

Andrew Carnegie's Realized Impact on the United States

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Andrew Carnegie is either considered a “Captain of Industry” or a “Robber Baron,” one with the connotation of a brilliant entrepreneur, and the other implies an exploitative tyrant. Nevertheless, Carnegie’s impact on the steel and railroad industry, the infrastructure and urbanization of the United States, and industrial business management should not be ignored. At the age of thirteen, Andrew Carnegie and his family immigrated to the United States from an impoverished Scotland, eventually settling in Pittsburgh, Pennsylvania. With only five years of formal education, all of which he received prior to his arrival in the U.S., Carnegie eventually became employed by the O’Reilly Telegraph Company. The only importance of this employment to his rise to wealth and prominence was his introduction to Tom Scott of the Pennsylvania Railroad Company, beginning his management experience in the railroad industry by age twenty-four.¹ From there Mr. Andrew Carnegie started to accumulate wealth, acquire existing industrial enterprises, and launch new enterprises. Because of these experiences and the wealth he acquired, Carnegie adapted the Bessemer process of steel manufacturing, vertically integrated the steel industry of Western Pennsylvania, and significantly expanded and reinforced the American rail network. In doing so, Carnegie drove down steel prices, allowing American steel to be the foundation on which the twentieth century in the United States flourished.

In order to understand how Andrew Carnegie revolutionized the steel industry, a firm understanding of the Bessemer steel manufacturing process must be acquired. Carnegie obviously did not create the Bessemer process, nor the first to implement it. Henry Bessemer, the Englishman credited with inventing the process that Carnegie later adapted, also competed with another American inventor William Kelly.² Because of more substantial external financial support and a more established personal and entrepreneurial base, Bessemer retained his U.S.

¹ Charles R. Simcoe, *The History of Metals in America* (Materials Park, OH: ASM International, 2018), 33.

² *Ibid.*, 25-6.

patent while Kelly went bankrupt during the Panic of 1857.³ While Kelly received the first patent for the process, Bessemer later received a patent specifically for the equipment to conduct the process that would later take his name. Bessemer discovered, for himself at least, that when a highly pressurized flow of oxygen comes into contact with a bath of molten cast iron, the temperature of the molten iron increases without the aid of additional fuel and more efficiently than simple heat conduction. By raising and sustaining heat at these new levels, Bessemer witnessed that carbon could no longer be required to turn iron into steel; therefore, theoretically making steel cheaper to produce.⁴ Bessemer never implemented this process outside of his pilot plant but marketed it out to extremely interested American ironworks. These American ironworks were represented by businessman Alexander Holley, who facilitated the purchase of Bessemer's patent rights in 1865. Holley then consolidated the ownership of these ironworks with William Kelly's ironworks, along with his patents, allowing Bessemer steel to enter mass production.⁵ Fifteen plants under Holley's holding company operated using the Bessemer process by 1875. To expand the usage, and therefore the royalties revenue, across the United States, Holley enlisted the services of Tom Scott of the Pennsylvania Railroad Company, once mentor to Andrew Carnegie.⁶ The American steel industry, however, simply did not contain the capacity to produce steel in vast quantities in the 1870s. At the beginning of the decade, the Bessemer process only produced seventy thousand tons of steel, but by the turn of the century, the United States produced ten million tons, a third of all steel in the world. Half of this product went into the expansion of the railroad, becoming the material of choice due to the plummet in prices, twenty American dollars per ton. Andrew Carnegie drove this.⁷

³ Ibid., 28.

⁴ Ibid., 27.

⁵ Ibid., 29.

⁶ Ibid., 30.

⁷ Ibid., 32.

Carnegie's mentor and supervisor at Pennsylvania Railroad Company Tom Scott aided his initial investment in the iron and steel industry. From within the Pennsylvania Railroad Company, Scott and Carnegie formed the Keystone Bridge Company in 1865, which needed a major investment of steel in order to complete perhaps Carnegie's greatest single infrastructure project, the Eads Steel Bridge crossing the Mississippi River at St. Louis, Missouri. Along with his brothers and a few other investors, Carnegie formed the steel manufacturing firm Carnegie, Kloman, and Company, Andrew Kloman being the one with the primary steel management background. In 1872, this firm invested in the construction of a Bessemer steel plant in the Pittsburgh area, known as Braddock's Field. The construction of this plant marked the initial schism of Carnegie from the Pennsylvania Railroad Company and Tom Scott, as he and that company already invested in Alexander Holley's Bessemer steelworks. Carnegie did succeed in luring Alexander Holley away from Penn Rail Co.'s existing steelworks to manage the construction of this new plant, The Edgar Thomson Works. Carnegie named this plant after Tom Scott's primary colleague in the railroad industry, mainly to gain attention from railroad customers through name association and potentially to spite them. In this plant, Carnegie installed two Bessemer converters, along with two Siemens-Martin open hearth furnaces. The combination of these two processes would eventually replace solely manufacturing steel through the Bessemer process, as the soon-obsolete process produced a higher quantity of defective material.⁸ Now that Carnegie constructed his first Bessemer plant, he had to employ the best management to operate his new facilities.

Typically, when higher administrators move organizations, they bring along their best and most trusted underlings from their previous organization, who then receive equal or higher

⁸ Ibid., 34-5.

positions in their new organization. This happened exactly when Carnegie brought in Alexander Holley from the Pennsylvania Railroad Company steelworks. An assistant superintendent by the name of Captain William “Billy” Jones under Holley became general superintendent of the Thomson Works.⁹ Jones became the first in a large community of excellent upper management of Carnegie’s steel empire. Predicting Jones’s excellence, Carnegie paid him extremely over the asking price, especially for someone who had received little formal education. Jones, however, had significant experience in both expansion and management of labor and oversaw the massive expansion of the Thomson Works over the 1870s and 1880s as Carnegie consolidated ownership of his growing industrial empire, limiting shareholding to either himself or his brothers.¹⁰ As a part of this expansion and consolidation, Carnegie endeavored to control the entire steel manufacturing process, from the procurement of raw materials to the distribution of finished products, including the infrastructure that finished product was transported on.

In the same way as with the Bessemer process of steel manufacturing, one must understand the economic science of vertical integration to fully grasp just how Andrew Carnegie revolutionized the steel industry of the United States. Vertical integration, simply, is one company, corporation, government entity, or individual owning the entire process of the production of a specific commodity or service. This includes but is not limited to the source of the materials used to produce the commodity or service, any transportation involved, and obviously the complete process of manufacturing the commodity. Vertical integration of a commodity or service may not be considered a monopoly, which gave corporations like Carnegie’s a way around anti-trust laws. The first step of vertical integration, known as backward integration and the core need and purpose of practice, is to secure their supply chains of raw

⁹ Ibid., 36.

¹⁰ Ibid., 37-8.

materials. This is done by procuring the source of raw materials used in the product and any primary manufacturing before the final production of the corporation's commodity. The final step is the forward vertical integration is to control, typically by outright owning, the transportation from the source to manufacturing, to the markets, and anywhere in between. This final step especially characterized vertically integrated firms of the late nineteenth century. In the late 1800s, corporations such as Carnegie Steel produced extremely large quantities of product to a specific niche in the market but to a large number of consumers. As a result, previously independent services were "assimilated into the management of an integrated manufacturing company."¹¹ This rise of vertical integration in the United States in the late nineteenth century is not coincidental to the mass expansion of a nationwide rail and communications network,¹² to which Carnegie significantly contributed.

Due to the massive production capacity of the Thomson Works of Carnegie Steel during the late 1870s, significant delays occurred between the production of steel in bulk and the processing of said steel into rails for the railroad and bridge companies that Carnegie also owned. While Carnegie temporarily fixed this issue by selling off excess steel ingots to local refining mills in the Pittsburgh area, he started to bring more of his own refining mills online to alleviate the burden. These local refining mills, angered at the loss of business, combined under the leadership of Carnegie's bitterly estranged former business partner Andrew Kloman, to start construction of the Pittsburgh Bessemer Steel Company plant, located extremely close to Thomson in nearby Homestead, Pennsylvania. Kloman, unfortunately for Pittsburgh Bessemer but fortunately for Carnegie, died before the completion of the construction of the new plant. The

¹¹ Roger W. Schmenner, "Manufacturing, Service, and their Integration: Some History and Theory," *International Journal of Operations & Production Management* 29, no. 5 (2009): 432. doi:10.1108/01443570910953577

¹² *Ibid.*, 436.

collective of local refinery owners then turned to Carnegie to bail them out of an impending financial and labor crisis. At the time, this acquisition of the later renamed Homestead Works solved many problems for Carnegie by “obtaining what would be the most modern rail mill in the industry and eliminate a competitor at the same time.”¹³ While Carnegie controlled the steel industry of southwestern Pennsylvania, these labor problems caused him to regret the acquisition of the Homestead Works. This boom of production quickly depleted, however, already owned, local source of iron ore and the fuel source for Bessemer converters, coke. The Frick Coke Company, owned and operated by Henry Clay Frick, already supplied Thomson Works with significant amounts of Coke, and these businesses grew parallel to each other. In order to continue to expand, however, Frick sold more controlling interest over to the Carnegie Brothers Company in 1881. Eventually, Carnegie owned complete control of the Frick Coke Company, along with more and more Pittsburgh area steel mills by 1892, with Henry Clay Frick becoming more involved in the newly rebranded Carnegie Steel Company after the death of Tom Carnegie, Andrew’s brother.¹⁴

Also in 1892, vertical integration reared its ugly head. Perhaps the bane of the “captains of industry” and perhaps what made them into “robber barons” was their lack of attention to labor problems and the laborers themselves. This culminated for Andrew Carnegie during the Great Strike of 1892 at the Homestead Works and is the largest controversy of Carnegie’s life and career. Acquired a decade earlier, as previously mentioned, labor issues plagued the plant since and during its construction. The workers, unionized under the Amalgamated Association of Iron and Steel Workers, walked out of Homestead after Carnegie Steel, represented by Frick, failed to complete the negotiations with the union with the hopes of dissolving the organization.

¹³ Simcoe, 39.

¹⁴ Ibid., 40.

Local authorities overwhelmed by massive local support, Henry Clay Frick, without the direct consent of Carnegie contracted the Pinkerton Detective Agency to land on the Homestead bank of the Monongahela River and disperse the strike. While attempting to do so, the 300 armed and uniformed men were fired upon by the protestors, starting a confrontation lasting several hours. With no resolution produced and fatalities on both sides, eight thousand Pennsylvania state militia arrived to restore the management of the plant. While work eventually resumed at the Homestead plant, morale and production never recovered to previous levels, and the industrial-political reputations of Carnegie and especially Frick also never returned to what they were before the conflict.¹⁵ Rising labor costs and a worsening national economy played a role in the strike and profits continued to decline afterward. As a result, Carnegie dissolved the union at Homestead, which perhaps helped him gain an undeserved reputation for being anti-union.¹⁶ The purpose behind the implementation of the Bessemer process and the vertical integration of the steel industry eliminated the need for highly skilled workers, reduced the importance of skilled workers overall, and cheapened the labor of unskilled workers. Carnegie, visiting his birthplace of Scotland, learned of the Homestead Strike while in progress on July 1, 1892. He recounts in his autobiography that he wished to handle the situation personally, but Frick knew of Carnegie's tendencies to meet the demands of the workers without question and assured Carnegie that he had control of the situation.¹⁷ While Carnegie distances himself significantly from the incident, he identifies, although not by name except for the Governor of Pennsylvania, the persons

¹⁵ Ibid., 41-2.

¹⁶ Jonathan Rees, "Homestead in Context: Andrew Carnegie and the Decline of the Amalgamated Association of Iron and Steel Workers," *Pennsylvania History: A Journal of Mid-Atlantic Studies* 64, no. 4 (1997): 527, <http://www.jstor.org/stable/27774021>.

¹⁷ Andrew Carnegie, *Autobiography of Andrew Carnegie*, ed. by John C. Van Dyke (Boston: Houghton Mifflin Company, 1920), 228.

responsible for the escalation of violence. He, of course, suggests that if he were “home” the situation would have been handled more efficiently and without bloodshed.¹⁸

As already established, he served in the higher administration of the Pennsylvania Railroad Company under Tom Scott, an influential and important figure in the railroad and growing steel industry. This position came with a very substantial salary for someone of his age, which allowed him to begin investing and building his wealth base. Carnegie particularly did so under the advice and guidance of Scott¹⁹, as mentioned before, by investing in local oil, mining, railroad, and ironworks companies. Carnegie’s first investment move was his first, investing nearly half his yearly salary in the Adams Express Company, a historically stable nationwide logistic service. Because of this, he quickly recouped his investment and began to expand his investment portfolio. As a part of the deal involving Scott for the Pennsylvania Railroad Company, Carnegie purchased stock in the Woodruff Sleeping Car Company in exchange for a sleeping car contract. While he did invest in companies surrounding the oil boom in Oil City, Pennsylvania, Carnegie typically only invested in railroad and railroad-adjacent companies. This allowed Carnegie to build a significant wealth base (\$400,000), laying down a track to begin building his steel empire, while only making a maximum annual salary of \$2,400.²⁰ As for the position itself, Carnegie acted as the superintendent of Pennsylvania Railroad Company’s Western Division, handling all logistics and management based in Pittsburgh. This allowed Carnegie to develop crucial connections to the smaller railroad, construction, and iron companies, as well as within local and state governments. These included other superintendents, city attorneys and magistrates, and local business executives. In several public speaking

¹⁸ Ibid., 230-2.

¹⁹ Andrew Carnegie, *How I Served My Apprenticeship* (1896), in *The Andrew Carnegie Reader*, ed. by Joseph Frazier Wall (Pittsburgh: The University of Pittsburgh Press, 1992), 36.

²⁰ Simcoe, 33-34.

engagements, these connections are what Carnegie attributes the majority of his success to. When giving a gesture lecture to students at a Pittsburgh business school in 1885, he stressed the importance of the motivation of the “self-made man” and diversifying investments and relationships, putting “many eggs in many different baskets.”²¹ Fast forward to the initial formation of Carnegie’s steel enterprise and his experiences and wealth base allowed him to adapt the management style and structure of the railroad industry to the steel industry. As previously discussed, Carnegie brought over several top industrial managers to run his new enterprise on the ground level but along with this personnel, he brought the control and coordination, down to the minute, of the railways to the steel industry for the first time, specifically through the application of statistical analysis and extremely diligent financial records. To facilitate this administrative adaptation, Carnegie also enticed many railroad and steel executives, ruling over their sections with autocratic power and authority, chief among these were John Fritz, William P. Shinn, and the previously mentioned Henry Clay Frick. Carnegie’s primary responsibility in the daily operations of the administration was ultimate management of the cost and predictions sheets of the company, becoming his obsession. Without getting into extreme technicalities, the detail of these cost sheets alone outmatched any other industry at the time and the diligence that Carnegie pursued with his executives for the accuracy of these costs was relentless. These practices may not seem revolutionary today but in the late nineteenth century, these practices outside the railroad industry were unheard of and Carnegie proved this could be done while keeping a relatively small executive team.²²

²¹ Andrew Carnegie, *The Road to Business Success: A Talk to Young Men* (1885), in *The Andrew Carnegie Reader*, ed. Joseph Frazier Wall (Pittsburgh: The University of Pittsburgh Press, 1992), 42.

²² Alfred Dupont Chandler, *The Visible Hand: The Managerial Revolution in American Business*, (Cambridge, MA: Belknap Press, 1977), 266-9.

All of these practices and connections led to the expansion of both the steel-railway industry and market. The railways were the primary consumers of steel at the turn of the century, second to urban construction. These two consumers are by no coincidence related. Access to steel grew due to the increased proficiency of the railways to transport it. This proficiency was allowed by the ability to have constant maintenance because of the quantity of steel at such low prices. This relationship allowed for urban areas in the Midwest and Northeast, like Chicago, St. Louis, Buffalo, and most of all New York, to be better developed through the construction of better housing, workplaces, and sanitation systems. This construction and urbanization, of course, had its pitfalls, especially due to the unregulated labor practices of the day and perhaps the reason that construction companies were able to purchase massive amounts of materials and build so quickly, mutually beneficial to the steel and rail industry. A byproduct of this would be the American Technological Revolution, allowing inventors like Thomas Edison and Nikola Tesla to make advancements in electricity and automation. All things considered, the combination of all of Andrew Carnegie's innovations had the effect of making his steel enterprise the most efficient in the world.²³ (Chandler 262)

As a final mention, either as coincidental confluence, deliberate networking, or a willful combination of both, Andrew Carnegie obtained a powerful political position despite never actively seeking, much less winning an elected office. Due to being a Scottish foreign national and not becoming a U.S. citizen until 1885, Carnegie was unable to hold a significant political office. To counterbalance this, his connections and management executives mostly handled this for him. Henry Clay Frick was his primary political agent, how or why he became this is uncertain, but it is clear that Carnegie did not recruit Frick for this purpose, as previously

²³ Ibid., 262.

established. What is clear is that Frick used Carnegie's connections gained through his experience in the Pennsylvania Railroad Company to gain extremely beneficial contracts with local governments, making very many local businessmen angry in the process, growing that Homestead Works venture group.²⁴ Carnegie, of course only wanting to obtain the most profit in the most efficient way, had to balance all these connections. To do so, he frequently played both sides. By supporting competitors against the union AAISW, he ensured that unionized workers at his own plants would not strike, therefore increasing his own profits and production. At the same time, while competitors were mired in labor problems, Carnegie would negotiate new deals with local governments and railroad companies to price his competitors out of the supply pool.²⁵

The most significant and obvious impact that Andrew Carnegie had was that his methods drove down steel prices, allowing that steel to become extremely common in the construction projects that developed the urban and industrial centers of North America. Carnegie also revolutionized how large corporations developed their management structure, high merit instead of pedigree/brand, and financial accounting process by proving that the philosophies previously thought could and should only be applied to the railroad industry, can be effectively implemented in any industry. In doing so, Carnegie disrupted if not broke up a fraternal code that seemed to govern industrialists following the American industrial revolution, isolating himself at the top. Tom Scott, of course, dominated this fraternal order. While Carnegie made his share of the mistakes, especially neglecting his workers by leaving them at the mercy of his corrupt administrative executives, he held himself and those accountable in his personal writings and following business decisions. This perhaps forces us to consider the price of industrial innovation

²⁴ Andrew Carnegie, *The Road to Business Success: A Talk to Young Men* (1885), in *The Andrew Carnegie Reader*, ed. by Joseph Frazier Wall ((Pittsburgh: The University of Pittsburgh Press, 1992), 80.

²⁵ David Nasaw, *Andrew Carnegie*, (New York: Penguin Press, 2006), 365.

in the “robber baron” era of industrialization. Carnegie, who is perhaps the best example of this, and his reputation needs to be considered when one looks at the full scope of evidence, innovations, and complexity of his life and business career.

Bibliography

- Carnegie, Andrew. *Autobiography of Andrew Carnegie*. Edited by John C. Van Dyke. Boston: Houghton Mifflin Company, 1920.
- Carnegie, Andrew. *How I Served My Apprenticeship. 1896*. In *The Andrew Carnegie Reader*, edited by Joseph Frazier Wall, 31-39. Pittsburgh: The University of Pittsburgh Press, 1992.
- Carnegie, Andrew. *The Road to Business Success: A Talk to Young Men. 1885*. In *The Andrew Carnegie Reader*, edited by Joseph Frazier Wall, 42-50. Pittsburgh: The University of Pittsburgh Press, 1992.
- Carnegie, Andrew. *My Experience with Railway Rates and Rebates. 1907*. In *The Andrew Carnegie Reader*, edited by Joseph Frazier Wall, 42-50. Pittsburgh: The University of Pittsburgh Press, 1992.
- Chandler, Alfred Dupont. *The Visible Hand: The Managerial Revolution in American Business*. Cambridge, MA: Belknap Press, 1977.
- Nasaw, David. *Andrew Carnegie*. New York: Penguin Press, 2006.
- Rees, Jonathan. "Homestead in Context: Andrew Carnegie and the Decline of the Amalgamated Association of Iron and Steel Workers." *Pennsylvania History: A Journal of Mid-Atlantic Studies* 64, no. 4 (1997): 509–33. <http://www.jstor.org/stable/27774021>.
- Schmenner, Roger W. "Manufacturing, Service, and their Integration: Some History and Theory." *International Journal of Operations & Production Management* 29, no. 5 (2009): 431-443. doi:10.1108/01443570910953577
- Simcoe, Charles R. *The History of Metals in America*. Materials Park, OH: ASM International, 2018.