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Revisiting the construction of the Empire State Building: Have we forgotten something?

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ABSTRACT

What's past is prologue. Or is it? 40% under budget and 25% faster than anticipated! The construction of the Empire State Building (ESB) was not only the fastest erection of a skyscraper ever, but the construction company that took on the job allegedly began with no equipment or supplies that would be adequate for the job. The project was completed ahead of schedule and under budget. Instead of 18 months as anticipated, it only took 1 year and 45 days. The costs totaled \$24.7 million instead of the estimated \$43 million. So, we ask, how was this possible and is there something we can learn from it? Based on a review of existing literature describing the history and construction of the ESB, we outline strategic, operational, and contextual based explanations to what appears to be a truly successful megaproject. We illustrate how, for example, inspiration from Henry Ford's assembly line technique, the uniqueness of the logistics during the construction period, the economic decline of the Depression, and early ideas of concurrent engineering and fast-track construction, enabled the success. Our conclusion is that there are lessons to be learned in going back to basics.

Key words: Empire state building, Megaprojects, Project Management, Success, Learning from history

INTRODUCTION: A SUCCESSFUL MEGAPROJECT

Megaprojects fail! They are big and bold, but they almost always overshoot in costs and time. Take, for example, the Verrazano-Narrows Bridge in New York (built in 1959-1964), which had a 280 % cost overrun, the Sydney Opera House in Australia (built in 1959-1973), which had a 1,400 % cost overrun, or the Scottish Parliament Building in Scotland (built in 1999-2004), which ended up with a 1,600 % cost overrun (Flyvbjerg, 2014, p.10). Two out of the three also came in over time. These examples are not uncommon. In fact, Bent Flyvbjerg—an authority of the field—have called it the ‘iron law’ of megaprojects, “*over budget, over time, over and over again*” (Flyvbjerg, 2011, p.321).

It is not so much the size or numbers of failed megaproject, but it has come to our attention that the Empire State Building (ESB) was completed 40% under budget and 25% faster than anticipated. The construction took merely 13 months (*cf.* Tauranac, 2014a, pp.198-226; Wagner, 2003, p.122). 13 months, which was 5 months faster than initially anticipated, for a massive and iconic structure (built in 1930-1931), and also 25% under budget—clearly something was at work here. It seems as if the construction industry and the management of mega projects has somehow gotten less efficient instead of more. Consequently, we took a retrospective look at the effort that went into the fastest erection of a skyscraper to date. Based on a review of existing literature we aim at taking stock of the construction of the ESB. With the uniqueness of the case in mind, we ask how the mentioned success was possible and if there something we can learn from it? In the analysis we inductively outline strategic, operational, and contextual based explanations to what appears to be a great success from a project management (PM) perspective and a quite unique megaproject.

MEGAPROJECTS AND THEIR FAILURE

Megaprojects are characterized by being large-scale, complex projects, delivered through various partnerships that attract a high level of public, or political interest (*cf.* Van Marrewijk

et al. 2008; Flyvbjerg, 2011; Flyvbjerg, 2014). According to the McKinsey Global Institute (2013), such projects will supposedly, each year until 2030, deliver about 4% of the total global gross domestic product. Beyond the expected appropriateness to deliver large-scale investments, megaprojects are driven by technological development, political enthusiasm, economic-, or esthetic interest. With the terminology of Flyvbjerg (2011), megaprojects are driven by the four sublims. These sublims, however, do not only explain the attractiveness but also the ‘failure’ or disappointing performance. Recent studies on why megaprojects tend to fail also suggest factors such as; impacts on local environment, laws and regulations related to planning, insufficient funding, changes in scope and design of a project, government bureaucracies, overly optimistic expectations (optimism bias), how their organizational structure develops, and the absence of an effective public sector champion (cf. Flyvbjerg, 2011; Plotch, 2015; Mišić et al. 2015; Lundrigan et al. 2015).

AN ICON IN PERSPECTIVE

Even if the focus of the article is not on the iconic nature of ESB *per se*, but rather on the construction process and the circumstances thereof, some general facts and background information is still relevant to provide.

The ESB was erected in the beginning of the Great Depression (1929-1939), the deepest and longest-lasting economic downturn in modern history. One of the central initiators of the project was the businessman, DuPont Treasurer, and former vice-president in charge of finance of General Motors, John J. Raskob (Tauranac 2014b; DuPont, 2016). Raskob, who had long harbored the dream of building a skyscraper, had made a lot of money during his career and in the process become well-connected man (Walsh, 1928; Bascomb, 2004). Together with Coleman du Pont, Pierre S. du Pont, Louis G. Kaufman, and Ellis P. Earle, Raskob formed the Empire State, Inc., and gave Alfred Emanuel “Al” Smith (former Governor of New York and democratic U.S president candidate) the responsibility to lead the

operations (Empire State Realty Trust, 2016; Tauranac 2014a, 2014b). To design the building they commissioned the architectural firm Shreve, Lamb, and Harmon. Headed by chief designer William F. Lamb, the ESB was designed in a distinctive Art Deco style, with the characteristic and sleek form allegedly inspired by the shape of a pencil. The site of the construction was that of the original, and at the time outdated, Waldorf-Astoria Hotel on Fifth Avenue between West 33rd and 34th Streets. With the words “*Gentleman, stand back*”, Smith officially initiated the demolition of the hotel in late September 1929 to leave room for the new building (Bascomb, 2004, p.188; Reis, 2009, p.26). The main contractor, Starrett Bros. & Eken, started the excavation on January 22, 1930, and the actual construction begun less than 8 weeks later, on March 17. The 60,000 tons of steel used for the framework were manufactured in Pittsburgh and transported the 400 miles to the Manhattan construction site via train and trucks (Bascomb, 2004). At the peak of construction, 3,000-3,500 workers were involved. The building was completed on April 11, 1931, and it officially opened on May 1st the same year. The costs totaled \$24.7 million (approx. \$390 million relative today), which should be contrasted with the \$43 million initially estimated (approx. \$670 million relative today). With its antenna included the building stands a total of 1,454 feet (443 m) high, which made it the worlds tallest—a title it held until 1972, when it was surpassed by the Sears Tower (today Willis Tower) in Chicago. With its 102 floors, the ESB also became the first skyscraper to have more than 100 floors (Empire State Realty Trust, 2016).

[Table 1 goes about here]

METHOD

Due to the iconic nature of ESB and consequent appeal to tourists, there is a wealth of literature on the history surrounding the project (*cf.* Charles River Editors, 2007a, 2007b; Doherty & Doherty, 1998; Hopkinson & Ransome, 2006; Lassieur, 2015; Mann, 2003; Tauranac, 2014a; Wagner, 2003). Each of these items of course covers the same general story,

but frequently focuses on one aspect of the story or another. Most appear to appeal to be tourist souvenirs or coffee table books. The Mann (2003) text provides a nice summary, whilst the Tauranac, (2014a) is more scholarly, detailed, and complete. Because photography was well developed at the time, each tends to contain an exquisite collection of photographs—some are classic (*cf.* NYPL, 2016). The ESB has also attracted the attentions of more academic nature (*cf.* Francis, 1987; Sacks & Partouche, 2010), and throughout the years, there has been numerous professional documentaries made (*cf.* The History Channel, 2005). The wealth of original shorter clips on Youtube is overwhelming. We have utilized and reviewed a large part of this material in order to take stock of the unique undertaking.

The approach of this paper can be described as a retrospective case study (*cf.* Eisenhart, 1989; Yin, 1994) based on an integrative literature review (Torraco, 2005), with a thematic inductive categorizing (Braun & Clarke, 2006). The review was undertaken using Google Scholar and Nvivo for Mac as primary means for searching, structuring, and analyzing information. As there exists few ESB studies of pure academic nature, and since Google Scholar is shown to have a broader, but equally as accurate, coverage as traditional search engines (Amara & Landry, 2012; Jean-François et al., 2013), Google Scholar was considered a suitable tool. A total 69 entries were identified with “Empire State building” used in the title. With a large part of these items not digitally accessible, books were manually assessed. In general, we followed the common steps of integrative reviews. That is; identifying the research question; identifying relevant literature (and video material); literature selection; collating, summarizing, and reporting the results. In order to complement (and triangulate) the results, documentaries and public sources was added (*cf.* The History Channel, 2005; Empire State Realty Trust, 2016).

In an analytical sense, perhaps it is easier to learn from mistakes instead of good practice or good fortune—mistakes are obvious; the connection between good practice/fortune and

outcome is often less straightforward. Still, we focused on analyzing and categorizing the enabling factors. When assessing the material and understanding the construction process, a dozen factors was considered and analyzed. The result was categorized into strategic, operational, and contextual factors. The strategic factors are objective, financing, approach, leadership and organization; the operational factors are equipment, logistics, design, repetition and motivation. The two contextual factors are the economy and the weather. The nature and influence of each of these factors is discussed below and summarized in Table 2—main sources included. First, the basic approach of the project is presented and reflected upon.

UNDERSTANDING THE CONSTRUCTION OF THE ESB

The basic approach to the ESB construction can be described as a fast-track approach (*cf.* Wagner, 2003, p.72), which can be compared to the today's more common approach of design-bid-build. Utilizing the notebook kept by the Starrett Bros. & Eken firm during the project (published by Willis & Friedman, 1998), Sacks and Partouche (2010) have reconstructed the schedule of the project, which they suggest reveals planning that consciously considered the flow of work. The authors concludes that, *“the production planners set time buffers to shield tasks from variability, they used stable pacemaker tasks to set the pace for all activities, and they sized work teams and work zones to fit whole multiples of the base ‘takt rate’ in order to achieve balanced production rates for all activities in each paced group”* (Sacks & Partouche 2010, p.709). With ‘takt rate’ they refer to the idea of a time unit, or the rhythm, to create the pace. Others highlight the importance of coordinating the flow of the four ‘pacemakers’; stone, steel, concrete, and metal trim (Willis & Friedman, 1998; Empire State Realty Trust, 2016). While it is true that the economic circumstances of the Great Depression provided stable supplies of materials, workers and equipment, the same contractor (Starrett Bros. & Eken) had achieved similar construction rates in other projects before the advent of the economic depression. The analysis of the project as a network of interacting flows shows that management concepts and techniques that had not yet been

identified explicitly in the context of construction were nevertheless applied in practice on the project and resulted in a successful and efficient construction process. The collaborative design team represents an important innovation for the time and implies low variation in design, continuous small batch information flows and short cycle times for dealing with errors. The investments in logistic resources with multiple parallel paths made the project stable, preventing bottlenecks in the supply chains. For example, each steel girder was prefabricated and given an index number that indicated the delivery date and where it was to be installed. The lead-time was approximately 80 hours from production at the Pittsburgh factories until arrival at the construction site. Sophisticated buffers, such as consolidation centers, complemented with a pull system for delivery to site, enabled limiting material storage on-site moving material once only, and ensured the continuous workflow.

The more common project delivery process, both then and now, is design-bid-build which Ghosh and Robson (2014, p.3) describe it as follows, *“In the design-bid-build approach, design and construction are viewed as two independent non-overlapping processes. The designers and contractors rarely consider how to manage the entire production system. In general, planners use a work breakdown structure (WBS) to break down a project into work packages to create a framework for project planning, scheduling, and controls. In this approach, designers and contractors view production primarily as a transformation process where entire production can be managed by breaking it down to smaller units, and managing the units. As a corollary to this disintegrated process, designers often leave interface resolution (interface between product and process design) to the contractors.”* In this process, an architect and/or engineer completed a design, made detailed construction drawings, wrote specifications and invited multiple contractors to submit proposals stipulating their price to execute the project. It basically was an outgrowth, and is consistent with, a Gantt chart approach to project planning, control and management. Geraldi and Lechter (2012) have

described the development of the Gantt chart. It was originally established as a general production-planning tool for repetitive operations by the mid-1920s by H. L. Gantt, although not formalized until a decade later. Thus, the concept could have been available at the time of the ESB project, but appears to have been ignored or deemed unfit for the project. Instead, participants seemed to go with a form of Lean construction (Ghosh & Robson, 2015), or flow approach (Sacks & Partouche, 2010) although neither of these approaches appeared to have been invented at the time (Scherrer-Rathje et al., 2009).

Strategic factors

The strategic factors are those factors that form the backbone of a project. That is, they form the framework upon which the project was planned and implemented.

Objective: By consensus the objective in the project was to build the tallest building in the world and could well have been intertwined with the construction of the Chrysler Building at the time (*cf.* Charles River Editors, 2007a, 2007b). In some sense, it was the beginning of the race of the titans (Tauranac, 2014b) and the project a ‘vanguard’ (Frederiksen & Davies, 2008). Put another way, Raskob, who had been an executive at General Motors, took it upon himself to “one up” the efforts of Walter Chrysler—the man behind the Chrysler Building. In the development phase, Raskob allegedly asked the architect Lamb “*How high can you make it so that it won't fall down?*” (Douglas, 2004, p.110). Other indication of this competition is also that even before the final architecture was agreed, a plan was made to add a 158 spire to outdo anything Chrysler might do (Charles River Editors, 2007a). Normally such a general objective would have been a detriment to such a major project, but in this case it drove the project from the earliest sketches for construction.

Financing: One element of the strategic background that tends to go unnoticed is that the backing for the project came from private funding. Put another way, just as private organizations tend to be more efficient than public ones (thus driving present trends toward

privatizing government operations), private funding can be more efficient and effective than state funding. Estimated cost of the project was \$43 million (Bob Moore Construction, 2015, p.3); funding was secured by a loan \$27.5 million from Metropolitan Life Insurance Company (Wagner, 2003, p.23). The rest of the initial funding came from Raskob and other individual investors in Empire State, Inc., the development company.

Approach: The ESB was the first commercial project to utilize fast-track construction (Bob Moore Construction, 2015, p.2). Sacks and Partouche (2010) characterized the approach in terms of various flows. Ghosh and Robson (2015), on the other hand, discussed the project in terms of a Lean project delivery system. Either, or both, could be considered appropriate in terms of present thinking. The description preferred here, however, is the one described at the time by Shreve of the architectural firm, as he reflected on the progress of the project from its just-in-time (JIT) input to its choreographed output, *“We always thought of it as a parade in which each marcher kept pace and the parade marched out of the top of the building, still in perfect step. Sometimes we thought of it as a great assembly line—only the assembly line did the moving, the finished product stayed in place”* (Tauranac, 2014a, p.204). To our way of thinking, the *“marching in step”* reflects the need to coordinate the number of subcontractors who cooperated in the project, and the vertical *“assembly line”* the ideas drawn from the technology introduced by Henry Ford in his plants. Our suspicion is that the individuals in the project who had experience in the auto industry were well aware of what Ford was doing.

Leadership: Considering the strong personalities, or “egos”, involved, progress could have been difficult in the project, but proceeded in a manner that could best be called shared leadership. Al Smith’s official position was president of Empire State, Inc., the development company. Unofficially, he provided political cover and publicity useful to the project. William Lamb, of the architectural firm Shreve, Lamb and Harmon, was the chief architect and apparently brought into the project on a *“whatever it takes”* basis. His flexibility in design

and acceptance of construction suggestions were instrumental in making rapid progress in the project possible. Paul Starrett of Starrett Construction was the man on the scene responsible for day-to-day activities (i.e. Construction/Project Manager) and the coordination of subcontractors. Andrew Eken of the same firm is acknowledged as the individual responsible for the JIT nature of materials coming to the construction site. John Raskob was the moneyman, and if there was the boss, it could have been him because it was he who initiated the project and was responsible for the scale.

Organization: There was a corporate organization, Empire State, Inc. (ESI), responsible for development that was composed primarily of the investors in the project (Wagner, 2003, p.23). Al Smith, previously Governor of New York and unsuccessful candidate for U.S. president, was president and Robert C. Brown, General Motors executive, was vice president. Other members included investors John Raskob, private investor, Smith advisor and past executive at GM, Louis Kaufman, bank president, Ellis Earle, NJ politician, and Pierre du Pont, Executive of du Pont and major GM stockholder. ESI was the development organization in what now would be called a *strategic alliance* with the architectural firm of Shreve, Lamb and Harmon and the Starrett Construction Company.

Operational factors

The operational factors are the items associated with the implementation of the project. There appeared to be five items—equipment, logistics, design, repetition, and motivation—associated with completing the project in 13 months.

Equipment: Part of the lore of the project was Paul Starrett's summary of his firm's equipment status in his proposal to ESI'd Smith. "*Ordinary building equipment won't be worth a damn of it (ESB). We'll buy new stuff, fitted for the job, [...] It cost less than renting secondhand stuff and it's more efficient*" (Charles River Editors, 2007a). Not only was the equipment new and functioning, it was also novel. For instance, an internal distribution

system was developed. Narrow rail tracks were installed on each floor and moved higher up as the construction progressed. Specially designed hoists and dump cars speeded up transportation of smaller materials like concrete or limestone slabs—a first for an office-building construction job (Taurancac, 2014a, p.215). Mortar was delivered at a rate that saved both labor and time, which meant saving money.

Logistics: Clever things were done with orders and deliveries that contributed to progress in the project. Justifiably, a lot is made of the JIT nature of deliveries. Large pieces of precut limestone and prefabricate metal arrived ready to install. All the workers had to do was put them in place and attach them to the framework (Mann, 2003, p.25). Materials moved smoothly to the site, but also within the building itself. The operation was so tight that steel often arrived still warm from the forges in Pittsburgh. Elevators salvaged from the Waldorf-Astoria demolition were used to move freight (Mann, 2003, p.26).

Design: William Lamb of Shrev, Lamb and Harmon was the chief architect who had an appreciation of “*an intense earnestness to make practical necessities that armature upon which he moulds the form of his ideas, instead of being the intolerant aesthete [...] there entered the last and perhaps the most important item in the owner’s program—speed of construction. Hardly a detail was issued without having been thoroughly analyzed by the builders and their experts and adjusted and changed to meet every foreseen delay. (For instance) choice of interior marbles was limited to those which could be obtained in time to be fabricated and set. [...] As far as possible, hand work was done away with. [...] Windows, spandrels, steel mullions and stone [...] were designed so that they could be duplicated [...] and put together almost like an automobile on the assembly line.*” (Charles River Editors, 2007b). Wagner (2003, p.31) indicates there were 15 initial plans for ESB before Plan K, the 16th, was accepted. Design-for-duplication was essential. Paul Starrett, the Construction/project manager reflecting on the design expressed that “*Never before in the*

history of building had there been and architectural design so magnificently adapted to speed in construction” (Taurancac, 2014a, p.198).

Repetition: “Repetitio est mater studiorum”. Were it not for the modular nature of design and the repetition of certain processes, the speed at which construction proceeded could not have been attained. It is well documented that the architect Lamb designed the floors identically for expeditious construction. Thus, as construction proceeded, it was repetitious in a manner similar to the line in Ford’s plants and enabled the building to grow with an average of 4,5 stories per week (Wagner 2003, p.31; Tauranac, 2014a, p.204).

Motivation: Clearly, someone got laborers on site to buy into the need for speed. When the workers reached the 86th floor, 23 days ahead of schedule, the celebrated and planted a flag of triumph (Tauranac, 2014a, p.212). To put this celebration into perspective, consider riveters worked eight hours for \$15.40 (Tauranac, 2014a, p.209). Consequently, the early finish cost each worker \$354 in an economic environment where other employment was scarce indeed. Even if Smith officially proclaimed that the men who completed the Empire State Building should be given jobs in other building projects, “*whether they need more men or not*”. (Francis, 1987, p.85), the risk was high as the number of construction jobs dropped 50 percent (Doherty & Doherty, 1998, p.33). A carrot and stick approach developed. The stick was, “*If you worked on the Empire State, you hustled all day long, whether you were a skilled electrician or a water boy or a rivet punk. If you could not handle the pace, there was a line of hungry men who snaked around the block each day ...*” (Charles River Editors, 2007a). There was consequently always someone else willing to the workers’ place. On the other hand, the carrot was, “*Every Monday, the various trades placed money into hats and then spent the week racing one another skyward, competing to see which gang could throw up the most steel, drive the most rivets, [...] On Fridays [...] The gang that won the week’s competition picked up a nice bonus*” (Charles River Editors, 2007a). Francis (1987, p.85)

argues that the worker saw the work “*as an act of faith in the city and the nation on the part of the investors*”. Others report that workers seemed to have a special camaraderie, pride, and dedication to the building (*cf.* Tauranac, 2014a).

Contextual factors

The contextual factors (externalities) are those uncontrollable factors that nevertheless contributed to the success of the project.

Economy: The crash of the U.S. stock market had occurred in 1929 and recovery had not occurred when construction started in 1930. Ten million workers lost their jobs (Doherty & Doherty, 1998, p.31). Consequently, Starrett was able to recruit the elite of the city’s construction trade (Charles River Editors, 2007a). Hopkinson and Ransome (2006) and Lassier (2015) capture some of this situation in their fictionalized description of progress during those times. Additionally, there were two deviations from prior building codes that were highly preferred for final construction (Charles River Editors, 2007b). One dealt with a reduction in the size of the girders for a substantial savings in material, which initially was vetoed by the mayor (Tauranac, 2014a, p.206). The other dealt with the permissible speed of elevators. Code at the start of construction permitted 700 feet/min speeds; developments consistent with start of the project increased to 1200 feet/min, which became standard and utilized in the building (Tauranac, 2014a, p.218). Undoubtedly, the size of the approx. 3,000 person workforce being employed in an otherwise down spiraling economy had an impact on reconsideration. Finally, the state of the economy produced a priority for ESB demands for steel, limestone, and cement, which enabled the early use of a JIT system. For instance, the steel girders came from Pittsburgh in alternating sections that ranged six to eight floors each, values that represented about a week or two’s needs at the rates of utilization in the project.

Weather: It is better to be lucky than good. In the case of ESB, it was even better to be lucky and good. Despite all the good things that were done on this project, if weather had been

unseasonably bad, it could not have been as successful as it was. As it were, 1931 was the warmest year to date in New York. From the start of the actual construction March 17 (1930) there were only three days below 30 F until late November the same year, and not a single day of snow fall until late December. 1930 was, however, marked as year with “*highly fluctuating temperature anomaly pattern through the course of year*” (ClimatStations.com, 2016).

[Table 2 goes about here]

LEARNING FROM HISTORY AND MOVING FORWARD

This project is interesting because of its impact. Its magnitude is overwhelming—so much accomplished in so short a time, a true success in terms of execution. It should however be noted that the ESB was not a success in all aspects. When completed, the building was very difficult to rent and quickly got the nickname “*Empty State Building*” (Reis, 2009; Tauranac, 2014a). Eventually, the building was filled with tenants and the success from a symbolic perspective is undisputed (*cf.* Francis, 1987), with ESB today being one of the most famous buildings in the world.

With an aim to take stock of the history and construction of the ESB in order to understand why it became such a success, we have identified a total of 12 enabling factors—five strategic, five operational, and two contextual. In this regard, Einstein is reputed to have said, “... *things should be made as simple as possible, but not simpler*”. Our view is it is simplistic to say; ESB came in early and under budget because it was done during the depression, or ESB came in early and under budget because Paul Starrett was an effective project leader, or ESB came in early and under budget because of abnormally good weather. Any one of those explanations by them self would be too simple. Instead, our analysis suggests that it was the interplay among a dozen factors that enabled the observed results (see *figure 1*).

With the objective of a ‘vanguard’ project, the private funding, the innovative approach, the complementary competences of the leadership troika, and the early strategic alliance constituted the framework upon which the project was planned and successfully implemented. Facilitated by the vertical assembly line approach, new and innovative equipment, JIT logistics, and a design adapted for speed, the motivated workers was able to make the most of the modularly. Nice weather in combination with stable supplies of materials, workers, and equipment due to the Great Depression, expedited the process. That is as simple as we might make it. As described, some factors they had control over, others, not so much. Still, they are all part of the complex explanation.

[Figure 1 goes about here]

Reflecting on the identified factors, it is clear that the ESB avoided some of the previously mentioned major sources for megaproject failure. For example, sufficient funding was attracted through Raskob and other individual investors in Empire State, Inc., which has been highlighted as a major challenge (*cf.* Plotch, 2015). A successful organization was set up in terms of Empire State, Inc. (another challenge *cf.* Lundrigan et al. 2015; Mišić et al. 2015). Concurrent changes in scope and design of the building (*cf.* Plotch, 2015) was handled through the strategic alliance between the architectural firm of Shreve, Lamb and Harmon, and the Starrett Construction Company. Overly optimistic expectations (*cf.* Flyvbjerg, 2011) were clearly avoided, possibly due to the experience of Starrett Construction Company. Some government bureaucracy (*cf.* Plotch, 2015) was definitely navigated through the personal connections of Smith, and the knowledge of former Governor Smith. And finally, and maybe most importantly, an effective ‘public sector champions’ existed in terms of Smith (*cf.*; Plotch, 2015).

Similar to all case studies, this work is a potential subject of verification. As an in-depth case study, it has done what in-depth case studies are supposed to do—identify critical variables (*cf.* Eisenhart, 1989; Yin, 1994). It is suggested herein, however, that there are twelve critical variables enabling success. These we have contrasted with common known challenges of megaproject. The next logical step will be to further pursue the “*how these factors likely derived themselves and further develop why they were important in the case*” as a complement to the “what/that” developed in the present analysis. Take for example “Financing”. We state “that” it was private and conclude “that” existing studies suggest that it was beneficial, but we cannot wholly explain how (or why) this was positive for the project. The same thing goes for a couple of the others. This is an extension that needs to be made. The second thing that might be done with the study is to extend it. We have identified two possibilities – the Grove Park Inn that was constructed in the same general timeframe and has an excellent account of its structuring (Johnson, 2004). In a more modern sense, we have studied in detail the Destination 2011, which depended upon a modular approach and certainly was completed in an expedient manner (*cf.* Jacobsson and Wilson 2012, 2014). It deserves a second look.

Following the successful combination of megaprojects and processes, as academics we would suggest others to revisit and take a more closely look at fast-track projects and concurrent engineering. Our mentality may be oriented toward processes consistent with a Gantt chart approach in our publications—well thought out, well planned approaches. The experience with this work, in particular, suggests that it may be more appropriate to view an effort as one where construction begins while plans have yet not been completed. Nevertheless, somewhere along the line progress in management seems to have deviated from learning from history.

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Table 1. Empire State Building facts

Location (address)	350 5th Ave, New York, NY 10118
Construction started	March 17, 1930
Construction completed	April 11, 1931
Building opened	May 1, 1931
Height, roof (tip, incl. antenna)	1,250 feet, 381 meters (1,454 feet, 443 meters)
Floors	102
The building sits on	79 288 square feet (7 340 square meters)
Architect (firm)	Shreve, Lamb and Harmon
Developer	John J. Raskob
Current owner (2016)	Empire State Realty Trust

Table 2. Summary: Factors contributing to the success

No.	Factor	Short Statement	Citations/aggregate	Main refs.
STRATEGIC FACTORS				
01	Objective	Taller than the Chrysler Building	Race to the top – Walter Chrysler & John Roskob. Evolution Bethlehem Engineering to Shrev & Lamb.	M-12 T170+
02	Financing	Private money	Built to give unemployed friend a job. Would cost more than he had dreamed.	T170+
03	Approach	Fast-Track vs. Design-Bid-Build	Shrev & Lamb given 18 mounts from presentation to opening. So-called fast-track construction, an innovation in 1930 compresses the project schedule by running design and construction phases simultaneously. <i>“We always thought of it as a parade in which each marcher kept pace and the parade marched out of the top ...”</i>	T170+ W72 T204
04	Leadership	Paul Starrett w. Andrew Eken behind scenes. Al Smith as front man. Shrev & Lamb not to be overlooked.	<i>“Smith to Help Build Highest Skyscraper”</i> NYT. Paul Starrett, a genius at negotiations and management. As part of the bid to get the job, Starrett bet on a long shot and won. The logistics and assembly of the parts, as directed by Eken, were a testament.	M-4 T174 W75 T204
05	Organization	Structure follows strategy.	Raskob & Smith. Shrev & Lamb. Starrett Bros. & Eken. Sub-Contractors—forming a strategic alliance	M-4, 14 T170+
OPERATIONAL FACTORS				
06	Equipment	Special for project	Ordinary building equipment wouldn’t cut it. Rather than renting, the idea was to buy new equipment specifically fitted for the job at hand.	W75
07	Logistics	Designed for speed w. clever things: Early JIT	The components that made up the building came from factories, from foundries, and quarries from far and wide. Lamb said that handwork was done away with as much as possible.	T204 T205
08	Design	On the Fly: First was 50 stories	The designers had the draftsmen make drawings from the bottom up. They did not worry about designing the eighth floor until the drawings from the third floor had been completed.	T205
09	Repetition	14.5 Stories in 10 days. Rivets	<i>“When we were in full swing going up the main tower, things clicked with such precision that once we erected fourteen and a half floors in ten working days – steel, concrete, stone and all,”</i> said Shreve.	T204
10	Motivation	The supervision entailed was enormous.	Sticks and carrots. The overseers, from job foremen to architect and engineer, were on the site constantly, [...] workers standing 1,050 above the street [...] raised a flag.	T205 T212
CONTEXTUAL FACTORS				
11	Economy	Construction took place during the depression.	Recruiting, labor costs, purchasing and decision making were all enhanced by the economic conditions.	DD31, CRa, T206
12	Weather	13 month implies one winter.	Records indicate record mildness.	CS

Figure 1. Enabling factors