American Wasteland: A History of America's Garbage Industry, 1880-1989

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Unlike many industries that developed into modern business enterprises over the last century, the nation's garbage industry seems to have followed a path-dependent development pattern far different from the structuralism emphasized by Alfred D. Chandler and his students. Rather than encouraging the development of a more efficient industry, the increased managerial attention the waste industry received at the beginning of this century may have actually delayed its integration.

In 1900, America's garbage trades were divided among many small firms using a variety of technologies to handle society's waste. Recovering or utilizing materials others deemed worthless, these firms remained profitable by keeping overhead low and externalizing their costs as much as possible--sometimes to the extent of sorting waste on city streets. Seeking to end this situation and improve service, between 1900 and the end of the First World War, a group of private citizens and municipal authorities (hereafter referred to as the "modernizers" of waste management) successfully implemented garbage reforms designed to integrate the industry through centralized management. The vehicle for this integration was the municipal refuse department, which brought professional engineering and management know-how to the garbage business.

Professionalization and the creation of managerial hierarchies did not, however, create a more efficient waste management industry. Rather, these attempts at rationalization delayed the industry's integration by creating a set of institutional rigidities which precluded market-driven solutions. These rigidities sprang from the social and political attitudes of the individuals reforming the way Americans discarded their waste, who often embraced sophisticated collection and disposal technologies to eliminate a hazard whose existence was largely politically defined. In more than a few ways, the institutional rigidities of the modernization movement affected the shape and direction of America's waste industry until well into the 1930s, when depression, and then war finally forced the adoption of market-driven solutions.

The Chandlerian approach popular with those who study the rise of America's "big businesses" does not lend itself well to the garbage industry. Though several firms followed a structuralist development pattern in the post-World War II period, the industry's earlier period lacks such a precise evolutionary pattern. This is not to say that the garbage industry's failure to integrate into a modern business enterprise at the beginning of this century can be explained using

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traditional interpretations of the period. Unlike other industries attempting integration at the turn of the century, waste management had both technologies suitable for economies of scale and managerial structures to exploit them. Yet, in spite of these organizational capabilities, by the dawn of the Great Depression waste service was improved but the industry providing it remained fragmented and inefficient--the result of what seems to be an over-abundance of managerial control in an industry not yet prepared for it.

By focusing on the creation and ultimate destruction of institutional rigidities in America's garbage industry, this paper attempts to create a historical bridge between the two periods historians of this industry have studied most. Martin Melosi, whose work *Garbage in the Cities* is perhaps the best-known, focuses on the industry's early history, when the institutional rigidities of modernization were just forming. Scholarship on the industry's post-WW II period often takes integration for granted, using the existence of garbage oligopolies like BFI and WasteManagement as proof of the industry's corrosive effects on the environment, workers' rights, and the ethics of local officials [2]. With no clear link between today's corporate monoliths and yesterday's newly created public agencies, this study provides an institutional framework to understand America's waste management industry as it developed in what was perhaps its most turbulent period.

Before beginning, the use of two words requires amplification. Though normally used in connection with advanced or improved standards of living, the terms "modern" and "modernizer" are used here in a pejorative sense. As the staunchest advocates for waste management reform, "modernizers" like George Waring developed "modern" waste management solutions based on nineteenth century assumptions about sanitation. Even though germ theory proved that the aesthetically unappealing did not pose a threat to public health, the "modern" waste systems built between 1896 and 1914 continued to reflect their designer's fears of disease-carrying garbage gases [7, pp. 431-440]. Needing to eliminate these gaseous threats to society, the modernizers built incinerators, reduction, and recovery plants all over the country, often using designs that were more theoretical than field-tested. These facilities proved to be the bane of the engineers charged with their operation in the 1920s, as they consistently failed to live up to their designer's expectations, while the cost of replacement, political and otherwise, made their abandonment unthinkable. In many ways, the systems built by modernizers embodied the institutional rigidities which delayed the industry's integration, the physical consequences of compromises worked out among reformers active at the beginning of this century.

The waste management systems reformers built at the turn of the century reflected an ideology that emphasized improving public health through efficient public administration. Basing their plans on the successful examples of America's big businesses, the modernizers tried to control waste like Andrew Carnegie controlled steel. While a relatively straightforward process in a theoretical sense, the modernization of America's waste management industry was more complicated. As Melosi and other "garbage historians" ably demonstrate, the groups pushing for the reform did not necessarily want the same solutions, making cities adopt waste systems driven largely by political, rather than economic, considerations.

In *Garbage in the Cities*, Melosi identifies the tenuous alliance between municipal engineers and private citizens interested in sanitary reform. Hinting at

the complications created by its breakdown, Melosi claims that by the 1910s the movement had "splintered into two distinctive though not totally independent factions.... [One] dominated by sanitary engineers who functioned within the municipal infrastructure and a second . . . composed primarily of citizens, [who] operated in the public realm" [8, p. 72]. Engineers saw the problem primarily as one of proper organization and adequate funding. A 1901 waste management handbook suggested that "[a]n engineer who is willing to study the problem can dispose of these wastes in a manner that will be sanitary, provided, of course, that his municipality will grant the money and the power to accomplish his ideas" [9, p. 9]. Private citizens, whose political support municipal officials needed, demanded that their waste be "sanitized" just in case garbage gas still posed a threat. As a result of this pressure, municipal engineers designed and built facilities whose primary purpose was the elimination of a threat that did not exist.

The move to improve the country's waste management was further complicated by the condition of the industry to be reformed. As it existed at the turn of the century, the waste "industry" was in reality a collection of trades, each catering to different parts of the waste stream. Swine and truck farmers handled most of society's garbage, or "kitchen swill," scavengers focused on rubbish, and general haulers handled ashes.

The private sector's advantage over the municipal agencies mimicking them was cost: while scavengers relied on low-tech, low-cost methods of recovery that externalized as many costs as possible, municipal engineers designed capital-intensive facilities whose internalized costs were justified on extremely optimistic levels of recovery. As municipally owned facilities failed to produce the revenues modernizers promised, blame quickly fell on private-sector competition. Arguing that scavengers were "creaming off" valuable waste and leaving municipal agencies with the dregs, municipal officials campaigned for the abolition of the private sector in favor of a more efficient, professionally managed public waste agency. The dean of waste modernization, George Waring, was most explicit on this point, arguing that the "push-cart man who jangles his string of bells through the street" carried on "a more or less illicit traffic. . .that the city fathers could better control [in a manner that] would not only enrich the public coffers but would also increase . . . public safety."

Like engineers in America's heavy industries at this time, municipal waste officials were impressed by the efficiencies realized by exploiting economies of scale. In steel and railroading, the key was lowering per-unit costs by spreading fixed costs as widely as possible. To accomplish this with waste, modernizers favored systems that relied on technologically sophisticated machinery whose theoretically high-throughput capacity would make waste disposal faster, cheaper, and more sanitary than pre-industrial methods. Incineration was the darling of the modernization movement, since its offered the most "sanitary" method of disposal and because municipal engineers were confident that they could operate these facilities with big business-like efficiency.

Throughout the 1900s and 1910s, innovations in incineration technologies emboldened public officials, as each refinement promised to make incineration cheaper. The resulting incinerator-building craze left its mark, as most cities with populations exceeding 50,000 listed incineration as their primary method of disposal on the eve of the Great Depression [1, p. 100].

A less popular, but by no means less expensive, technology involved the "reduction" of waste. Embracing the modernizer's ideals of sterilization and maximum reutilization, reduction captured grease and other by-products by cooking waste in vats of benzene and mineral spirits and then squeezing the residual out in hydraulic presses. This method was popular because the sale of liquid and solid residue more than covered processing costs.

The final method embraced was resource recovery (or as it is known today, recycling), which was essentially scavenging on an institutional basis. Influenced by a tour of processing facilities in Europe, in 1896 George Waring built the nation's first recovery plant in New York City, where valuables were sorted off a conveyor belt driven by a garbage-burning steam engine [10, pp. 93, 114]. Because of their high operating costs, these facilities fared poorly -- victims of the changing composition of America's waste stream and the unpredictable nature of the nation's secondary materials markets.

Each of the processes the modernizers endorsed seemed designed to further their goal of centralizing control over society's waste. An escape hatch for system designers whose facilities failed to live up to expectations was to blame inadequate volume--a situation cities sought to avoid by passing "flow control" ordinances, laws that gave municipal agencies the exclusive rights to control waste. With their facilities and ordinances in place, cities had the managerial control they thought they needed to make their systems run well. But even then things did not go as planned.

Part of the problem lay in the character of the waste itself. As the Great War drew to close, the consumption habits of Americans changed dramatically, and so did their waste. Grease content, a key element in the profitability of the nation's reduction trade, dropped precipitously during the war and never recovered [5, p. 41]. The advent of convenience foods reduced waste's total organic content, making it less useful as swine feed or tillable fertilizer. The waste systems modernizers built, however, were designed around the very characteristics that changed most at war's end (i.e. moisture levels for incineration, grease content for reduction)-- characteristics which were directly linked to the final cost of disposal. As the properties of America's waste changed, the costs of operating modern waste disposal facilities grew.

The second problem municipal waste management programs faced was a lack of standardization. If anything, this was the creation of the modernization movement itself, since each city built a slightly different waste management system. Demonstrating their commitment to modernity by employing all the latest (and often untested) waste technologies, cities spent millions modernizing their waste systems [4, p. 208]. Unlike the private-sector confusion that had encouraged the modernization movement in the first place, this fragmentation was longer lived, as small, under-capitalized firms were replaced by agencies backed with resources of the state.

The modernization movement also stimulated a kind of system building competition between municipal officials. Rather than cooperate, city engineers tried to outdo each other by building more elaborate (and more expensive) waste systems. Driving this competition was a quest for the universal solution, which municipal engineers chased as a kind of Holy Grail well into the 1930s, hoping that their invention would solve the nation's garbage problems and make them rich in the process.

Modern waste systems reinforced system building, as each city designed around local needs: New York used incineration and open sea dumping, while Philadelphia relied on incineration and reduction. In theory, the systems built in New York, Buffalo, San Franciso, and elsewhere should have been able to exploit economies of scale far beyond the reach of the private sector by concentrating control in a few hands and spreading the cost of capital and labor over a large waste stream.

There can be no doubt that consumers benefited from the creation of municipal waste management agencies. Before modernization, fewer than fifteen percent of a city's population received waste services, and even this "free" service came at the cost of allowing scavengers to sort waste on one's sidewalk. After modernization, regular collection was nearly universal in America's largest cities, and rising in medium-sized cities as well. This increase was undoubtedly the result of professional management, as municipal waste agencies integrated backwards from providing disposal services to offering collection and transportation, thereby bringing the previously separate tasks under the management of a single firm.

The justifications for public-sector monopoly (or oligopoly) control of an industry normally revolve around market failure; that the private sector's inability or unwillingness to provide the level of service demanded compel the creation of public agencies. As the targets of these modernization programs, in the first years of this century private operators could not hope to meet society's newly elevated expectations. The decision to stay out of disposal also reflects the changing nature of waste management technology in the 1910s and 1920s, when designs and operating procedures changed constantly in effort to obtain the theoretically possible high levels of throughput required to offset the high cost of modern disposal equipment. While local officials interpreted this failure as justification for their own agency's existence, it also reflected the underlying weakness of the systems they built: their costs were justified on the need to solve problems that were politically defined. Throughout the late nineteenth century, the construction of sewers and waterworks were accepted as the cost of preserving scarce resources for the common good. The same logic held for waste management, and throughout the first two decades of this century, society willingly paid a premium for methods of collection and disposal that projected an image of municipal modernity. As the depression took its toll, however, society's ability (or willingness) to pay this premium all but disappeared.

Efforts to perfect modern methods of disposal evaporated with the Depression, as cities slashed their budgets to accommodate the contraction and municipal waste managers were told to make do with what they had. By 1936, it was common for city engineers to discuss their budgets in percentages of their last "real" budget of 1929-1930, when they last had enough money to run the systems they built [6, p. 74]. Budgets that averaged $300,000 in pre-Depression years were a fifth of that by 1934, and while the volume of waste Americans generated declined during the contraction, there was still enough to pose a serious logistical problem to those charged with its management.

The reduction of public funding changed the industry, as practices previously rejected reappeared as expedient alternatives in a time of crises. One of the most notable changes was the rise of single-can collection. Before the Great Depression, waste was collected in one of three forms, each requiring separate methods of collection which in turn placed heavy demands on labor and

transportation. To cut these costs, cities like Worcester, Massachusetts began collecting all of their waste in a single can [3, p. 57].

The collection of mixed waste, however, pushed the costs of operating disposal facilities skyward. Reduction plants, already marginalized by the change of dietary habits that followed the Great War, ceased to be viable even where cities were still willing to subsidize them, with the last of these facilities closed by 1935 [10, p. 114]. Commingling waste also made incineration more expensive, as the waste's higher moisture content made it harder -- and more expensive -- to burn. By the end of the Depression, engineers calculated that incinerators cost an average of two dollars a ton to operate, while burying waste cost a mere twenty-nine cents a ton[12, p. 70].

The move away from trying to recover maximum value from waste signaled the end of the modernization movement. Rather than viewing waste as a commodity to be mined and sanitized, municipal officials working in the Great Depression saw it as an expensive nuisance that could not be ignored. One of the first to reject the modernizers' approach was New York City's William Carey, who began using dumps out of expediency more than anything else. Recognizing that he lacked the budget to burn all of the city's waste, Carey established "fills" in the Five Boroughs, where waste was buried in undeveloped areas. By committing the heresy of authorizing landfills from the office that had furthered the waste industry's modernization most (it was specially created for Waring in 1896), and producing substantial cost savings in the process, Carey exposed the gap between the modernizer's ideals and practical reality.

For defenders of the waste modernization, Carey's actions threatened everything they stood for -- one went so far as to accuse the city's Superintendent of Sanitation of threatening to "nullify the progressive activities of all sanitary engineers [by] returning us to primitive methods...." [13, p. 100]. Indicted by a grand jury for endangering the public's health, the Superintendent defended his approach by emphasizing results: in 1939, he saved the city over a million dollars, and given half a chance, would improve upon that number in 1940. What was more, Carey noted that his "sanitary" method of sealing dumps prevented them from emitting noxious odors or attracting vermin, thereby allowing him to recover land while simultaneously disposing of waste in a cost effective manner. When asked what he thought of the charges, New York Mayor Fiorello La Guardia commented that his Superintendent was "being indicted for doing his job."

Reductions in municipal revenues brought on by the Great Depression also provided an opportunity for entrepreneurs entering or already in the business. As the level of municipal services declined, private haulers expanded their operations by offering service on an informal basis. One of Southern California's future garbage "kings," Elmo "E.J." Harrison, got his start this way, driving a Model T down alleys in Ventura County and offering to haul waste for a fee. Operating in markets that were either underserved or unregulated, Harrison and hundreds of independents like him hurried the waste industry's transformation through the adoption of pre-industrial technologies, the most common of which was "filling" land.

The return to landfilling by both public and private waste firms heralded a new age of industry integration. The lower barrier presented by landfill technology opened the industry to private competition and pressured public agencies to compete on a cost basis. The technology around which most of this competition

took place was the "sanitary" fill, which seems to have been perfected late in the Depression by Fresno's Public Works' manager, Jean Vincenze. Elected to his post in 1931, the former consulting engineer immediately broke with the traditions of modern waste management by canceling the city's incineration contract. Claiming that the facility was capable of only "warming garbage over," Vincenze put his energy into perfecting a method of disposal that would be both aesthetically pleasing and economically acceptable.

Vincenze's break from modernization came in the way he approached waste: rather than seeing it as a hazardous material containing some recoverable wealth, Vincenze treated garbage as a commodity with zero or negative economic value. This approach also weakened any remaining justification for modern methods, since removing assumptions about revenue generation forced advocates of incineration or reduction to examine their processes on a strict cost basis. Unlike incinerators, which took months to build and hundreds of thousands of dollars, landfills had a short start-up time, often less than a week, while a single bulldozer operator could entomb a days' worth of garbage for pennies a ton.

Unlike New York City, where William Carey encountered hostility from local modernizers, Vincenze had the luxury of experimenting in a growing city with an abundance of surrounding land. Improving on techniques he saw used in the San Francisco bay area, Vincenze developed a method of "cut and cover" that reduced vermin and offensive smells at minimum cost. By 1938, the *Engineering News-Record* extolled the virtue of this simple approach, emphasizing that as Vincenze and his department became more expert at running their fill, their operating costs continued falling. Between 1934 and 1938, Fresno's waste collection rates dropped three times, while the level of service provided rose.

These results were nothing less than startling in an industry grown cynical about sure-fire schemes to make garbage more efficient. That Fresno could expand the number of residents receiving waste service by thirty-five percent during this period was proof that something dramatic was taking place. Rather than concentrating on throughput and effective processing, the low cost and simplicity of landfill operation allowed officials of waste management firms (public and private) to concentrate their efforts on cutting costs in the labor intensive area of collection and transportation.

The main weapons haulers used to combat high labor costs was the packer truck -- a Depression-era invention that came into its own as the Second World War began. Designed to carry commingled waste in an aesthetically pleasing manner, the packer truck revolutionized the waste industry by establishing standards in collection while re-enforcing trends towards commingling waste and mixed disposal. The prototype for the collection vehicle we see on the street today was developed in 1938 by Detroit's Gar Wood Industries. The "Load-Packer" revolutionized collection by compacting waste as it was collected, increasing the amount of territory a single crew could handle, and thus increasing worker productivity while helping private and public firm cut their operating costs.

The dramatic shift in technologies and private sector participation makes it clear that by the end of the Great Depression, the institutions created by the modernization movement were weakening. Those running municipal waste systems in the late 1930s were more than a generation removed from the ideals of maximum reutilization and sterilization, and increasingly embraced the very technologies modernizers sought to eliminate. While there is little doubt that this trend would

have continued absent war, it is equally clear that without war institutional change in America's waste management industry could not have been as complete or as far-reaching.

The twin pressures of labor and capital scarcity that accompanied America's mobilization accelerated the transition from capital-intensive methods of disposal to the more cost-effective techniques mastered during the Depression. War-induced labor shortages affected cities up and down the Pacific Coast, forcing cities like Long Beach to adopt landfills and two-man collection crews as necessary expedients, a pattern that repeated itself throughout the country.

The shortages of manpower and capital were no less acute in the military, which was in the process of building hundreds of camps to house and train draftees. Needing a waste management solution that could literally be built overnight and lacking any single organization that could handle the project on a contract basis, the Army Corps of Engineers drafted municipal officials with experience in waste management and charged them with designing a universal system for military use. By throwing municipal engineers from around the country together and focusing them on a single goal, the Army Corps of Engineers achieved in a year that which a collection of professional managers had been unable to do in thirty. By making consensus a mandatory result of the debate, the Corps encouraged a furious exchange of ideas to find the fastest, simplest, and cheapest solution possible. By 1943, landfilling was the military's official solution to handling its waste -- incinerator-building was prohibited for the duration -- and was quickly spreading to the civilian sector. Cities like Long Beach, New York, and Houston all operated landfills as war-time expedients, though each kept their "temporary" solutions at war's end [11, pp. 84-85].

The trend toward landfilling was reinforced by the thousands of camp engineers returning to their civilian duties as officials with the nation's cities and counties. While many cities continued burning waste well into the 1950s, it is clear that the institutional consensus around this expensive technology no longer held, and officials no longer feared professional censure for using landfill or single-can collection. These two basic simplifications proved key to the industry's later integration, for as the barriers to entry fell, competition increased and the industry began integrating into regional and national business organizations.

The story of the waste management industry's delayed integration provides insight on the limits of the structuralist development model in explaining the rise of America's economy. Certainly, in the cases of railroads, steel, and automobiles, the structuralist progression makes sense, as firms in each of these industries did develop in a linear progression, moving from entrepreneurial organization to modern business enterprise through the vehicle of professional management. But even when production characteristics were conducive to economies of scale, professional management was not always the answer.

The structuralist approach shys away from this conclusion by focusing on those industries where professional management was successful -- U.S. Steel, General Motors, and Du Pont each provide excellent case studies of competent managerial enterprise. Little attention is paid to firms where managers made the wrong decisions and backed the wrong technology. This is true in the private sector because these firms no longer exist -- but in the public sector, poor choices are often subsidized for decades at public expense. Insulated from the vicissitudes of markets and subsidized by public funds, managers in the public sector have in the

past created institutional rigidities in entire industries by embracing technologies or regulatory programs whose costs far exceed their benefits.

America's garbage industry is a case in point. By introducing professional management, the public sector did indeed improve the level of local service, but public intervention also impeded the development of a more integrated industry. By selecting very expensive waste management technologies and then spending twenty years trying to make them cost less, the modernizers demonstrate how managerial hierarchies, when harnessed to the wrong solution, can do more harm than good.

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