NORDIC JOURNAL
of Science and Technology Studies

CRAFTING SUSTAINABILITY IN ICONIC SKYSCRAPERS

A System of Building Professions in Transition?

by Kathryn B. Janda

This paper focuses on coordination, fragmentation, and the potential for transition in the system of building professions in the American construction industry. The paper relies mainly on local press coverage of three iconic New York skyscrapers—the Empire State Building (completed in 1931), the U.N. Secretariat (completed in 1952) and One World Trade Center (completed in 2014)— to compare how the roles of different building professionals are seen by and portrayed to the public eye over time. The historic cases show how different professional groups—builders in the 1930s, architects in the 1950s, and engineers in the 2010s—imbued each project with "sustainable" qualities appropriate for its time. Using a system of professions (Abbott 1988[r]) approach, the paper describes and discusses the implications of changes in societal interest from doing to designing in American skyscrapers. The paper concludes by arguing that greater coordination between doers and designers in the construction industry, of the kind exhibited in the early days of skyscrapers, would enable the social production of sustainable buildings. For this to happen, however, society would need to place a higher value on tangible outcomes compared to lofty goals..

Keywords: *builders, architects, engineers, skyscrapers, sustainability, professions*

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Introduction: Skyscrapers as socio-technical systems

Buildings consume almost half of the energy used in many developed economies and are considered to be one of the most important sectors for climate change mitigation (Edenhofer et al. 2014[r]). Owners and clients are often thought to be the main actors in building design decisions, capable of choosing whether and how to include sustainable elements in a building project. But what role do building professionals play in enabling/disabling the sustainability of the built environment? This paper contributes to a body of previous work exploring how individual professions and professional networks affect the uptake of energy innovations by focusing on: supply chains (Guy and Shove 2000[r]), property agents (Schiellerup and Gwilliam 2009[r]), builders (Killip 2013[r], Janda and Killip 2013[r], Janda, Killip, and Fawcett 2014[r]), building professions (Janda and Parag 2013[r]), heating installers (Banks 2001[r], Wade, Murtagh, and Hitchings 2018[r], Wade, Hitchings, and Shipworth 2016[r]), and architects and engineers (Janda 1999[r], 1998a[r], 1998b[r]),

This special issue of NJSTS considers the relationship between craft and sustainability. Other papers in this volume consider craft in the context of building homes and apartment buildings (Woods and Korsnes 2017[r], Fyhn and Søraa 2017[r]). This paper extends the craft focus to building projects that are larger, more complicated, and more public: iconic skyscrapers in New York City. It centers around the relationship between builders, architects, and engineers, using a system of professions (Abbott 1988[r]) approach to discuss the implications of shifts in societal interest over time between *doing* and *designing* in the realm of American skyscrapers.

Today, skyscrapers are a common element of modern cityscapes, presenting recognizable patterns individually and as a group in the skylines of central business districts around the world. But in the not-so-distant past, they were quite an American innovation. Starting in the 1880s, the industrial age brought new materials to the construction industry—steel, concrete, and glass—and new building processes. It brought new services—electricity and telephones—¬which were followed by technologies like light bulbs and elevators that used these services to extend daytime and urban space. The technologies and economic rationales for skyscrapers and central business districts spawned new fields of study (particularly commercial real estate development). It also changed the relationship of existing professions. American engineers and builders were among the newly professionalized groups that arose to claim control of the new commercial and industrial building types, and architects were among the existing groups that had to adapt their more established practice to the changing times.

Although architects, engineers, and builders are distinct professional groups with specific areas of expertise, in the construction process they are interdependent. Buildings are shaped by the collective interactions of members of these groups, suggesting a construction system that is (or can be) tightly coordinated. Fyhn and Søraa (2017[r]) describe a highly harmonized form of work in their study of high-tech Norwegian apartment construction practices. Typically, however, design and building processes are fragmented, both across professions and over the lifetime of the project. This suggests that the construction system also has ample room for discord and conflict. The World Business Council for Sustainable Development identified a series of functional gaps between (1) trades and professions that intersect with (2) management discontinuities in the building delivery process, resulting in what they called "operational islands" (WBCSD 2007[r], p. 32, see Figure 1). Moreover, the professions themselves are constantly changing in response to larger social forces and trends, which creates additional opportunities for friction. Following from this logic, the construction industry is fragmented and perhaps even broken in ways that prohibit it from functioning as well as it could (Janda and Killip 2013[r], Janda and Parag 2013[r]). Schiellerup and Gwilliam (2009[r]) call this the "social production of (un)sustainable buildings."

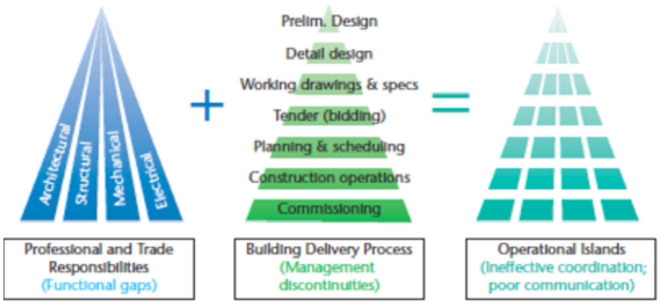

***Figure 1**. Players and Practices in the Building Market (Source: WBCSD 2007[r], p. 32, Figure 3.12)*

The extent to which design and making are separated or integrated is an embedded theme of this special issue, with papers on both sides discussing craft as various permutations of these practices. For example, in Beer (2017[r]) and Owen (2017[r]) the *designers* of urban ecology and knitting patterns are different than the *makers* and *doers*. In Hutchinson (2017[r]), the artist is both designer and maker. In Fyhn and Søraa (2017[r]), the *doers* create a new form of workmanship within the constraints of a highly automated and scheduled building design.

Reconsidering the relationship between designing and doing in the built environment raises a number of research questions. If gaps between building professions and management discontinuities are part of the "normal" construction landscape for buildings, when and where did this practice start, and how has it changed over time? Which building profession is in charge of the system of crafting buildings, and does it matter whether these professionals are architects, engineers, or builders? What qualities should a "good" or "successful" building have, and are some professions better at producing these qualities than others? A full social and historical examination of these questions is beyond the scope of this paper.

Instead, it offers a glimpse of this intellectual territory by examining public-facing reports in the media of three high-profile skyscrapers constructed at different points in time. The analysis shows that in the 1930s builders were revered as essential members of the building team; in the 1950s they were largely absent from news stories; and in the 2010s builders are present but not central actors. This finding leads towards an Orwellian observation about the construction industry: "all building professionals are equal, but some are more equal than others."

What are the implications of professional (dis)integration, differences, and gaps for sustainability? Current definitions of sustainability often refer to a triumvirate of environmental, social, economic benefits. These are thought to be simultaneously obtainable objectives, for example in the business case for the "triple bottom line" (cf, Elkington 1997[r]). This frame for sustainability is, however, relatively recent. This paper considers sustainability in a broader historical context. A review of the term "sustainable" in the Oxford English Dictionary reveals that this term has been in use since 1611 and has carried three strands of meaning in 300 years: (1) capable of being endured; (2) capable of being upheld as true, and (3) capable of being maintained or continued at a certain rate or level (OED 2012[r]). The third strand of meaning dates back to a 1924 paper on population dynamics, and this strand evolved further in the 1970s to carry the environmentally-oriented meaning of "sustainability" explored in this special issue. As this paper considers two cases that predate the notion of *environmental* sustainability, it uses the root definition of the term—"capable of being maintained or continued"—rather than the later meaning that connotes environmental objectives. This redefinition leads us to the question of *what* is being sustained by the production of these prestige skyscrapers and *by whom*?

The paper begins with a brief history of the relationship between urban development and professional practice in America, with a particular focus on skyscrapers. This section concludes with an introduction to Abbott's "system of professions" theory, which is the main lens underpinning this paper's comparative discussion of professions. Next, it moves on to the paper's methodology, the selection of the cases, the reasons for using secondary methods, and the biases introduced. The paper then describes each in case in its historical context and discusses the professions involved as they were seen in the contemporary media of the time. A discussion section returns to Abbott's assertion that successful professions are those that lay claim to solving particular socially accepted problems. Through the benefit of hindsight, it considers what qualities and social meanings the case study buildings have sustained, and which professions are most closely associated with these features. The paper concludes by arguing that greater coordination between *designers* and *doers* in the construction industry, of the kind exhibited in the early days of skyscrapers, would enable the social production of sustainable buildings. For this to happen, however, society would need to place a higher value on tangible outcomes in the built environment.

Background: American urban development and professional practices

In late nineteenth century and early 20th century America, technological change and urbanization required new commercial and industrial building types. Many of these new buildings, including offices, apartment houses, hotels, and factories, sprouted without the benefit of architectural guidance. Unlike their European counterparts, American architects of this time had no clear role in society or long-standing tradition of practice. In response to the new building forms, many of which were "unpardonably bad" (Brock 1931[r]), American architects formed a variety of professional and educational institutions. The American Institute of Architects was founded in 1857; the Massachusetts Institute of Technology started an architecture department in 1866; and the first American architectural journal started in 1868 (Fitch 1973[r]). These institutions sought to extend the role of architects into the business community, beyond their more usual participation in public buildings, prestige dwellings, and churches.

American builders and engineers were closely and unambiguously linked to the new building technologies, methods, and forms—¬especially skyscrapers. The builders were masters of the new materials, physically responsible for erecting the structures and bringing the designs into being. The engineers controlled the machines: their jurisdiction included the mechanical, electrical, and structural systems (in which they overlapped with builders and architects). Compared to architects, American engineers and builders were largely self-trained and lacking in academic ambition (Fitch 1973[r]). Professional societies for American engineers developed only a few decades after the American architectural institutions, but the disciplinary roots for engineers and builders were neither long nor fed by European history or traditions. European architects such as Le Corbusier and Adolf Loos saw the engineer as a kind of noble savage, a modern peasant who un-self-consciously created beauty by ignoring architecture and culture (Banham 1960[r]). Indeed, engineers were seen by both Americans and Europeans as creatures entirely without high culture.

Skyscrapers were an American response to the need for new building forms in the urban environment, and they posed new economic, aesthetic, functional, and social questions. Early proponents of skyscrapers believed firmly in the "fundamental importance" of economic criteria, and they justified the development of skyscrapers with detailed studies of their economic viability (Clark and Kingston 1930[r], Morgan 1934[r], Simon 1929[r], Starrett 1928[r]). These writers were often engineers or builders, two professional groups with clear motives for perpetuating this building form. Opponents of skyscrapers claimed they created more problems than they solved, turning streets into narrow canyons, inhibiting the passage of light and air, and increasing congestion. Such battles on functional and economic grounds all but eclipsed formal and stylistic issues about skyscrapers voiced by American architects. Some American architects recognized that the so-called new "American" style of setback skyscrapers was based on the same principle used by the Mont St. Michel in Brittany and the oldest pyramid in Egypt; accordingly, their formal qualities were neither new nor uniquely American (Sexton and Walker 1928[r]).

Despite quibbles over where the visual vocabulary originated or what it symbolized, through the first quarter of the twentieth century, skyscrapers were American by default if not by design. Europeans were interested in the concept of skyscrapers and perhaps even believed the economic arguments for their development, but cultural barriers prevented their construction in Europe (van Leeuwen 1988[r]). Artists Glyn Philpot and Henri Matisse praised the skyscrapers in New York, but said they would look "ridiculous" in their own countries (NYT 1930c[r]).

In this paper, these conflicts between different professions with regard to a new American building form (skyscrapers) are viewed though the lens of Andrew Abbott's 1988 theory regarding a "system of professions" (Abbott 1988[r]). This approach fits within the general sociology of professions (Tripier and Dubar 2005[r]). It is concerned with the ways in which different professional or occupational groups define their work and compete for authority, which is linked to their use and appropriation of knowledge. From a system of professions perspective, each work group is linked (neither permanently nor absolutely) to a set of socially-accepted tasks considered to be its "jurisdiction". Professional groups compete and develop interdependently, based in part upon their ability to perform (and defend) the tasks within their jurisdiction.

Gaining control over work is an important goal of most professional groups. In the building industry, as in medicine, the major groups involved in the process hold different degrees of power. Doctors, for instance, have more authority than nurses but neither group can treat patients without their consent. Similarly, architects, engineers, and clients enter into an interdependent yet structured negotiation with each new building design. Traditionally, architects control the overall design of a building, directly negotiating with the client, the subcontractors (including the engineers), and the builder during construction. Under subcontract to the architect, engineers design the structural, mechanical and electrical components of the building and may contract out their installation or install these components themselves.

According to Abbott's theory of professions, differences between professions matter because they are neither haphazard nor objectively rational. In Abbott's view, these differences serve a strategic function, enabling them to retain socially legitimate control over their separate jurisdictions. Yet jurisdictions and professions change over time and are shaped by a number of social, economic, historical, and institutional factors (Abbott 1988[r], Bureau and Suquet 2009[r], Evetts 2006[r]). This paper and previous ones (Janda, Killip, and Fawcett 2014[r], Janda and Killip 2013[r], Janda 1999[r]) are concerned with jurisdictional changes to building professions, mainly in regard to energy and environmental considerations. These issues will be further described in the concluding section, after a discussion of three building case studies.

Methodology and methods

The three skyscrapers selected for this paper are chosen for their fame and iconic status at different points in time. Each case is a highly publicized prestige building that garnered much media attention during the time of its design and construction. In this sense, each case in this paper belongs to a larger set of socially important buildings that have attracted attention from architectural historians, urban planners, financiers, and the public.

Two of the cases—the Empire State Building and One World Trade Center—are important in part (but not exclusively) because of their height. Between 1930 and 2017, 126 supertall buildings have been built around the world (CTBUH 2017[r]). Standing at 1250 ft (381 m), the Empire State Building was the tallest building in the world from 1931 until 1973, when it was eclipsed by the original twin towers of the World Trade Center. The Empire State Building was built during the Great Depression following the 1929 Wall Street stock market crash. At the time, its construction represented a symbolic triumph over grim economic conditions.

Between 1931-1969, there was a worldwide hiatus in the construction of tall buildings. The U.N. Secretariat was built during this period. It is a prestige building but stands only 505 ft (154m) high. Its prestige derives not from its height, but from the importance of its mission: to house the headquarters of the newly-formed United Nations. Its role was to provide a symbol of peace and international cooperation after World War II.

From 1930-1990, supertalls were an exclusively American construction form and then only built in sparingly in Chicago and New York. In 1990, these goliaths started to appear much more frequently in Asia and the Middle East, as well as elsewhere in the USA. One World Trade Center, completed in 2014, is the tallest building in the western hemisphere, but not the tallest building in the world. Built on the site of the former Twin Towers destroyed in the September 11, 2001 terrorist attacks, it holds special significance as a reaction to that catastrophe.

As a historically-oriented paper, the analysis uses secondary sources and draws inferences based on articles written at the time each building was designed and built. Articles were found by searching newspaper and publications databases for the name of the building and selecting articles contemporary to the relevant time period. The goal was to investigate what social meanings the buildings and their professions had *then*, not now. The discussion and synthesis sections slightly deviate from this approach, using the benefit of hindsight and history to describe how the Empire State Building and the U.N. Secretariat have evolved in practice. This provides a basis for considering transition pathways to a future system of building professions.

Since the cases are widely dispersed in time, there is an additional wildcard to the analysis. The sources of public information have changed in 90 years, both in type and in nature. The etiquette of print reporting changed from the 1930s to the 1950s to the 2010s. Although the kind of information and perspective included in "a newspaper story" has changed over time, controlling for this shift is beyond the scope of this paper. All three case studies rely largely on newspaper stories as the dominant form of searchable media, with one exception. Following the advent of the internet in the 1990s, the One World Trade Center (One WTC) case study also includes videos and websites. These online sources are included because they take thought, time, and effort to construct. A review of social media is excluded due to the more ephemeral and reactive nature of this form of communication. The contemporary sources were found in a contemporary way: by Google searches for the building name and companies involved in its construction.

A different selection of cases (for example, a focus on recent sustainable skyscrapers (cf., Inhabitat 2017[r]) would no doubt shine a light on different facets of the relationship between construction professions and sustainability. The research design is therefore consciously exploratory rather than explanatory. It looks for sustainability in places where it may or may not be found. There is no control group, and no attempt to normalize the results. And yet, in relation to the question of what is sustained over time, each of these cases provides a built response to social desires at the time of its inception. Further research with additional cases would yield additional insights, but they would also lengthen the analysis considerably. Although other research designs might hold more explanatory power, each of the selected cases illuminates an important historical facet of the ongoing professional relationship between builders, architects, and engineers from the perspective of what is newsworthy (through the lens of public media) or interesting (through the lens of professional and academic publications).

Three cases of building professions and New York skyscrapers

Each case description opens with a short historical narrative about the role of building technologies and professional responsibilities at the time of construction. Following this narrative, the roles of architects, engineers, and builders are articulated, compared, and synthesized in context with the perceived and socially constructed "success" of the building.

Case 1: the Empire State Building (1931)

As skyscrapers evolved and proliferated into the twentieth century, American architects found themselves in conflict not only with the concept of technology but with the social groups, value structures, and practices which supported these new building forms. The values embedded in mass production were contradictory to the traditional practice of architecture as special and extraordinary. Subjective, aesthetic ideals threatened to be subsumed by rational engineering principles; questions of social values were being replaced by summations of economic benefits. The new social emphasis on economics and technology supported ideals of efficiency more easily than it did the pursuit of aesthetic quality, and architectural organizations found themselves fighting to protect their profession.

By the 1930s, many American architects viewed the rise of engineers and builders with trepidation, seeing a potentially destructive conflict between their craft and these other professions. The American Institute of Architects (AIA) reported that competition with construction firms "might result in a complete submergence of the professional ideal at the cost of esthetic values." As "foes of ugliness," the AIA developed a broad manifesto aimed at preserving the architect's position in American society (NYT 1930a[r]). On Christmas Day 1932, *The New York Times* published a long article detailing L. Andrew Reinhard's vision of a new era for architects (NYT 1932[r])[1]. This article recognized that recent developments in the building industry would change the role of architects. Whereas the old way of building valued appearance, cost, and time (in that order), the new era valued cost, time, and appearance. As a result:

> *Making fine presentations and attractive drawings no longer is of first importance, and architecture no longer is a one-man job. The architect of the future in large urban jobs will much more frequently find himself a member of a group or groups representing the economic, functional, and esthetic factors governing modern building. Each of these groups, from a different angle, will be working for a solution of related problems out of which the coordinated project will emerge.*

In response to the economic conditions of the time, American architects took a practical approach to their changing status.

1 Reinhard was a prominent New York architect of the time and was the general architect for Rockefeller Center, built in 1929.

Raymond Hood, speaking on behalf of the Architectural League of New York, said that architecture had "become a combination of the arts and sciences and not merely an expression of art" (NYT 1930b[r]). While Hood may have believed that architecture needed to fit itself into the new order where cost is paramount, the actual process of combining art and science seemed problematic. He foresaw coordinated efforts between architects, sculptors, muralists, landscapists, and craftsmen, but did not include builders or engineers in this matrix of cooperation.

While American architects of the early 1930s worried about the demise of aesthetic criteria in the face of economic concerns, engineers were calling for coordinated efforts between groups involved in the building process. Their immediate goal was greater efficiency of construction, but their interest extended beyond the technical specifications of building systems. Articles such as Mortimer Freund's "Heating and Air Conditioning Must Be Carefully Considered in Design of Buildings" (Freund 1931[r]) appeared steadily in engineering journals of the time. Such articles argued that close cooperation of architects and engineers would result in "a better building, a satisfied owner, and an important reduction in cost." Beyond the function of the building itself, there was significant published concern about the future effects of skyscrapers on public utilities, transportation, and economic viability of neighborhoods (Simon 1929[r]). Not all engineers were broad thinkers, however, for there were certainly those who believed "it is a fair statement to make that the building is no better than its mechanical equipment" (Ralston 1930[r]).

Builders shared the engineers' emphasis on the importance of time and money over aesthetic criteria. A building was "successful" if it was quickly and efficiently constructed. In a 1928 book entitled "Skyscrapers and the Men Who Build Them", W.A. Starrett—one of the brothers whose company built the Empire State Building—urged cooperation between groups involved in the construction process, specifically between architects, owners, and builders (Starrett 1928[r]). While engineers seemed to see their role as equal and integral to that of the other groups, Starrett positioned his profession as the star of the show: both different and better. In the eye of the builder, architects and engineers had more in common with each other than the builders had with either group. While architects and engineers only design and draw plans, builders "devise ways and means of accomplishing the completed whole" (Starrett 1928[r]). To the proudly practical builders, the process of realizing physical achievements was more important, more dramatic, and more meaningful than aesthetic, theoretical or intellectual advances.

The entire Empire State Building was constructed over the course of 11 months (1930-31), during a time of social flux and economic crisis. Two months after Alfred E. Smith announced his plan to build the highest building in the world, the stock market crashed. The project went ahead, financed by loans, but clearly it was part of the "new" architectural era where priority was placed first on cost, then on time, and finally on appearance. The ordering of these priorities affected the design and construction process of the building and accordingly influenced its final form.

A May 2,1931 *New York Times* article announces the opening of the Empire State Building by the United States President Herbert Hoover (NYT 1931[r]). This article focuses on two attributes: the height of the building and the coordinated effort of the groups involved in its construction. A stunning 18 inch (46 cm) high photograph of the building dominates a full page story, supporting the caption "the highest structure raised by the hand of man." Portraits of "the four men who created the Empire State Building" appear beneath this impressive image. Depicted here are William Lamb, the Architect; H.G. Balcom, the Engineer; Col. W. A. Starrett, the Builder; and Alfred E. Smith, President of the Owning Company.

Architects (Shreve, Lamb and Harmon)

Although the American architectural community gave Shreve, Lamb, and Harmon an award for the Empire State Building, the design's aesthetic reception was lukewarm at best. A 1931 editorial in *Architectural Review* focused on the building's height ("Nearly three times as high as St. Paul's") and practical design rather than its style (Editorial 1931[r]). This article suggests that Lamb made every effort to eradicate frivolous ornamentation and create an efficient design. His window details provided a simple juncture between wall and window to abolish "inadequate and useless" reveals and enable efficient construction. Lamb designed the building from the inside out, arranging the available floor space for optimum efficiency at the various setback levels required by the city.

Although William Lamb's approach to designing the Empire State Building makes him an exemplary "modern" architect as described by Reinhard, it does not make him an aesthetic visionary. In a paper published in *The Architectural Forum*, Lamb insists that "whatever 'style' it may be is the result of a logical and simple answer to the problems set by the economic and technical demands of this unprecedented program" (Lamb 1931[r]). Instead of maximizing the design opportunities, he explicitly sidesteps them. It is as though the building's form developed almost autonomously from its intended function, without the help of his or any other human hands. He extends this "automatic" motif to the construction process by comparing it to that of an automobile on an assembly line. The builders, however, describe it quite differently.

The Builders (Starrett Brothers)

Of the professional groups participating in the Empire State Building, the builders make the greatest bid for heroism. They favorably compare "their" achievement to the height of the pyramid at Gizeh (sic.) and the time it took to build St. Peter's in Rome (Morgan 1934[r]). While the structure itself is impressive, builders depict the construction process as more important than its product. Starrett (1928[r]) describes building as a kind of sporting event, where builders perform in front of an imaginary "enthusiastic spectator who gazes with admiration at some feat of skill and daring...and perhaps sees nature used against its very self in the accomplishment of a spectacular bit of work." Compared to Lamb's seemingly autonomous design development, men are central to the builder's perspective. A pictorial record of the Empire State Building's construction contains drawings of men (sometimes with their shirts off) in confident control of great steel columns (Rudge 1931[r]). These builders and "daring craftsmen" are "big, husky Swedes" and other immigrants (if American, they are said to be half-breed Indians or Southerners) who courageously walk narrow beams with "easy nonchalance." The risks these builders took were real: fourteen deaths occurred during construction of the Empire State Building. The fact that these deaths are not mentioned in the laudatory literature or in *The New York Times* articles suggests that cultivating a heroic image was more important to builders and readers of the time than accurately reporting safety accidents and failures.

For a time when most Americans were out of work, the making of the Empire State Building was an important achievement. Thousands of craftsmen from 32 different fields completed the building in record time. The lead craftsman from each field was given a certificate of recognition for his achievements, and their names are contained on plaque in the main lobby (Empire State Realty 2017a[r]).

The Engineers (H.G. Balcom)

Compared to the architect and the builders, the engineers have little to say about the importance of their role in constructing the Empire State Building. Balcom does not write up the details of his experience for review in the major engineering journals. A few articles describe the details of the mechanical systems (Mayer 1930[r]), the electrical systems (Walsh 1931[r]), and the structural design, (Edwards 1930[r]) but the self-praise in these articles is noticeably slight. Technologically speaking, the Empire State Building pushed few boundaries other than its height. It depended on steam and electricity from public utilities so there were no generators on site. Air-conditioning had recently been used in the Milam Building of 1928, but this new technology was not installed in the Empire State Building more than 30 years after it opened. Steel and glass curtain-walls appeared in other buildings of the 1930s, but the predominant Empire State material was routine limestone cladding. Without cause to describe anything really revolutionary in their field, the structural, electrical, and mechanical engineers could not and did not vie for public acclaim for their contribution to the project.

Synthesis

The Empire State had nine more rentable floors than the Chrysler Building, the cathedral of capitalism, but none of the ornament. Its original design height was 1050 feet, only 4 feet higher than the top of the Chrysler Building's spire. It was at the suggestion of John Raskob, the developer, that the Empire State further distinguish itself as the tallest building in the world by adding a 200 foot dirigible mooring mast to the top. This idea of integrating future transportation options in the building design was somewhat akin to Le Corbusier's Contemporary City design of 1922, but it is significant that this vision did not come from an architect. It was proposed by a member of the only group that could impose extra costs on the project—a developer.

The Empire State Building was more a triumph of construction process than a prosperous commercial building. Despite all of the coordinated energy its architects, builders, and engineers devoted to its efficient design and construction, once built the building was not as financially successful as its owners had hoped. It was hard to rent and remained half empty for much of its first two decades. The building also experienced other unexpected problems: it acted as a lightning rod, and it served as the setting for at least sixteen suicides. The planned dirigible mooring mast never brought air traffic to the heart of Manhattan, but it worked as an architectural element when revamped as a hollow tower. It also served as a focal point for the fictitious battle of King Kong against the biplanes. The Empire State Building successfully achieved fame if not fortune. It was the tallest building in the world for more than forty years (1931-1973). One commentator summed up its achievement as:

> *The Empire State Building, bigger, grander, more amazing than any other building ever built, rising out of and above the Great Depression, was a significant boost to the morale of the city. It was a statement: despite all the problems, we can do this. (Levy 2015[r]).*

Case 2: The UN Secretariat (1952)

Technological enthusiasm was a rising tide in America until the 1930s, but it was checked by the depression and altered by World War II. During the 1930s and 1940s construction slowed, and in the interim simplicity, economy, and efficiency became formal as well as functional criteria (Fitch 1973[r]). American architects such as Albert Kahn, Raymond Hood, Norman Bel Geddes, and Walter Teague began to rely on visual clarity for effect not just for economic viability. A new conception of architecture developed that emphasized volume rather than mass, combining elements of the setback skyscraper and the International Style. In commercial architecture, this was often (although not always) expressed in rectangular steel-framed boxes. European architects working in the United States—Le Corbusier, Walter Gropius, and Mies van der Rohe—pushed the trend to its fullest extent.

In establishing themselves as the expressionists of modernity, architects successfully resurrected the use of aesthetic criteria in American commercial construction. Concurrently, they appropriated concepts from the engineering mentality and relegated engineers and builders to a subordinate position in the construction process. As the machine aesthetic became more widely known, the machines themselves became less visible. Building equipment functioned supportively, behind screens and in basements. Clients wanted the advantages of new building technologies, but they were not interested in the incremental process of their development. Air-conditioning was an expected service; how it was provided was of little concern unless there was something fundamentally different about the system.

Whereas the Empire State Building provides an example of coordinated and economically efficient design and construction, the process of designing, planning, and building the United Nations Secretariat complex in New York was fraught with difficulty and delays. *The New York Times* was able to select and print the pictures of the four men responsible for the Empire State Building, but no such clarity of participation was possible with the United Nations headquarters. For a building that was supposed to symbolize world peace and international collaboration, the design and building of the U.N. Secretariat was a process fraught with conflict.

Architects (Le Corbusier, Niemeyer => W.K. Harrison)

The U.N. Secretariat was a conscious experiment in consensus architecture. In 1947, the acting Secretary General asked 54 member nations to submit the names of outstanding architects from their countries to sit on the design panel (NYT 1947a[r]). The list was shortened to the ten best, then cut to five, which included France's Le Corbusier and Brazil's Oscar Niemeyer. The U.S. was not allowed to submit an architect, but Wallace K. Harrison was appointed director of planning, a role that effectively functioned as chief architect, and three American architectural firms (Skidmore, Owings & Merrill; Clarke, Rapuano & Holleran; and Voorheese, Walker, Foley & Smith) were selected as associate architects (NYT 1947b[r]).

According to a *New York Times* magazine article entitled "What Kind of Capitol for the U.N.?" (Samuels 1947[r]), the rhetoric espoused by the international architects on the design panel was to produce a building that grew out of the practical functions that needed to be performed within it. The further desire was to include provisions for cutting-edge technological systems such as television monitors, push-button weather controls, and pneumatic message tubes. Although the interest for these internal functions may have been shared by most of the architects trying to work in tandem on this project, the external statement was greatly debated. Le Corbusier felt the complex should not symbolize "a world capitol, or a temple of peace" because the U.N. did not yet exist: the nations were not united. Instead, he saw a meeting place which was to be a model of efficiency which provided perfect working conditions. Other architects in the group felt the design should be not only international, but un¬national; that it should reflect the "true spirit of our age" or that it should show "stability and wide purpose," something that went beyond a rectilinear box clad predominantly in glass.

A review of architectural literature does not make clear who was responsible for what part of the Secretariat's final design. Harrison was sometimes identified as chief architect, sometimes called "chief planning officer" (Barrett 1948[r]), or "planning director" (NYT 1948b[r]). Also involved in the process were Deputy Planning Director Max Abramovitz and Glenn Bennett, the executive officer of the planning division. Le Corbusier is generally credited with the original idea and design for the 39-story secretariat, but he was not allowed to participate in the building process or review changes to his plans (NYT 1948a[r]). The Fondation Le Corbusier includes his sketches of the complex in their anthology of his work (Le Corbusier 1983[r]), and Le Corbusier compiled his own ideas about the project in a book (Le Corbusier 1947[r]). The lower, curved Assembly building is generally credited to Oscar Niemeyer. However, the University of California, Berkeley architectural librarians file images of the Secretariat under "Harrison and Abramovitz", which points to the formal record of their inputs. After the Secretariat's completion, Harrison receives the most administrative credit for the project. He was called the "unwilling hero" and a "new kind of architect" for presiding over three years of conflict between initial design and completion.

Builders (various)

Like its design process, the construction of the U.N. complex was fragmented and distributed amongst several players. The building apparently did have a "coordinator of construction" named James Dawson (NYT 1948b[r]), but his role in the project is unclear. Pieces of the project were given to the lowest bidder, not to the best, brightest, or most powerful. Although the contracts awarded were dutifully reported, there was no coherent story developed from the building process as there had been for the Empire State building.

Even if one construction firm had carried the task through from excavation to exterior finish, however, the time had passed for glorification of this process. In the 1930s, builders were proud of the system they devised to construct skyscrapers. Two decades later, however, the concepts involved in building a steel framed skyscraper were no longer new. The construction system was still running, and the builders who ran it were unimportant. After building 85 stories of steel and limestone, 39 stories of steel and glass was not a topic of conversation in the press.

Engineers (various & anonymous)

Although the glazed Secretariat would probably been unbearable to work in without air-conditioning, the research found no laudatory articles in engineering journals detailing the achievements of the cooling system or its designers. The building uses the Conduit Weathermaster system, which was developed by Willis Carrier and first implemented in the Philadelphia Savings Fund building of 1932. An article in *The New York Times* on the environmental controls in the Secretariat, however, quotes a representative from the Johnson Service Company rather than from Carrier. It is unclear to what extent the system in the Secretariat represented a departure from other air-conditioning systems in use at the time. On the one hand, the system was a "crowning achievement" because of its magnitude and ability to handle unprecedented loads (Banham 1969[r]), and it was interesting to the public because of its 4,000 decentralized temperature controls (Teltsch 1949[r]). A seven-page article about the Secretariat in *Architectural Forum* suggested that the service of conditioned air was not new, and its application in the Secretariat represented "nothing revolutionary" (Ellis 1950[r]). Only the lighting engineer was mentioned by name because he designed completely new fixtures for the lobby (Ellis 1950[r]).

Synthesis

In the U.N. Secretariat, compared to the Empire State Building, architects took (or were ceded) greater levels of aesthetic control. They successfully managed other professions to achieve their desired aesthetic effect. Their role was neither a "one man job" of previous buildings, nor even the joint effort portrayed in the 1930s; Harrison acted instead as the primary decisionmaker above and beyond the engineers and builders. With architects as primary decisionmakers, aesthetic considerations once again took some precedence over economic efficiency. Harrison turned the building away from its most energy-efficient orientation on the site because of the view from Manhattan. Light-colored venetian blinds that would reflect more sun heat out of the building and lighten the cooling load were rejected because they would make "an irregular pattern" when seen from the street (Ellis 1950[r]).

Le Corbusier had hoped the Secretariat's form would become an image synonymous with world peace. Although this design goal was not fully met, it is certainly an iconic building. Although its form was influential, the Secretariat did not, in fact, function as the "perfect" work environment. When workers moved into the building, they found that the external promise of the structure did not translate well to the interior (Barrett 1950[r]). Although the solid glass facade led workers to think they would have more access to views, perimeter space was given to ranking officials, not to all workers. The exciting "mechanized city" replete with internal televisions and electronic communication systems were inhabited by some who still preferred to use file folders. The heat¬-absorbing windows protected workers from some of the sun's intensity, but the blue tint meant their eyes had to adjust when they opened the windows. The vertical distribution of space was also mentioned as a hindrance; workers preferred horizontal hallways where they ran into colleagues more frequently.

Case 3: One World Trade Center (2014)

By the mid- to late-twentieth century, vertical distribution of space in urban settings became commonplace. Starting in 1969, the world saw hundreds of skyscrapers and dozens of supertall buildings, built all over the world. This includes the 110-story Twin Towers at the World Trade Center, which were originally completed in 1973. They were demolished by two planes in terrorist attacks on September 11, 2001. These attacks ushered in a new era of concern about skyscrapers, symbolism, and safety (Glanz 2014[r]). The original name for the winning project to rebuild on the site of the Twin Towers in 2003 was "Freedom Tower." It was officially changed in 2009 to "One World Trade Center" due to concerns that the owners had about trying to attract tenants to a site that was so "emotionally charged" (Rose 2013[r]). It was also consciously built as a 1,776 foot tall tower to echo the year of America's Declaration of Independence (Rose 2013[r]).

In contrast to the first two cases selected for this paper, One World Trade Center (One WTC) was built in the age of the internet, which both broadens and complicates the media analysis. In addition to multiple media sources, the published names of the experts involved has grown and expanded. In contrast to the "four men" who were given responsibility for the Empire State building, Goldhagen (2015[r]) notes the names of seven individual architects, nine different types of engineering firms, five consulting firms, and one builder.

Architect (Libeskind => Childs)

Much as the U.N. Secretariat before it, ideas for rebuilding on the site of the original Twin Towers were initially submitted by several architectural firms. From these site plans, Daniel Libeskind was declared the master planner for the site in February 2003. However, within three months, the developer, Larry A. Silverstein, selected a different architect and architecture firm—David Childs of Skidmore Owens & Merrill (SOM)— to design the building on the site. The Libeskind and SOM designs proceeded concurrently through 2003. Libeskind's 1776 foot tall design first proposed offices reaching to the 64th floor and a freestanding spire filled in with trees, later modified to a fused spire with offices reaching to the 70th floor. Child's design was a twisted 2000 foot tower with offices to the 64th floor topped by wind turbines and antennas. By the end of 2003, the two designs merged as Libeskind agreed to collaborate with Childs. But in July of 2004, Libeskind sued Silverstein for $843,750 in unpaid architectural fees (Dunlap 2004[r]). In October 2004, the lawsuit was settled for $370,000 (Greenspan 2013[r]). By 2005 Libeskind seemed to have had a change of heart, releasing a statement saying that Child's redesign in response to police department requests was "even better than the tower we had before" (Greenspan 2013[r]). Neither Libeskind's trees nor Child's wind turbines survived the value-engineering process that resulted in the final design. Although the design concept was intended to achieve a Leadership in Energy and Environmental Design (LEED) gold accreditation, a rating application was never submitted. The only overtly "green" feature of the building was a fuel cell which was destroyed during the 2012 hurricane named Sandy, before the building was even completed (Vidaris 2017[r]).

Engineers (8 + WSP)

Goldhagen (2015[r]) notes nine different types of engineering firms involved in One WTC. These include: WSP (structure), Jaros Baum & Bolles (m/e/p, sustainability); Steven Kinnaman & Associates (vertical transportation); Weidlinger Associates (protective design engineer);;

Schlaich Bergermann und Partner (spire/cable net wall structure); Philip Habib and Associates (civil and transportation); Mueser Rutledge Consulting Engineers (geotechnical); Vidaris (facades); LERA Peer Review and Historic Structures (peer review). This project is listed first on the Schlaich Bergermann website project list (sbp 2017[r]). It is the first of six scrolling pictures on the Jaros, Baum & Bolles website (JBB 2017[r]). It is listed without particular prominence amidst other projects at the remaining firms. (SKA 2017[r], PHA 2017[r], MCRE 2017[r], Thornton Tomasetti 2017[r], Vidaris 2017[r], LERA 2017[r]).

Despite so many engineers being involved, only WSP makes a feature of their work on the building by producing and hosting an 8:40 minute YouTube video called "Engineering an Icon" on its website (WSP 2015[r], 2017[r]). Interestingly, WSP's involvement is deliberately described as collaborative rather than monumental. No quotes from WSP engineers are featured on the WSP website. Instead, it features a quote from the architect's managing partner, TJ Gottesdiener: "We tried to make it look as clean, strong, monumental as possible and that meant making it look as simple as possible – although this is far from a simple building."

WSP's video includes statements from "key members" of the design team. The "Engineering an Icon" video opens with a full minute of interviews with Steve Plate, the director of One WTC construction for the Port Authority of New York and New Jersey (the client); Judith Dupré, writer and "official" biographer of One WTC; Mike Mennella. an executive vice president at Tishman Construction; and T.J Gottesdiener from SOM. Ahmad Rahimian, WSP's Director of Building Structures, and Yoram Eilon, its Vice President for building structures, enter the video only after the other participants have been introduced. Rahimian and Eilon take 15 seconds for a shared quote where Rahimian says "The entire engineering community, the construction community, basically went back into a soul searching" and Eilon adds "We had to think what it means, what is expected from us, not only by the developer but primarily by the public." Later in the film they discuss the importance of going beyond code for public safety and the strength of the 14,000 PSI (pounds per square inch) concrete. Together Rahiman and Eilon speak for less than 25% of the total video time, and these comments concentrate largely on the strength of the building's concrete core. This core is one of the most important innovative features of the enhanced focus on safety due to the 9/11 attacks (Glanz 2014[r]).

Despite the importance of this innovation, WSP's video about One WTC clearly signifies a particular positioning with respect to other professional groups (WSP 2015[r]). It shows the engineers recognizing the prominence of architectural design, crediting the roles of other stakeholders, and fitting their achievements neatly within this envelope.

Builders (Daniel Tishman & Port Authority workers)

Building One World Trade Center took almost 11 years, from October 2004 to May 2015. It was contracted out to Daniel Tishman, of Tishman Construction. This family-held firm originated in 1898. It built the original Twin Towers, as well as New York's Madison Square Garden, and Chicago's John Hancock Center. Daniel Tishman sold his family business to AECOM 6 years into the 11 year process of building One WTC (Korman 2010[r]).

As with the U.N. Secretariat, little newspaper space is devoted to the builders—since most is absorbed by the architectural squabbles—but there is some online presence in the form of videos. One YouTube video shows this 11 year span collapsed into just two minutes, set to triumphant orchestral music (Earthcam 2015[r]). Another a short documentary interviews workers about how it feels to work on One World Trade Center (WorldsearchFilms 2010[r]). Individual builders talk about their feeling of pride and the vast amount of materials they used, but the nature of the story is fragmented and piecemeal compared to the grand unified challenge represented in media stories about the Empire State Building.

Synthesis

As Goldhagen (2015[r]) describes, One WTC had a lot to live up to. One WTC was "a singular project, larger than its clients, financiers, architects, and tenants; larger even than survivors' families and New York City's residents. One WTC is a project fraught with the agony of meaning. Everyone had every right to expect a major civic icon. Which we did not get. This is a fair-to-middling commercial office building with some notable good features." For the thousands of people involved in its inception and the massive public expenditure the rebuilding effort took, the result seems less than inspirational (Charney 2014[r]). Dupré, the building's self-proclaimed biographer, concludes the WSP video (WSP 2015[r]) by saying: "Every time I see One WTC, I feel a surge of pride. As a New Yorker, I almost feel maternal for this tower. This giant…[the] tallest tower in the western hemisphere. But it inspires love. It's beautiful. It does what it set out to do. It's tall, it's strong, it's humble. It is luminous. And it changes constantly. It's beautiful."

Interestingly, a promotional video on the One WTC website titled "Be Inspired" counters both the lack of a distinctive design and the absence of sustainable features. The video chronicles a fictitious tale of solar financing portrayed by three imaginary One WTC tenants who produce a new form of solar cell to power a satellite. This project simultaneously provides noteworthy financial returns while delivering internet access to female campers in the forest, children on a beach, an old man in a mountainous area, and researchers in a frigid landscape, to the great joy of a crowd in Tokyo (onewtc 2017[r]). Its concluding comment is: "become greater than the sum of your parts: rise!" This sentiment aptly summarizes the main result of One WTC's long and troubled gestation, while glossing over its drawbacks. It is neither the most beautiful nor the most sustainable building in the western hemisphere, but it is currently the tallest

Discussion and Conclusions: Back to the Future

This paper considered three cases of prestige skyscrapers in New York City—the Empire State Building (1931), the U.N. Secretariat (1952), and One World Trade Center (2014). It contributes to this special issue by examining how architects, engineers, and builders created skyscrapers that carry and convey different social meanings. It asked the question: *what* is being sustained by the production of these prestige skyscrapers and *by whom*? The paper shows that the craft of builders was valued in its own right the 1930s, architectural design ideas were at the forefront in the 1950s, and engineers back-led a structure of unprecedented strength in the 2010s. This concluding section brings the history of these skyscrapers into the present and considers how the fragmentation or integration of building professions (de)constructs environmental sustainability.

In the twenty-first century, the Empire State Building continues to host statements about the importance of building trades. In addition to the original Art Deco plaque honoring workers in the lobby, construction workers are an integral part of the "Dare to Dream" exhibit on the 80th floor (Levy 2015[r]), and builders are also described in a Apple-iOS app (Empire State Realty 2017a[r]). In addition to focusing attention on the triumphs of its builders, the current owners recently added environmental sustainability to the building's list of achievements. In 2009-10, the Empire State Building underwent a high-profile energy renovation with a team that included the Clinton Climate Initiative, Johnson Controls, JLL, the New York State Energy Research and Development Authority, and Rocky Mountain Institute (Empire State Realty 2017b[r]). Notably, part of the renovation's purpose was sharing lessons learned with other multi-tenanted office buildings. It was a multi-stakeholder process that included "engineers, property managers, energy modelers, energy efficiency experts, architects, and building management" (Empire State Realty 2017c[r]). The sustainability renovation is featured as a public exhibit on the 2nd floor and on the building's iOS app. The Empire State Building's environmental sustainability program continues to promote doing over design by emphasizing integration across professions and transparency to other office buildings and the public.

Since its inception, the U.N. Secretariat has provided a fitting backdrop for the work of the U.N., which has been called the largest and most familiar non-governmental organization in the world (National Geographic 2017[r]). Its iconic image—the concave white curve of the assembly building beneath a slender rectilinear glass tower, with a row of national flags in front—has been featured in a number of TV shows and movies. In terms of the environment, the U.N. started a broad, cross-agency sustainability program called "Greening the Blue" in 2007 (UN 2017[r]), which focuses mainly on environmental management reporting. It also initiated a renovation of the Secretariat in 2008, which was supposed to contain "a hint" of green: the Secretariat's glass curtain-wall was supposed to be re-glazed using building-integrated photovoltaics (BIPV) to generate solar electricity (MacFarquhar 2008[r]). A later article, however, confirms that the actual renovation of the curtain-wall did not follow this path (Heinteges & Associates 2017[r]). The new glass increased safety and reduced infiltration, as well as matching the historic color, thickness, and sheen, but it did not implement BIPV. Sustaining the iconic image of the building was prioritized over environmental considerations, privileging architectural design over action.

The building biographer of One WTC claims it "inspires love", but architectural critics disagree. One WTC has not yet withstood the test of time or a terrorist attack, but it is certainly designed to be both strong and safe. The 14,000 PSI WSP-engineered concrete core points toward yet another form of sustainability: resilience against attack and explosives. The building is engineered to sustain itself and its inhabitants. In terms of environmental sustainability, the building had a *goal* of achieving LEED gold accreditation. This goal is featured on one of the engineer's websites (Vidaris 2017[r]), even though it did not become a reality.

It is unlikely that the professional dynamics between architects, engineers, and builders will return to the kind of coordination that marked the Empire State Building, because these professional groups no longer expect (or call for) harmonious interaction with each other. In the 2010s, the WSP engineers created a video that performs this integration, but the newspaper stories and academic research show a much more fraught and difficult process (Charney 2014[r]). Indeed, the design process for skyscrapers seems to have become more fragmented and onerous over time rather than less. The Empire State Building took 11 months to build, the U.N. Secretariat took 3 years, and One WTC took 11 years. The Empire State Building formally recognized the achievement of 32 different trades. Press from the U.N. Secretariat focused on international architects, not builders or engineers. The list of participants in One WTC recognizes only one builder but seven individual architects, nine different types of engineering firms, and five consulting firms. Over time, these cases show a shift in focus from the importance of *doing* to *designing*, both in the reduction of media stories about builders and the rise in the number and types of designers. Both the formal qualities of skyscrapers and their functional efficiency may suffer due to this fragmented and compartmentalized approach to design and construction.

Proponents of green, sustainable, and energy efficient designs often advocate for what is called "integrated design" (Yudelson 2008[r]). This is a change in the typical linear design process which starts with an architect and ends with the builder. Integrated design gives "each speciality the opportunity to participate fully, even in areas where they don't possess particular expertise [...] to help realize better sustainable design solutions" (Yudelson and Meyer 2013:30[r]). A key feature of integrated design is ensuring that the builder is included at the outset of design process to provide insights into the constructability and cost of the project. Builders contracted to manage complex construction projects are estimated to spend 90 percent of the project budget and coordinate dozens of trades, yet typically they do not participate in schematic design discussions. In the cases presented here, only the earliest case—the Empire State Building—followed an integrated design process. Optimally, a fully comprehensive integrated design process would also include future building operators and occupants (Yudelson and Meyer 2013[r]), treating the whole building and its occupants as an evolving and durable ecosystem.

How might the fragmentation in the construction industry be shifted? The WBCSD calls for a new "system integrator" profession (WBCSD 2009[r]) to bridge operational islands (see Figure 1). In smaller projects, such as home refurbishment, builders may be able to play this role (Janda, Killip, and Fawcett 2014[r], Janda and Killip 2013[r]). In larger projects, like skyscrapers, it is difficult to imagine how a single existing profession would expand to successfully cover the gaps. Builders claimed this territory in the 1930s, but it seems anachronistic to believe they will hold this role again. As envisioned by Reinhard's manifesto from 1932, architects have claimed this territory. Their ability to successfully defend it, however, is based on the current social focus on goals and ideas rather than outcomes. For example, architects have successfully taken credit for designs that are unbuilt and even unbuildable (Harbison 1991[r]). As designers themselves, engineers may be better situated than builders to challenge architects for control of the current system. However, the subtle performance of the engineers in the WSP video suggests they may continue to cede this role to architects.

For builders to gain more professional credit for their work, Abbott's system of professions theory suggests that they would need to claim a socially accepted problem. This means not just a change in the way that work is performed, as suggested by the advocates of integrated design, but a change in the way that their jurisdiction is seen by society. For society to refocus on the problems of *doing* rather than *designing* could require a greater appreciation of outcomes rather than goals. A good start in this direction may be reconfiguring the nature of sustainability research itself. Janda and Topouzi (2015[r]) argue that most sustainability research follows a "hero story", exhibiting a pattern similar to Joseph Campbell's classic text about the hero monomyth (Campbell 1968[r]). In this story form, it is perfectly normal to claim idealized benefits that are not substantiated in reality: like LEED accreditations that were never actually submitted, or benefits from photovoltaic panels that were never installed. These authors suggest sustainability in practice would be improved by implementing a system of stories that reflect more of a building's longer lifecycle. The "hero story" can continue to focus on design process and projections, "learning stories" could tell what happens in practice by comparing design ideals to reality, and "caring stories" could show the importance of maintenance, use, and renovation.

The cases examined in this paper show that the American system of professions in the construction industry produces environmentally unsustainable skyscrapers. Of the three cases considered here, only the earliest example, the Empire State Building, goes beyond the "hero story" of its original inception by making its sustainability renovation both public and transparent. Reorienting the current system of professions—through greater integration, new leadership, or different social meanings—to favor the social production of sustainable buildings is an important evolving area for future transitions research.

Acknowledgements

I wrote the first version of this paper in 1993 for an architectural history class taught by Kathleen James at the University of California, Berkeley. Its resurrection was inspired by a June 2017 "Crafting Climate" workshop at the Norwegian University of Science and Techno-logy, organized by Jøran Solli, Håkon Fyhn, Roger Søraa, and Margrethe Aune. I am grateful to the UK Research Council's Centre for Energy Epidemiology (CEE, EP/K011839/1) at University College London for supporting my attendance at the NTNU workshop and further development of this paper. Final revisions on the paper were supported by a guest professorship at Linköping University, *Tema T* through a grant from the Swedish Research Council Formas. I would like to thank my colleagues at Tema T for their interest and insights, the editors of this special issue, and two anonymous reviewers for their comments.

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