 1998), and yet rail workers nevertheless experienced significant deterioration in their conditions of work. The trucking industry, on the other hand, saw a stark decline in the union membership rate from 46 percent to 23 percent over the deregulation period of 1978 through 1996 (Peoples 1998, 112). Weekly earnings in that sector during that time period fell from $499/week to $353/week in constant 1983–84 dollars (ibid.). This decline is directly attributed to the 1980 Motor Carrier Act, which encouraged a shifting of risk from owners to operators and prompted the widespread use of nonunion "owner operators" with closer resemblance to sharecroppers than the label of "self-employed" suggests. As Peoples (1998) reports, in the sectors where the workforce continued to expand after deregulation such as trucking and airlines, wages and union density were under direct attack, whereas in the rail sector, where wages and union density remained more constant, it

was the number of workers that declined radically. Altogether this meant that across the entire transport industry cost savings that were reaped from deregulation were largely taken directly from workers. From the time before deregulation through to labor's total annual compensation in 1991, worker losses amount to up to $5.7 billion in trucking, $1.2 billion in railroads, $3.4 billion in airlines, and $5.1 billion in telecommunications (Peoples 1998, 128).

Another implication of the wave of deregulation that occurred from the late 1970s through the 1990s was the rise of intermodalism. Intermodalism refers to the organization of transportation across more than one mode, and it has been a vital element of the rise of global logistics. Before deregulation, intermodalism was discouraged by policies that created financial incentives against cooperation and joint planning. Deregulation fostered the rapid growth of intermediaries in the logistics industry, and yet even before the deregulation of transport was under way, industry analysts predicted the rise of intermediary operators as an almost necessary feature of intermodalism. Writing in 1970, LaLonde, Grabner, and Robeson suggest that "a new form of distribution middleman with intermodal capability and spanning a wide range of intermediate distribution functions will emerge to serve the needs of the multinational distribution manager during the 1970s" (48). The story of intermodalism brings us back to the emergence of the shipping container and wartime experiments. Jean-Paul Rodrigue and Theo Notteboom (2009) suggest that intermodalism was far from a new concept in the world of transportation and in fact that efforts to ease the transfer of goods from one mode of transit to another were active in the late nineteenth and early twentieth centuries. They suggest that the pallet was the first successful intermodal technology, which in the 1930s reduced the time required to unload a boxcar from three days to four hours. It was World War II that truly "demonstrated the time and labor saving benefits of using pallets" (2009, 2). Yet Rodrigue and Notteboom argue that while intermodalism had earlier precedents, it was "the advent of the container that had the largest impact on intermodal transportation" (2009, 2). True intermodalism took some time to develop because of the reticence of shipping companies to invest too heavily in container technologies prior to the standardization of both the box and its infrastructure. The maritime sector was gradually able to move ahead with a standard dimension container following the International Standards Organization's designation of two standard measures: the twenty-foot equivalent unit (TEU), which became the industry standard reference for cargo volume and vessel capacity, and the forty-foot equivalent unit (FEU), the most commonly used container today.

Yet U.S. rail was unable to adapt prior to deregulation. Rodrigue and Notteboom (2008, 4) explain that after the 1980 Staggers Act when the deregulation process was set in motion, "companies were no longer prohibited from owning across different modes and they developed a strong impetus towards intermodal cooperation." And indeed, as Figure 6 suggests, growth in intermodal rail loadings (with rail as the key link in the intermodal supply chain) has increased since 1965, but the rate of growth really takes off after 1980.

Deregulation of the rail sector in the United States was thus a lynchpin in the construction of the global material infrastructure for business logistics. Celebrating the seamless system that intermodalism promises, Rodrigue and Notteboom (2008, 4) state, "The advantages of each mode could be exploited in a seamless system. Customers could purchase the service to ship their products from door to door, without having to concern themselves with modal barriers. With one bill of lading, clients can obtain one through rate, despite the transfer of goods from one mode to another." Deregulation of the domestic transport sectors has all these implications and others, but it also piggybacked on an attack on labor that was explicitly transnational in form and scope. It is perhaps not surprising that a profound reregulation of the shipping industry—a fractious and contested process that started in the interwar period and gave rise to the "flag of convenience"—served as the precedent on which the globalization of U.S. industry and deregulation of transport sectors unfolded. "Open registries" or "flags of convenience" were experimented with first by U.S. firms in Panama. Their use expanded significantly during and after World War II and then again following the oil crisis of 1973. In 1949, Panama had already become the fourth-largest shipping nation, following the United States, the United Kingdom, and Norway—yet the vast majority of registered ships were American owned (306 of 462; Cafruny 1987, 94). Jonathan Barton (1999, 149) asserts the significance of the flags of convenience debates, which "traditionally only concerned shipping but now has wider ramifications in terms of the globalizing of other sectors." The radical transformation in the geography of shipping regulation "has provided a model of interstate failure to regulate flexible, globalizing, geoeconomic

Year	1965	1970	1975	1980	1985	1990	1995	1997
Loads (millions)	1.7	2.4	2.2	3.1	4.6	6.2	8.1	8.7

FIGURE 6. Rail intermodal loadings. Source: Association of American Railroads, reprinted in Plant 2002.

forces." And yet, this can only be understood as a convenient or successful failure, as the implications for the economy more broadly are significant and proceed apace. Indeed, by allowing firms to geographically circumvent "nation-state legislative and economic controls, the Open Registries issue provides an intriguing yet disturbing example of the problems of international agreement and international management of the transboundary geoeconomic ecumeme" (Barton 1999, 149).

Guy Heinemann and Donald Moss (1969–70, 416) explain that flags of convenience offer ship owners advantages including "immunity from direct taxation, lower repair costs, circumvention of strict Coast Guard safety requirements, and avoidance of high wages paid to American seamen." "Beyond the purely economic benefits," Barton (1999, 148) asserts that flags of convenience "provide an advantageous blanket of anonymity for ship owners since the associated difficulties of the investigation of shipping casualties and the tracing of owners, holding companies and operating companies makes for a complex web that international maritime agencies are left to unravel." More than half of the world's ships are flagged in this way, even as a majority of the world merchant fleet is owned by ship owners in Greece, Japan, the United States, Norway, and Hong Kong, statistics that "demonstrate the separation of the traditional concept of national shipping and the modern form of globalized shipping" (Barton 1999, 145).

Alan Cafruny (1987, 96) outlines the immediate stakes of the flag of convenience for labor: "The creation of an international market enabled owners to subvert the national gains won by militant seamen's unions internationally and, especially in the Unites States." In other words, "flags of convenience thus placed America's maritime unions on the defensive." Maritime workers have fought these developments since the 1950s; the Seafarers International Union and National Maritime Union launched a global boycott of vessels in 1958, which had most impact within the United States, "where 129 vessels were picketed, rendering the docks around these vessels unworkable when other dock workers refused to cross the picket lines" (Heinemann and Moss 1969–70, 417). After another round of actions in 1961, the president issued a Taft-Hartley injunction in order to break eighteen days of disruption to the industry. The expansion of flags of convenience was not only protected by the U.S. government but actively engineered by the same. Cafruny (1987, 94) outlines how an active coalition between "extractive multinationals, large independent shipowners, and the executive branch"—"implicitly endorsed" by the inactivity of Congress—established this powerful precedent in the postwar period.

That maritime labor felt the impact of the rise of flags of convenience is hardly a surprise—labor was the key target rather than collateral damage. Figure 7 not only suggests how critical the cost of labor was to postwar considerations of the shipping industry—especially in the United States—but the British figures also expose how much race and nationality was an organizing principal for maritime work. Cafruny (1987, 94) explains that the 1954 report from the Department of Transportation and Maritime Administration that carried this table found that a central reason for the dramatic disparities in wages derived from the capacity of shippers outside the United States to employ "non-nationals."

A New Imperial Imaginary: Cartography and Spatial Metaphor

Even as there has been a profusion of interest in the role of models, maps, and other "conceived" spaces in the production of human geographies (Elden 2007; Lefebvre 1991; Huxley 2006), transformations in the ways that the economic space of globalized capitalism has been conceived and calculated are almost entirely neglected outside the applied field of business management. The work that perhaps comes closest is writings on the concept of "time-space compression" (Bell 1974). David Harvey has used the concept to explore how globalization processes and the rise of advanced capitalism organized through the speed of supply chains and JIT production techniques have dramatically transformed experiences

	Number of Crew	Total Monthly Wages (USD)
United Kingdom, mixed crew	80	5,541
United Kingdom, white crew	54	6,444
Japan	56	6,273
Norway	43	7,145
Netherlands	55	7,567
Italy	41	7,713
Denmark	43	7,990
France	47	10,274
United States	48	29,426

FIGURE 7. Comparison of wage costs aboard United States and foreign flag vessels, 1953. Source: U.S. Department of Commerce, reprinted in Cafruny 1987.

and representations of space. His notion of space-time compression identifies "processes that so revolutionize the objective qualities of space and time that we are forced to alter, sometimes in quite radical ways, how we represent the world to ourselves" (1989, 240). Yet the history of business logistics reveals that changing representations of space were not only an outcome of space-time compression but also a foundation for changing lived relations of space-time.

Henri Lefebvre (1991) offered one of the most compelling analyses of the role of technical and professional conceptions of space in the production of space more broadly. His influential "triadic" conception of space puts emphasis on the role of scientists', technicians', bureaucrats', and managers' representations of space in shaping perceptions of space and spatial practice. Scholars from geography and other social science disciplines increasingly mobilize discursive methodologies to understand how economic space is produced and regulated and to explore how economic actors define and legitimize their methods and theories through their representations of economic problems and solutions (Amin and Thrift 2004; Barnes 2004; Buck-Morss 1995; Callon 1998; Gibson-Graham 1996; Mitchell 2005). But despite longstanding interest in the production of space (Gregory 1994; Harvey 1973; Lefebvre 1991; Massey 1977; McDowell 1999; Smith 1984; Soja 1989; Thrift 1996;), recent work on the rise of "geo-economic" calculation (Neil Smith 2005; Sparke 2006), and growing interest in social and political theory on the "performance of the economy" (Barnes 2002; Callon 1998; Mitchell 2005; Strathern 2002; Thrift 2000), there is a dearth of scholarship on the representations of logistics space.

We have already seen how powerful systems thinking was for the formation of business logistics. Rethinking distribution as an element of an integrated system of production and circulation, rather than a discrete and bounded activity, opened up the possibility of organizing the system differently. But what kinds of understandings and associations does the notion of a system bring with it? Did particular meanings already associated with the notion of a system impact how the physical distribution system was conceived and practiced? Systems theory emerged out of natural sciences, and it wasn't until the 1960s that it moved into social scientific work. Ludwig Von Bertalanfy's systems theory is a different variant of systems thinking than the systems analysis of RAND and operations research; nevertheless, they share common conceptual underpinnings and overlap in popular and research worlds (Hammond 2002). In his classic text, *General Systems Theory,* Von Bertalanfy (1973, 46) defines a system as "an arrangement of entities related in such a way as to form a unity or organic whole." The biological framing persisted in the organic

models of organizations as organisms, and this was a goal, not an accident. "Whether a living organism or a society," Von Bertalanfy explains, "characteristics of organizations, are notions like wholeness, growth, differentiation, hierarchical order, dominance, control, competition." He proceeds to cite "Iron laws" that "hold good for any organization," and the first he cites is the Malthusian law of population.

Biological models for human society are hardly new—for instance, the "body politic" has long been a powerful political metaphor with tangible effects (Rasmussen and Brown 2002). Systems theory places an emphasis on the "subjective bounding of the system, and a fundamental emphasis on flow" (Naim, Holweg, and Towill 2003). In a recent paper on systems thinking in supply chain management, Naim, Holweg, and Towill (2003) write, "Systems are intra and interconnected by flows, or exchanges of information and matter. It is these flows that determine the extent of integration in the operating environment." Systems theory thus posits a biological imperative to flow, wherein disruption becomes a threat to the very *resilience* of the system. This notion of an organic imperative to the integrity of the system becomes important in more recent attempts to protect supply chains from disruption (Collier and Lakoff 2007; Pettit, Fiskel, and Croxton 2010), and this has implications for the way securitization has unfolded, as we explore in chapter 2 and then in more detail in the concluding chapter.

But if the biological contours to the metaphor of the system would in many ways infuse the assembly of business logistics, the frequent deployment of another set of metaphors played a definitive role in ensuring that

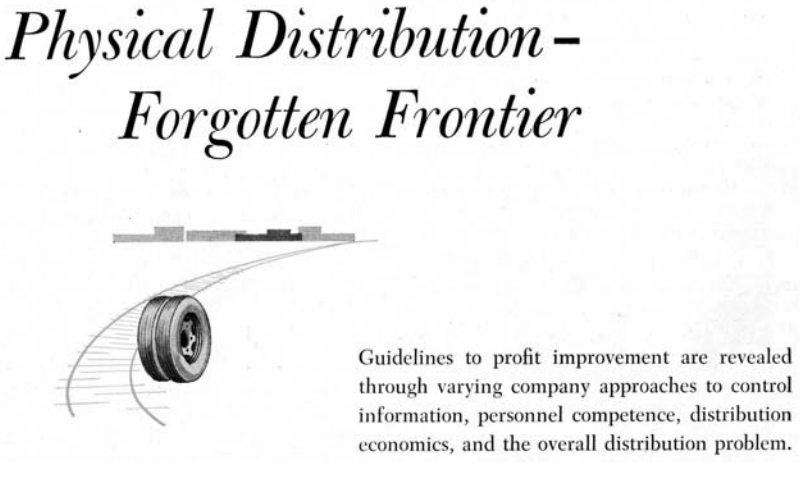

FIGURE 8. "Physical Distribution—Forgotten Frontier." Source: Neuschel 1967.

business logistics would remain tethered to its military past. In the writings that came to define the field in the 1960s through the early 1970s, colonial and military metaphors were rife. The landmark work on logistics and physical distribution carried titles about "new frontiers" and "dark continents," a reminder of the history of this new business science as an old military art. Writing in *Fortune* magazine in 1962, management guru Peter Drucker (1962, 72) identified logistics and physical distribution as America's "Last Dark Continent": "We know little more about distribution today than Napoleon's contemporaries knew about the interior of Africa. We know it is there, and we know it is big; and that's about all."

These colonial metaphors are perhaps more telling than their authors would suspect. From its history as a military art in service of the national, territorial, geopolitical state, logistics became a technology of supranational firms operating in relational geo-economic space. In contrast to the

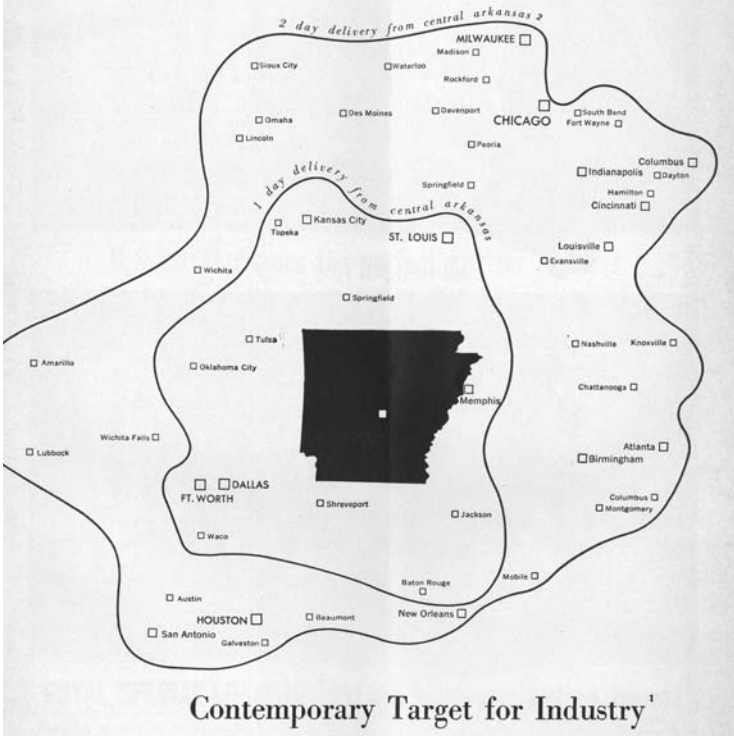

FIGURE 9. Contemporary target for industry. Source: Advertisement from *Fortune* magazine, June 1968.

absolute territory of geopolitical calculation associated with colonial rule, geo-economics relies on the unimpeded flows of goods, capital, and information across territorial boundaries. As Neil Smith argues in his analysis of American imperialism, geo-economics denotes a shift from direct territorial control to rule through markets (Smith 2004; 2005, 71). Territorial rule becomes a tactical option rather than a strategic necessity. Geo-economics thus does not operate "beyond space" or "after geography"; rather, geo-economic political geographies transform rather than dispense with spatial calculation, and the work of logistics is concerned precisely with the production of space beyond territory. Indeed, the revolution of logistics is precisely a revolution within capitalism, a revolution in the spatial logics of global economic and political power. These metaphors provide a glimpse into the changing and persistent politics of imperialism, a theme we will revisit in chapters to come.

After the Revolution

In 1991, following Operation Desert Storm (widely heralded as a logistical war par excellence), the corporate world once again looked to the U.S. military for lessons in logistics. Yet this time, they only found their own models, language, and lessons thrown back at them. In an interview with a leading business magazine, lead logistician General William Pagonis touted the lessons of corporate logistics management, mobilizing concepts such as "profit ratio" and "customer satisfaction," casually explaining their translation into the art of war. Indeed, the interviewer notes, "Pagonis demonstrates what senior managers of world-class companies have always known: good logistics can be a source of competitive advantage, and excellent logistics management has many similarities to and ideas for other management disciplines, including general management" (Sharman 1991, 3). In his report on contingency operations logistics, Major Brian Layer (1994) makes a similar claim, asserting that over the past few decades U.S. military logistics lagged behind the "logistic innovations" that have "revolutionized civilian distribution practices." However, "despite the deficit," Layer argues, "US operational artists can benefit from these innovative logistics ideas . . . many successful companies provide impressive logistic design models." Like leading civilian companies that "look to logistic design as a tool for gaining competitive advantage over their rivals," Layer argues that "military planners should look to their own logistics systems as a means to gain operational advantage over the enemy."

Yet tempting as it may be to tell a tale of the "civilianization" or "corporatization" of logistics over the past six decades, this narrative would

be a partial truth. The revolution in logistics hardly marked its "civilianization" but rather a different and even deepened entanglement between military and market methods.

As we will see in the chapters that follow, if we went into the logistics revolution of the 1960s with a corporate world eager to learn from military knowledge, we have emerged from the other side with an art and science that is deeply hybrid in its influence, with logisticians that receive their training in both military academies and business schools, and with a logistics industry that provides the backbone for both corporate and military strategy, such that it would be futile to try to disentangle who said what. As we will see in the concluding chapter, logistics is furthermore the sector of current U.S. military work that is most likely to be contracted out to private military companies, the proliferation of which also challenges this military–civilian divide. And finally, as chapter 2 explores in some depth, the entanglement of military and civilian logistics is particularly stark in the recent rise of "supply chain security," a form of security that aims to protect the material infrastructure and commodities flows of global trade.