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RESEARCH ARTICLE

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Causations of failure in megaprojects: A case study of the Ajaokuta Steel Plant project

Abstract This paper uses project organizational theories to draw lessons from a historic megaproject, the Ajaokuta Steel Plant (ASP). Archival reports on the ASP were explored to identify the unique attributes of the project; the political wrangling that underplayed its evolution, its economic significance and organizational impacts. Findings suggest the goals of the ASP project were, and still are, unambiguous. Failure occurred as socio-political forces aggravated the project's complex milestones. Stakeholders were impatient with pre-project investigations. During planning, owners ignored opinions that were contrary to their expectations. While delays lingered, pressures from the global economy weakened the project's motivation to succeed. These combined to turn the project's outcomes into a *chaotic* situation that triggered dire implications. Despite about 1400% overrun in cost, the success achieved on the plant was 28% at commissioning. Contractors remained on site until eight years after commissioning. Six key elements of the 482 items in the ASP project contract were not delivered nearly 40 years on. A simplistic look at these suggests poor planning is the main problem. However, planning issues is not entirely strange in greenfield projects. The paper draws strength from project organization theories to explain *what* was poor about the planning. Socrates' generic management theory was used to explain the role of leadership in the failure of the ASP project. McGregor's Theory X and Theory Y explain the significance of stakeholders' integration in megaprojects. Systems and chaos theories were used to explain the sensitivity of the ASP project to uncertainties. Narratives on these combine well to inspire stakeholders of megaprojects on *where* and *how* to seek courage in making effective plans that can help achieve success in complex projects. While normative literature only recognizes project success in a definitive perspective, this study provides insights from failure as an instrument to trigger sublime reflections.

Keywords industrial projects, megaprojects, Nigeria, project organizational theories, steel plant

1 Introduction

Megaprojects evolve as indelible legacies of a people who dared humongous obstacles – people who were keen to find solutions to complex problems of a sheer size. The planning, development, operations and management of megaprojects run over a period that sometimes spans hundreds of years. This paper considers it scholarly helpful to intertwine the histories of a people and megaprojects' and, draws strength from insightful reflections regarding how people and projects' histories interplay. One aspect of this is to draw useful lessons from the intended purposes for which such projects evolve and how a typical project can meet its intended purposes throughout the various stages of its development and operations. Flyvbjerg (2014) has summarized such purposes to include providing solutions to a large-scale need, incentivizing commerce and industry and providing a platform to showcase strength and pride. According to Flyvbjerg (2016), it is common that these purposes are not met. Hence it is vitally important to draw more sublime lessons from failures of megaprojects (if at all) than seeking confidence in success exemplars (if any) – see Love and Smith (2016).

One perspective to understand why megaprojects fail is to consider megaprojects in the context of the unique knowledge required to create and drive them. Such knowledge, like in the example of China's Three Gorges Dam project, is a symbol of a people's capacity to exercise exclusive competence (Xie and Zilberman, 2014). This is not essentially common to every case where the ambitions

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to build megaprojects exist. A typical implication of this is that megaprojects often have different implications for different people. The manner in which they transform a population through their sheer landscapes differs from place to place. According to Flyvbjerg (2014), there are sublime implications of this in how megaprojects are viewed through the lenses of politics, technology, economics and aesthetics. Normative literatures judge megaprojects along these lines also. Most studies define success of megaprojects as though success is attained only if completion is achieved within pre-contract budgets and schedules, and to imaginary outputs, often speculated even when the project environment has yet to evolve (De Wit, 1988; Pinto and Slevin, 1988; Chan, 2001; Collins and Baccarini, 2004; Andersen et al., 2006; Relle and Gilge, 2013). However, success often means different things to different people, and as such there are more robust definitions of success which do not oversimplify achievements by looking at the positive side of history alone (Markus and Tanis, 2000).

Pinto and Mantel (1990), Boehm (2000) and Shepherd et al. (2011) demonstrate the powers of positive thinking and the robust insights that reflections could bring from perceived failures in project environments. Their views suggest there is often more to learn from failure than success. Whereas insights from successful projects are about what worked so well and how, failed projects often provide insights about what worked so well or a little or did not work at all, when problems erupted and why, and how future experience can make the best of a negative history. Furthermore, in the case of megaprojects, stakeholders often regard achievements in their projects as a part of their proud history. They are able to see beyond normative debacles such as costs and schedule issues – for example, see the account of Murray (2003) and Shenhar and Dvir (2007) on the Sydney Opera House. The view of Boehm (2000) is such that even when a project is terminated, there are elements of victories to celebrate from stakeholders' aspirations not yet fulfilled.

The global rurality of Africa has been defined by Olatunji and Ajayi (2017) Balfour et al, (2008) and Ajaokuta Steel Plant (ASP) is one of the foremost integrated steel plants in Africa. It's economic and political significance are staggering: ASP was Nigeria's planned ladder to the commity of technological 'world powers' of the 20th century, and a part of Nigeria's developmental plan post-independence from Britain. The ASP was commissioned in 1985, after which the contractor spent an additional 6 years on site. As will be pointed out in this paper, ASP's budget blew-out severely and severally, and only less than one-third has been completed to date. In addition, this paper seeks to explain what went so wrong in the ASP project, and the lessons that could be drawn from issues encountered in the project which will be helpful in future projects.

2 The Ajaokuta Steel Plant project

The vision to construct the largest steelmaking plant in Sub-Sahara Africa started in 1958. Named the Ajaokuta Steel Plant, ASP was Nigeria's first steel plant. As an integrated plant, the ASP was designed to process inputs to the main steel plant by itself, convert ore and solid metal to liquid iron and pig iron to liquid steel. In addition, the plant will solidify liquid steel, reduce large steel blocks to billets and roll products into finished shapes. ASP project was further planned and implemented by successive Nigerian administrations between 1970 and 1985 when it was commissioned uncompleted.

2.1 The designed capacity

The ASP was designed to produce 2.6 million tonnes of steel within the first year, half as plates and the others into structural steel, rods and wires. There was an expectation to double the production capacity just after initial operations have commenced (Oyeyinka and Adeloye, 1988; Matusevich, 2003). In addition, ASP was to help expose Nigeria's industrial metallurgy and economy to the in-house manufacturing of capital goods. The ultimate goal is to serve as Nigeria's main platform toward becoming an economic and industrialized global power (Matusevich, 2003).

2.2 The facility

ASP is an 800 hectares blast furnace facility built on a 24000 hectares land, west bank of River Niger. The project site was not chosen for convenience, rather for political reasons. Iron ore, found in Udi and Agbaja, is 266 km and 370 km away respectively. Coal, found in Enugu, is 242 km away also. These three locations are within 130 km radius to each other. Had the plant been situated somewhere between Enugu and Agbaja, the plant and the raw materials could have been within 50 km apart only. In addition, Ajaokuta is 250 km from Lagos coastline, Nigeria's biggest steel market and the main commercial seaport Nigeria has had to date. Not only this, it was difficult significantly for the construction of support infrastructure for the plant. The plant's site was undulate and rocky, and sloped considerably toward River Niger. To condition the site appropriately, infrastructure works had included extensive levelling work, a massive stabilization work to the river bank, construction of flood canals, a river port and extensive infrastructures for power and water. These had meant 21 million m^3 of earthwork in site levelling and terracing, 1.7 million m^3 of reinforced concrete, 0.21 million tonnes of structural elements, 0.181 million tonnes of equipment, 60000 tonnes of refractory bricks and 65 km of standard rail gauge within the facility (Matusevich, 2003). If these descriptors are

isolated, Nigeria has not had a considerable reputation in delivering very large projects with similar extreme complexity before the ASP (Oyeyinka and Adeloye, 1988).

2.3 The technology and production capacity

The works of Matusevich (2003) and Oyeyinka and Adeloye (1988) are quite instructive regarding the technology and designed capacity of the ASP. Information from their work suggests the plant consists of five components and uses a simple blast furnace technology that relies on oxygen supply. The components include an oven plant of two batteries, each with 49 coke ovens, designed to blend 0.9 million tonnes of coke per annum. The sintering plant is the second component. It has two machine units, designed to process 2.64 million tonnes of sinter and pellets every year. Third, the blast furnace which has two units, with a capacity to produce 1.355 million tonnes of pig iron per annum. The steelmaking plant, the fourth component of the ASP, consists of two specialized *Linz and Donawitz* (LD) converters of 135 tonnes capacity each, and three units of 4-strand continuous casting machines. The fifth, steel rolling mills and a complex incorporating a billet mill, have a yearly capacity to produce 0.79 million tonnes. Within the steel rolling mill, there is a medium section and a structural mill with a capacity to produce 0.56 million tonnes per annum. In addition, this part has a light section mill and bar mill with a capacity to produce 0.4 million tonnes, and a wire rod mill that has a capacity to produce 0.13 million tonnes per annum. In addition to the main plant, ASP is designed to have three ancillary units. These are a raw material preparation unit, designed to process 2.135 million tonnes of concentrated iron ore, 1.32 million tonnes of coking coal, about 700 million tonnes of limestone, 250 million tonnes of dolomite and 85 million tonnes of manganese ore annually. There is also a plant for processing by-products, including wastes from coke ovens to produce dehydrated tar, ammonium sulfate and many more products. The third ancillary unit is a 110 MW power plant that uses captive technology.

2.4 The contracts

The initial contract for the construction of the plant was signed on the 4th of June, 1976 for 1 billion USD (about 0.620 billion Nigerian naira at the time). Commercial production was scheduled to commence in '1980 or shortly thereafter' (Matusevich, 2003). However, the cost was reviewed upward several times before 1985. For example, by February 1980, the cost had risen to 12.7 billion USD (about N7 billion at the time), and it was renegotiated and raised a few times afterward – see Matusevich (2003). In addition to the construction cost of the plant, construction of civil works for the plant was awarded for 1.523 billion USD (about N838 million) in November 1980. Before key components of the works were abandoned after protracted delays, the contract was revised to N1.48 billion in 1986 (see Oyeyinka and Adeloye, 1988). At this point in time, the value of the Nigerian naira has fallen from 0.55 to 1 USD in 1980 to 2.02 to 1 USD in 1986, now hovering around 400 to 1 USD in 2018.

2.5 The problems

2.5.1 Free…but in the dark

Britain has had a significant influence on Nigeria for the better half of a century before Lagos, Nigeria's foremost commercial capital city, was annexed by Britain in 1861 (see Crowe's 1942 documentation of the 1885 Berlin conference). By the middle of the 20th century, the struggle intensified to stop the British colonial rule towards obtaining Nigeria's independence in 1960. The fight was tough (Ekeh, 1975). Leaders of pressure groups needed to harmonize their varying viewpoints and raise the positive energy in the masses who must be convinced of Nigeria's true ability to survive as a sovereign nation. Otherwise, to the masses of the time, Nigeria is better of as perpetual 'slave' to Britain (Adebisi, 1989). Then political bias set in: Among the most prominent political leitmotif at the time was some unverified claims about Nigeria's endless list of mineral riches – crude oil, iron ore, gold, diamond, copper, bitumen, coal, niobium, zinc, natural gas, tin, limestone, columbite, water and forest resources as well as fertile soil (see Jensen and Wantchekon, 2004). These supposed riches have had little or no place in local diction. People hardly understood their meaning, uses, quality or quantity and the opportunities that might accrue through them. Nevertheless, Nigeria's first conceptual development plan was built around them regardless. Some initial random plans were adopted in 1958, and upon these political actors initiated several megaprojects almost simultaneously – a major hydro-electric power plant, oil exploration, an integrated steel plant, coal exploration, massive transport infrastructure projects and major agricultural projects (Falola, 2004). For an incipient economy that has not had a considerable financial reserve and a track record of project success, these are excessively ambitious. Intentionally also, Nigerian leaders shut out their long-term allies, Britain and United States of America, of impact on the ASP project. Instead, they chose a new ally in the old Solviet Union, an ally with which Nigeria has had significant language and cultural barriers (Matusevich, 2003).

2.5.2 ….Alone in the cold

Nigeria's intention to start as an independent entity among industrialized nations is a good idea. However, the good news ended almost at the level of an intention. The

knowledge base, proven market, technology and the infrastructure support to drive the projects were non-existent. It was Nigeria's first experience of a megaproject and there were limited exemplars around to learn from. The political leaders who ideated the project did so much but very little regarding knowing enough of Nigeria's mineral endowments. Other than names, they did not have appropriate information on either the industrial values, the commercial quality or quantity of their mineral deposits, or the implications of exploitation activities on their people, the environment and economy (see Williams, 1964).

2.5.3 Uncertainties and social cost of development

In addition, Nigeria's evolving industrialization project was bedeviled by inadequate data for planning at the time. The actual population was unknown and projections for future development were superficial (Barbour, 1972). Second, skilled labor was in acute shortage also (Williams, 1964; Oyeyinka and Adeloye, 1988). Moreover, economic implications of speculations around urbanization and actual growth were underestimated. As the proposed industrialization became the most important focus of the nation, other sectors of the economy such as agriculture lost their popularity (Matusevich, 2003).

2.5.4 Impatience and political costs

Oyeyinka and Adeloye (1988) outlined the life of a steel plant into four elements: The gestation, pre-investment, construction and plant operations. For greenfield plants, gestation is usually a period of 15 – 20 years prior to pre-investment and construction. It involves an intensive planning that requires exploring information and making provisions for resource inputs and varying production system scenarios. The success of a megaproject depends largely on these (Flyvbjerg, 2016). However, between 1958 and 1971 when ASP project commenced officially, planning efforts were brief and insignificant. They were conducted by political players and their lackeys (Matusevich, 2003). Within these years, political power changed hands a few times, back and forth from a democratic system of government to military rule. There was also a three-year-long civil war, which claimed the lives of several million people within this period (Jorre, 1972).

2.5.5 Alternative priorities

By the time the project commenced, Nigeria's second national development plan has been promulgated. Areas affected by the civil war attracted significant resources for reconstruction, reconciliation and reintegration. Amidst dwindled resources, competing ends multiplied and grew more intense. However, regime after regime kept faith in the ASP project regardless of whatever political differences they have had.

Being positive in thought did not change the shape and gravity of the main challenges that evolved in the course of implementing the project – other than being positive, key actors chose to ignore the huge challenges that evolved in the course of the project. For example, before 1971, British and American experts had warned that Nigeria was not ripe for such a massive project as the ASP (Matusevich, 2003). Support infrastructures were absent. The cost of the technology being considered for the project was too high for an incipient economy. Knowledge and skill gaps were significant. In addition, the consumption rate of steel in the whole of Africa was 8 kg per person, far below the consumption rate in developed countries at the time (300 kg per person). These issues were ignored. Rather ASP's stakeholders grew incredibly impatient (Oyeyinka and Adeloye, 1988). They refused to pay attention to the complexity underlying the construction of an integrated steel plant. Before feasibility studies were completed, media reports suggest the Nigerian public wanted an immediate commencement of the plant's operations – even before authorities determined the volume and quality of Nigeria's iron ore deposits and the consumption rate required to run the plant (Matusevich, 2003). While public agitation continued, all actions involving the project were only in the hands of political actors and bureaucrats.

The legislative framework for the project and the commissioning of the first team of technocrats to oversee the project did not happen until August 1971 – i.e., after six years of political (over) sensitization. By the time the technocrats came on board, they have had to cope with the politics and pressure from the public. As a result, their primary assignment was no longer straightforward. Neither the project team at this stage nor the political leaders or the sensitized public planned for the major misalignment that the project development processes have encountered. They had no foreknowledge regarding the outcome of the situation either. Oyeyinka and Adeloye (1988) added also that, throughout the gestation period, which was unusually short, the project cost has soared. Globally, cost/ton of install plant capacity escalated from 350 USD/ton in 1965 to 1700 USD in 1980, and the escalations continued afterward. In Ajaokuta's case, the project started at 6000 USD/ton in 1976, and the escalations continued in chains until the project was commissioned uncompleted in 1985 – please note: costs of support infrastructure were included in the cost of the ASP's, where as others may not have included such costs. One important factor in this was that the pre-arranged finance condition did not consider the chaotic variability that went with how the project situation later emerged. As a result, funding became a problem. Foreign debts rose. Despite this, Nigerian authorities did not look back. All steel plant projects that were started at the same time as Nigeria terminated their ambitions, however, Nigeria chose to press on (see Oyeyinka and Adeloye, 1988).

2.6 Episodic issues around ASP's success

Due to stakeholders' impatience, ASP's gestation only lasted a couple of years. Other than the nation's enthusiastic energy, the experience of government's local representatives (the technocrats) regarding greenfield plants was unverified, if at all any. They could not control preexisting issues either. Another problem was that the term of reference of the team was broad. It included: to carry out a feasibility study on the proposed steel project, conduct geological surveys to determine the volume and quality of the iron-ore and coal deposits in Nigeria and to repeat the same task on Nigeria's other mineral deposits such as dolomite, coal, and limestone. They have had to deliver these within few weeks, despite the urgent expectations from them on ASP (see Oyeyinka and Adeloye, 1988).

The team chose a consultancy firm from Russia, V/0 Tiajpromexport, for the exploratory studies of the steel plant. A project management firm from Germany was selected also. While the geological investigations were going on, the team sent several thousands of Nigerians to different institutions internationally and locally to acquire skills in different roles regarding how to operate and manage the plant. By the time the training was completed, exploratory studies were still ongoing. Apparently, the training received by the workforce was not focused on the actual content of findings from the exploratory studies as could become useful in the construction and operation of the ASP. In addition, when the results from the studies were out, additional major problems became evident.

2.6.1 Communication and communication disconnect

As Matusevich (2003) reported, project documents such as the reports of the exploratory studies and the project designs, both in several volumes, were made in Russian. They were to be interpreted (not reproduced) into English, Nigeria's lingua franca. The cultural barrier in the documentation was a significant problem; time and resources were spent in domesticating the documents, albeit without perfection.

2.6.2 Unscheduled change to project expectations

Matusevich (2003) also reported how ASP's management team was made aware of the quality of iron ore deposit in Nigeria only after exploratory studies had been completed. By this time, the construction phase of the ASP project was already in full swing. Findings from the studies show Nigeria's iron-ore has only 38% ferrous content. This became the turning point for the project as the initial design was made for an ore with much higher ferrous content. As a result, an unplanned major redesign became paramount. A basic oxygen furnace approach was added to the original blast furnace. At the time, the approach was the most appropriate technology to process ore with less ferrous content. Many more alternative technologies have evolved thereafter, some of which have proven to be more efficient than the basic oxygen furnace approach (see Manning and Fruehan 2001). Nonetheless, the designed process is not the only problem; the overarching issue was that the recommended process requires coking coal. Local coal deposit in Nigeria, estimated at over two billion metric tons at the time, is unsuitable for the plant because it is rich in Sulphur and Ash. As a result, it looked as though the ASP dream was built on a potentiality that never was – the local ore and coal, the two primary inputs of the plant, that failed to meet the standard required to run the plant as planned and designed. Oyeyinka and Adeloye's (1988) reflection on this is as though the original dream of ASP's stakeholders has been defeated. The stakeholders' dream was that of self-sufficiency: they wanted the plant to be a true symbol of Nigeria's independence and authority in the comity of industrialised nations. The apparent defeat emanated from the fact that appropriate coking coal for the plant is not available locally and importing the required volume leaves the project uneconomical and vulnerable to external forces. The plant is able to achieve considerable outcomes only when imported coal is mixed with 20 % of local coal.

2.6.3 Disruptive change of plans

Given the raw material situation explained above, an option was to consider a different technology for the plant's processes. Direct reduction method was adopted. In place of coking coal, direct reduction requires natural gas, an abundant resource locally, to fuel the production. A drawback however, is that the method requires the iron ore to have a high ferrous content of about 80 % (Zervas et al., 1996). It is uneconomical to deliver the same outcome (as 80 % ferrous content) from an iron ore grade of 38 % ferrous content, the quality of ore that is available in Nigeria. A positive angle to this is that the situation is slightly better than having to import coking coal. Nonetheless, while discussions were still ongoing on the processing method to adopt for the ASP, a new plant by way of direction reduction commenced elsewhere in South-South Nigeria. Like ASP, the new project was also a national priority. Persistent escalations to ASP's conditions and the several dimensions to its challenges raged on too. While these ambitious aspirations were expanding, Nigeria's economy contracted. As a result, Nigeria's creditworthiness had to freeze, the outcome of which became unfavorable to financing such megaprojects on funds that were borrowed externally under inflexible conditions.

2.6.4 Larger-than-life solutions

Two blast furnaces were included in ASP design. By 1987,

only one has been completed. However, the equipment has not been used commercially nearly 30 years on. Al-Amin (2013) cited an authority of the ASP, who indicated that if turned on, the blast furnace is designed to work continuously for ten years. Local supply capacity of raw materials is only a fraction of the rate of consumption required to make this happen. If this required volume of raw materials was to be made available, their exploitation should have started several years before the plant commenced its operations. Kamara et al. (2002) have captured this phenomenon that bedevilled the ASP accurately. The authors argued that clients' requirements are often soft and ambiguous: clients' *actual needs* are often not differentiable from mere insatiable *wants*. For an incipient economy, an incremental change management process could have delivered some outcomes that are more desirable than failure or idleness (see Buckley and Casson, 2010).

2.6.5 Change versus established culture and traditions

The motivation for building a steel plant in Nigeria stemmed from the prominence of traditional iron forging, a culture that has lasted many centuries in pre-amalgamated Nigeria (see Emeriewen and Kalilu, 2015; Killick, 2004). Initiators of the ASP did not realize the significant nuances between the traditional method and the ASP's integrated processes. One of such nuances is the use of limestone in steel making processes. ASP requires 700 million tonnes per annum, whereas traditional forging method does not require limestone. Meanwhile, limestone was discovered in Nigeria only when feasibility investigations and production design of the ASP had advanced significantly. Being a greenfield too, limestone mining and processing for the plant was slow. As Matusevich (2003) reported, had limestone production commenced several years prior, commercial production at the ASP would still have struggled to achieve its optimum production target when the plant was commissioned in 1985. For a megaproject like ASP, the plan to make the primary plant ready is as important as bolstering throughput supply network. The mutual exclusivity in these (i.e., the in-feed supply and primary operations of the plant) is as important as building stakeholders' confidence through extant cultures within the Nigerian steel industry.

2.6.6 Project leadership

Nigeria's political leaders were made aware of the issues. However, they would rather remain positive and hope the project succeeds than disappoint the masses who were already connected to the project ecstatically. ASP continued regardless. In stern expectation, three in-land rolling mills, which were expected to receive products from the steel plant, were commissioned and completed much ahead of the ASP. Similar support infrastructure by the private sectors also suffered the same fate: They have remained idle for nearly three decades now waiting for the sleeping giant in ASP to wake up someday. An important lesson from this is that leadership and situational optimism are not entirely synonymous (see Beazley, 2009). Nigeria's political leaders needed to keep faith with the enthusiastic energy of the populace, whereas they lacked the tool to build the needed solutions from the inside-out and show an authoritative class of their own rather than seeking independence on the back of borrowed funds, borrowed knowledge and support infrastructure that never existed.

In summary, 30 years on, ASP project has remained in the national discourse. The project is neither a complete failure nor a considerable success. Rather it is more of a story of philosophical symbolism. Thinkers consider its episodic attributes as a platform to seek education, perhaps as how not to undertake a megaproject. Others, especially local stakeholders, see it as a story of unwavering hope and optimism: that, one day, the sleeping giant in ASP will rise again. Yet the fundamental issues have remained unchanged. That is, the plan to achieve greater goals cannot be more important than giving a commitment to planning. It is also important to learn to separate politics from projects, not the least the need to evaluate project ambitions objectively (see Love et al., 2015). It was enough troubles that commitments were given to the project while exploratory investigations on crucial raw materials were not yet concluded. When Nigeria's economy and the Nigerian people were ready for the ASP, the technology and the skills to drive the project were not available. After an impatient wait, the preliminary project report suggested a necessity for some more careful considerations on operational issues. However, because of cultural difference between the producers of the report and the local stakeholders, some salient issues in the report were ignored.

As indicated earlier, the exploratory reports and the preliminary designs were documented in several volumes, in Russian, and were too complex for the local audience. In addition, when the rolling mills were ready, the steel plants were not. When the steel plants were ready for partial operation, the ingots were not. When there was a considerable quantity of raw materials to commence production, project costs have escalated and Nigeria's economy has become weaker. By 1985, only a bar mill and a wire rod mill were completed and commissioned. Although, work has continued thereafter, however it had meant the plant recorded only about 28 percent success, despite 1400 % cost overrun, when it was commissioned (Matusevich, 2003). By the time work stopped permanently on the plant, on paper, only six of the 482 items in the ASP contract were not delivered. Nonetheless, the outstanding items are vitally crucial. These include extensive work on the blast furnace and gas supply to the turbo-power generators. In addition, the cost of

infrastructural support for the plant was also nearly doubled, although the overall success was estimated at 38 %. Some of the reported success now requires a major overhaul, having become dilapidated because of poor maintenance and lack of use. The Ajaokuta steel plant has been in minimal operation since its commissioning. Poor funding, resourcing and management issues have affected operations. Attempts to turn around the fortunes of the plant through privatization have been unsuccessful. Despite these, the steel plant remains a national asset, exhuming lessons learnt by a nation aspiring to develop, with the hope that the 'idle lion' in the Ajaokuta Steel plant will rise again to fulfill its promises.

3 Insights: Analyzing the outcomes of the ASP using theories of projects and organizations

There are two dimensions to organizational factors that influence a project's outturn situation. One dimension relates to organizations that play roles in project evolution; the other is how projects themselves are organized (Smith and Lewis, 2011; Hu et al., 2012). The two must interact seamlessly. For example, a dysfunctional project-based organization is unlikely to deliver a successful project (see Hobday, 2000; Turner, 2008). Packendorff (1995) suggests there is a linear relationship between project success and the constituents of the project's systems such as project governance and resource inputs. Olaniran et al. (2017) argue that such a linear relationship is only partially true for traditional projects. Megaprojects are an exception. Baccarini (1996) explains how complexity often triggers random behaviors in constituent elements of megaprojects such that project outcomes are seldom predicted by inter-dependencies between them.

Outcomes of megaprojects can be explained using theories relating to organizations behaviors and project organization. This is because, according to Lundin and Soderholm (1995), projects are temporary organizations; their structures and culture facilitate how stakeholders make things happen. An interesting part of this is how intrinsic and extrinsic factors interrelate to define the behavioral theories that underline how the different players facilitate project outcomes. Four of such theoretical perspectives are discussed below, aimed at explaining lessons from the ASP story.

3.1 Socrates' Generic Management and Leadership Theory

Shafritz et al. (2015) report a generic management theory that dates back to Socrates' time (469 – 399 B.C.E). The theory considers projects as though providing leadership in project environments can be dissociated from the skill-sets that are available within project's internal system. Based around a story on the appointment of a war general that was to lead the Athenian army, Shafritz and his team documented the accounts of Xenophon (1869) regarding a story that was credited to Socrates. In place of a trained and experienced soldier, authorities have appointed a chorus manager who had neither fought in a war nor possessed a significant leadership experience in the army. Against vehement objection to the choice, Socrates had argued that the appointed chorus manager was the better option because the chorus manager had led a chorus team successfully. Socrates' opinion was that the chorus manager would not have succeeded if he was not able to identify the best in his team and that he succeeded because he had emulated and provided the best in his chorus team with admirable leadership. Another outstanding strength identified by Socrates was the chorus manager's ability to raise money and in managing the resources that were available to him judiciously. To Socrates, a man who leads a family is as good as a war general. However, the reality of an army general's competence is not in leading a train of the army to a war, rather whether a war general will remain standing both in courage and strategy when real weapons of war announce their presence in a fierce battle.

Project management theorists have interpreted Socrates' view as though leadership skill is dissociable from cognate experience and an adept knowledge of the leaders in the technical area for which leadership is to be provided (Cleland, 1995; Rausch et al., 2005; Shafritz et al., 2015). In addition, another core principle of this theory is that resourcing and resource management make the leader a king. This is also corroborated by Walker (1995) and Boyd and Chinyio (2006) as though the most vital instrument of success is a leader's ability to make resources available to the team, to select and learn from the best around, and to drive results the way he best knows. This simplistic view of leadership is one of the most noticeable debacles of the ASP. As stated earlier, the initiators of the project have had no understanding of the engineering and social complexity of having a steel plant at the time the project started. They were merely enthused by the opportunity to identify with the people's interest – mainly the desire to grow the Nigerian economy into a superpower status from start as a sovereign nation. They have had no experience of major industrial projects. Interestingly, they were undeterred by opinions that were contrary to their views, and showed little or no understanding of critical issues. In addition, they lacked the patience to exercise due diligence. Planning was poor; as a result, the entire project became vulnerable to unforeseen and poorly mitigated risks.

This lesson is not peculiar to Nigeria's ASP project alone. Several authors within the construction project management field have often described the client as the ultimate, the king; the only party whose opinion and satisfaction matters (see Ahmed and Kangari, 1995; Walker, 1995; Boyd and Chinyio, 2006; Isa et al., 2010). In Flyvbjerg et al.'s (2013) view, client's opinions are sacrosanct: Opinions at variance are either deceptive or

delusional. Love et al. (2015) have provided an idealist view. They suggest variabilities are a constant feature of complex projects and that such projects deserve holistic consideration of issues such as clear integration between leadership and project systems. Moreover, substantial evidence had emerged from extant studies in support of the view that projects are not likely to survive unless clients, away from political undertones and pre-project symbolisms [unrealistic expectations], are able to truly own and drive some clear opinions about their expectations, and are able to integrate well with the project team (see Kometa et al., 1995). As articulated by Bolden et al. (2003), several projects and/or organizational leadership theories also support this view (examples include Tannenbaum and Schmidt's continuum model, 1958; Fiedler's contingency model, 1967; Hersey and Blanchard's model, 1977).

3.2 McGregor's Theory X and Theory Y

McGregor (1960) postulated Theory X and Theory Y which reflects the assumptions of a leader about the led. Theory X assumes the led has a tendency to undermine the leader's ambition. Thus, the led needed to be coerced, controlled and threatened with punishment. Theory Y, on the other hand, assumes the led seeks responsibility and is self-led in achieving set objectives, only by utilizing a portion of their potentials in the form of imagination, ingenuity, and creativity. An overarching implication of McGregor's postulation in project organization theory is that complex issues in major and mega projects are not often solved by client's coercive posture. Rather openness, integration and co-operative approaches to risk-sharing often motivate the led to support the leader's ambition with extraordinary commitment (see Grudinschi et al., 2014; Mohammad-Hasanzadeh et al., 2014; Naoum and Egbu, 2015; Grandia, 2016; Jelodar et al., 2016;).

In the case of the ASP, project initiators did not believe they needed to lead from the front by providing information that will make project implementation more successful. They did not realize how out-of-control they were having to deliver a greenfield project on the borrowed fund, borrowed knowledge and a support infrastructure that never existed. Their perspective on project success is the input-goal approach. They have shown very limited commitment to understanding how processes help deliver results. In Beazley's (2009) interpretation of this phenomenon, the situation is as though the initiators of ASP could not draw a line between attributional and dispositional optimism. Attributional optimism is a form of systematic error made when actors seek to find reasons for their own and others' behaviors (Abramson et al., 1978). Dispositional optimism is characterized by positive expectations that influence motivated action (Carver and Scheier, 2014). Political actors that engineered leadership on the ASP only wanted to be seen as progressive. However, they are disposed only to soothing advice. The truth is: A leader that is keen to succeed should understand how to deal with the bias in his or her optimism (Flyvbjerg, 2006; Flyvbjerg et al., 2013). By transferring the most significant risks to the project team – the risk to determine the raw materials, investigate the quality of the inputs, to design the process plant, train the workers, determine the output, the market, the business philosophy and environment etcetera – ASP's initiators seemed to have lost their authority [including financial control], which in reality they never had. Baloi and Price (2003) have documented the vulnerability of projects' cost performance to external forces such as global factors of cost variability, macroeconomic dynamics and finance engineering issues. Theory X could have been appropriate if ASP project team have educated the project initiators about the negative sides to the project initiators' intentions. However, strategic optimism theory was more applicable in the way the ASP turned out. Strategic optimism theorists argue strategic optimists are often keen to set high expectations and hope for good outcomes, whereas they often fail to reflect on present issues and shape their confidence about the future experientially (Spencer and Norem, 1996; Norem, 2001). This is true about the ASP team because the team presented themselves as though they have all the answers in the kitty. The gap between their optimism and project's actual reality is ASP's margin of failure.

3.3 Systems Theory

Hylighen and Joslyn (1995) defined systems theory as an abstract organization of phenomena, triggered by the interdependencies between complex constituent entities. Packendorff (1995) explained the philosophical implications of system theory to the planning and management of construction projects as though the way to analyze performance phenomena of megaprojects is "to consider the project as a whole, constructed from parts [governance, environment, culture, teams, supply chain, leadership, motivation, society, processes, international impacts], and the interdependencies between them ..//… the better the structure of the parts, the better the whole system." For example, it is misleading to simply conclude an opinion on outturn situations of the ASP by merely isolating the imperfections of an individual actor in the project. Even leadership, taken simply as it sounds, as an entity playing a role in the failure or success of the ASP, is not entirely simplistic. Nigeria's political leadership changed hands severally between the initiation and the commissioning of the ASP; none existed because of the ASP, and the motivation that each regime has had for the project varied considerably. In addition, all the regimes evolved through nefarious military actions or infantile democratic processes that lasted only a short time. The implication of this complexity is that project leadership is not exactly a flawless continuum. In the case of ASP, its initiation and

governance were shaped by the frictions of multifarious political situations, fuelled by pressure points from multiple dimensions, including stakeholders' impatience, international politics that was less than ideal, a local politics that changed shape frequently, project team's inexperience and an uncertain socio-environment. These are also to triggers variabilities to stage expectations and planned management processes.

Nonetheless, these are all snapshots of leadership issues, a single element of the ASP. Apparently, outcomes could have remained the same if the project leadership situation was different. Oyeyinka and Adeloye (1988) reported that 13 steel plants that started around the same time as the ASP were abandoned. They have all had different leadership models. In ASP's case, potentials of the project were kept alive and could still be revisited. Nonetheless, the two theories above on leadership and leadership behavior have helped explain what could have been done to improve future outcome – for example, that the project leaders should understand the psychology of the led, and that the relationship between the leader and the led should be integrative. These are crucial. However, the theories cannot whisk the problems away. It is only appropriate that the entire project organization system by looked into holistically. Project organizations have been likened to temporary organizations, motivated by a need to perform specific actions as though the accuracy of such actions determines the success of a project, largely in the form or a cause-effect relationship (Lundin and Soderholm, 1995). Systems thinking theorists have focused on the interdependencies between cause and effect by diagnosing project performance issues using holistic lenses rather than focusing on isolated observations. In particular, finite attributes of projects – uniqueness, costs, duration, teams and transition – are often conditioned by peculiarities [knowledge depth, clarity of owner's expectation], systems [due diligence in managing elements of a project and the rationalities underlying them], relationships [managing interdependencies between sub-systems] and perspectives [fine-tunning optimism with realism] (Cabrera et al., 2008).

In essence, overruns did not just happen because the planners were corrupt and deceptive (Matusevich, 2003; Flyvbjerg et al., 2013). Problems arose partly because of inflexibility in the finance arrangement and because the local economy became weak suddenly as a commitment to the project climaxed. Nevertheless, in the last three decades, successive governments have taken several steps – including privatisation, refinancing and sustained annual investments running to billions of dollars. According to media reports, Nigeria spends an estimated $4.5 billion annually to import steel. Less than half of this is required to complete the plant. Yet the outturn situation has remained unchanged. Apparently, the situation of the ASP evolved into a chaos [a lack of ability of a disturbed system to regain stability when inhibitors are withdrawn]. How this happened needs to be understood. This is important because it is common that megaprojects are not delivered to planned costs and schedule, it is only uncommon that stubborn problems remained defiant for decades, especially in such a symbolic project as the ASP.

3.4 Chaos Theory

Reichl (2004) defined 'Chaos' as a state of randomness, disorderliness, confusion or uncertainty. Chaos theorists have explained why certain natural systems seldom obey the traditional logic of science e.g., why relationships between causes and effects are nonlinear, particularly in complex projects in which complex organizations are involved (Checkland, 1999; De Meyer et al., 2002; Geraldi, 2009). Against conventional theoretical expectations regarding project success, chaos theory clarifies why project success is not fully explained by the strength of generic indicators such as accuracy of planning, control, technology, communication, leadership and resourcing (see Cooke-Davies et al., 2011). For example, as Olaniran et al. (2015) argued, traditional project management theorists are often quick to use deterministic perspectives in analyzing what, how, when, and why a project fails. Such theorists often declare 'failure' when a project overran its pre-contract budget or completion schedule or the satisfaction of every possible stakeholder group (Flyvberg et al., 2002; Smith and Love, 2004; Ogunlana, 2010; Priemus, 2010). The overarching uniqueness of chaos theory is that it explains *why* project outturns are not entirely predictable by observable finite parameters; the implications of uncertainty being the language of complexity in projects, as though even in a platitude of the knowns, there are many unknowns (Pich et al., 2002).

There are four attributes of a chaotic situation:

3.4.1 Sensitive interdependencies

These explain why small changes in inter-connected parameters are able to trigger significant and unpredictable consequences in a project system. Kellert (1994) refers to this as an unstable behavior within a system in which the system can no longer remain insensitive to small changes in the system's initial conditions. In the case of ASP, some of the isolated issues which might be ignoble in other countries and others projects, have created significant outcomes as ASP progressed. Whether they are considered individually or as a combined force, they would not have made much difference Examples of these include having to speed up exploratory processes, the preparation of project documents in Russian for an English audience, the manner in which erratic macroeconomic variations eclipsed the project, the political instabilities, and the superficial workforce training programs were all significant issues. Each of them was surmountable when they occurred. However, they triggered outcomes that further complicated

ASP's ultimate success. For example, additional time was needed to convert project documents from Russian to English, albeit with imperfections. While this was ongoing, the international finance scene moved, resulting in pressures on the local economy and ASP's finance arrangement. Findings from the exploratory studies had also meant that alternative decisions must be taken regarding the plant's design and processing options. These would not have progressed if the initiators of the second steel plant – the Aladja Steel Plant, which uses direct reduction, were not convinced of the bounded rationality that Nigeria's economy could sustain the two projects concurrently. However, that decision had added more burden to the already overly complex situation of the ASP. Aladja Plant was completed, but it never delivered as much promise as the ASP.

3.4.2 Feedback loop

This is where actions taken to ameliorate a chaotic situation further disintegrate orderliness within a system (Reigeluth, 2004). Murphy (1996) has reported a significant difference between linear and nonlinear systems in terms of feedback loop, in that linear systems achieve stability by leveraging negative feedback to effect corrections and discourage further deviation from stability. In contrast, chaotic systems evolve by means of positive feedback, in that every dimension is taken to simplify complexity and push for positive outturn situation often provide the material rationale for new formulations. This has meant some outcome(s) may be farther dispersed from the original goal of a project. Thus the implication of positive feedback, and one of the few routes to success in complex projects, is that new solution formulations must amplify deviations, destabilize certainty and generate new dimensions to issues. For example, Aladja Plant was a positive feedback to ASP's issues, and so were the numerous attempts made to make ASP viable regardless, including the addition of a natural gas system to ASP's hydro-power system. Although, a positive addition, the solution became unviable as vandalism of gas pipelines became a prominent issue in a particular part of Nigeria. Once broken, gas pipelines have had to be fixed repeatedly, communities needed to be cleaned, media upheavals needed to be addressed, other installations needed to be checked and the entire system must be re-secured. Interruptions caused by the vandalism also brought avoidable stoppages to work.

3.4.3 Bifurcation

This represents flashpoints of change where a system's character and structure are disrupted, resulting in continuous radical transformations (Sellnow et al., 2002). According to Schuldberg (2011), this is the point a project system transforms from regular change embodiment to a chaotic system. In the case of the ASP, this is a point when achieving immediate and target success became overwhelmed by situational changes. Some of these are summarized below:

(1) *The backward integration program*:

Following multiple positive feedback on the initial design of the ASP, political authorities at the time decided to control the attendant new formulations by introducing negative feedback measures (see the reports of Williams, 1964; Oyeyinka and Adeloye, 1988; Matusevich, 2003). According to these authors, ASP was then reprogrammed for backward integration. This means some essential components of the steel plant will be completed first, commercial production will commence, and proceeds raised from the production will be used to finance the rest of the project. There are two sides to how this affected the ASP. First, megaprojects seldom break even immediately (see Flyvbjerg, 2007). The gap between reintegration of proceeds and cessation of existing funding arrangement became a flashpoint. Stakeholders have had to reset their perspectives to the economic rationality of the project to this situation. Second, reseting or reducing project scope in the middle of implementing a megaproject may not translate into immediate performance improvements. In the case of the ASP, coordination became impossible. Clients only considered their overall spending and not the impact of new formulations. On the others hand, contractors could not redirect their investments in new formulation into the reset scope either.

(2) *Debts and pervasive corruption*:

For megaprojects, flexible funding arrangements are not negotiable. ASP cost plan blew out its limits fairly quickly. For an incipient economy with the public institution in a molten state, wastes and corruption became persistent phenomena. Debts rose, the economy weakened but ASP's scope and the sidekicks [wastes and corruption] continued to increase. Matusevich (2003) explained why these, and 'manufactured authoritarianism governments' are the cultural similarities between Nigeria and the old Soviet Union that further put the ASP out of stakeholders' control.

(3) *Reality vs client's expectation*:

Matusevich (2003) also wrote about how Nigeria's commitment to the ASP waned as a result of poor alignment between their expectation and certain realities at the time. For example, in Nigeria, ASP was not just a symbol of economic power and development, developing the steel industry is the only key to true independence and achieving prominence in the comity of global powers. In particular, Nigerian leaders were fixated on their perceived correlation between the development of the steel industry and Nigeria's true economic freedom and prosperity. In reality, however, no nation becomes truly independent by relying on one single industry. Soon after oil exploration started, and the better understanding of the truth regarding the perceived correlation between steel production and

economic growth, Nigerian authorities re-adjusted their expectations. The focus shifted to oil and gas, while steel and coal were no longer a priority.

(4) *Government stability and politics of megaprojects*:

ASP is a social project. It was initiated and implemented by a government that only lasted for few years. Between 1958 and 1971 when ASP was initiated and started respectively, Nigeria recorded five leadership regimes: One foisted by Britain, one as an interim arrangement following the independence, one constitutional republic, and two military juntas. In addition, there was a three-year-long civil war during this time (see Jorre, 1972). Between the ASP's commencement in 1971 and its commissioning in 1985, Nigeria was led by another five regimes, four of which were military juntas deposing each other and the only democratic regime at the time. Each of these situations has meant different outcomes to the ASP. This is because the leaders have had different focuses, and the disruptions in government did aggravate the economy against the project.

3.4.4 Attractor

This is the stable component of a system in continuous state of disorder (see Robertson and Combs, 2014). An attractor is also defined by Pryor and Bright (2007) as a situation in which "a system self-organizes into coherence and adapts to maintain, sustain or recreate order when subject to change from either internal functioning or external influence." Although not much progress has been recorded in the ASP following contractors' demobilisation from the site since the 1980s, the spirit of the ASP has remained within Nigeria. The plant has had a scant operation. Varying degree of success has been achieved. The gap between the plant's current state and revamping it to full capacity is known (see Akeju, 2018). If the project is to happen again, it is evident the mistakes will not have to repeat themselves.

4 Conclusions and implications for future research

ASP is symbolic to Nigeria and the developing world. Lessons from the project's history relate to extant work on authentic leadership. Project owners and leaders should see megaprojects as a platform for a collaborative relationship rather than authoritarian rationality. In addition, megaprojects are sufficiently unique. It is often possible to find that leaders of megaprojects are under-trained for the challenges that may evolve on the project. However, a clear chain of expectation in managing leaders of megaprojects is the depth of the leaders' own knowledge in the implementation processes of the proposed project and their due diligence on planning. Secondly, positive feedbacks in the form of new formulations in live projects are not in the negative interest of a megaproject. They are a part of the success story that cannot be dissociated from the project. As noted earlier, controlling positive feedback with negative feedback measures does aggravate project performance. Flexibility in megaprojects should not be treated like an avoidable disease, rather should be treated like a phenomenon to live with, to control and manage its consequences and allow for immediate intervention. The experiences presented in this study shows a project may exist without being an absolute success or failure. ASP did not deliver its promised potential. It did not fail either: It is a symbolic experience of an ambitious nation, a story of hope and an accumulation of lessons that have been learnt successfully about how not to fail. All construction stories have had unique stories. However, they are rarely told. Future studies in the area will reshape current understanding about project success and how this might help in the management of future projects. In particular, extant understanding about project organization will benefit if future studies consider complexity as a key factor of economic rationality in project success.

References

Abramson L Y, Seligman M E, Teasdale J D (1978). Learned helplessness in humans: Critique and reformulation. Journal of Abnormal Psychology, 87(1): 49–74

Adebisi O (1989). The Challenge of independence: Major issue before and after. In: Tamuno, N.T. and Atanda, J.A., eds. Nigeria since Independence in the first 25 years. Ibadan: Heinemann Educational Books, Nigeria Limited.

Ahmed S M, Kangari R (1995). Analysis of client-satisfaction factors in construction industry. Journal of Management Engineering, 11(2): 36–44

Akeju R (2018). FG needs $652m to reactivate Ajaokuta Steel equipment. http://freedomonline.com.ng/fg-needs-652m-to-reactivate-ajaokuta-steel-equipment/, 2018–6-12

Al-Amin M A (2013). Energy efficiency alternatives in the Ajoakuta Steel Project of Nigeria. International Journal of Advanced Research, 1: 592–599

Andersen E S, Birchall D, Jessen S A, Money A H (2006). Exploring project success. Baltic Journal of Management, 1(2): 127–147

Baccarini D (1996). The concept of project complexity — A review. International Journal of Project Management, 14(4): 201–204

Balfour R, Mitchell C, Moletsane R (2008). Troubling contexts: Toward a generative theory of rurality as education research. Journal of Rural and Community Development, 3: 95–107

Baloi D, Price A D F (2003). Modelling global risk factors affecting construction cost performance. International Journal of Project Management, 21(4): 261–269

Barbour K M (1972). Planning for Nigeria: A Geographical Approach. Ibadan: Ibadan University Press

Beazley C (2009). The many sides of optimism. Positive Psychology, United Kingdom

Boehm B (2000). Project termination doesn't equal project failure.

Computer, 33(7): 94–96

Bolden R, Gosling J, Marturano A, Dennison P (2003). Leadership Theory and Competency Frameworks. Exeter: Centre for Leadership Studies

Boyd D, Chinyio E (2006). Understanding the Construction Client. Oxford: Blackwell Publishing

Buckley P J, Casson M (2010). In: Buckley P J, Casson M, eds. The Multinational Enterprise Revisited. Berlin: Springer

Cabrera D, Colosi L, Lobdell C (2008). Systems thinking. Evaluation and Program Planning, 31(3): 299–310

Carver C S, Scheier M F (2014). Dispositional optimism. Trends in Cognitive Sciences, 18(6): 293–299

Chan A P C (2001). Framework for Measuring Success of Projects. Cooperative Research Centre for Construction, Queensland University of Technology, Brisbane, Australia

Checkland P (1999). Systems Thinking, Systems Practice: Includes a 30-Year Retrospective. Chichester: John Wiley and Sons Ltd

Cleland D I (1995). Leadership and the project-management body of knowledge. International Journal of Project Management, 13(2): 83–88

Collins A, Baccarini D (2004). Project success—A survey. Journal of Construction Research, 5(2): 211–231

Cooke-Davies T (2011). In: T. Cooke-Davies, L. Crawford, J. Patton, C. Stevens and T. Williams, eds. Aspects of Complexity: Managing in a Complex World. Newtown Square: Project Management Institute

Crowe S E (1942). The Berlin West African Conference, 1884–1885. New York: Longman

De Meyer A, Loch C H, Pich M T (2002). Managing project uncertainty: From variation to chaos. MIT Sloan Management Review, 43: 60

De Wit A (1988). Measurement of project success. International Journal of Project Management, 6(3): 164–170

Ekeh P P (1975). Colonialism and the two publics in Africa: A theoretical statement. Comparative Studies in Society and History, 17 (01): 91–112

Emeriewen K O, Kalilu R O R (2015). Emerging trends in blacksmithing in Benin City, Nigeria. Journal of Science and Technology of the Arts, 7(2): 70–76

Falola T (2004). Economic Reforms and Modernization in Nigeria, 1945–1965. Kent: Kent State University Press

Fiedler (1967). A Theory of Leadership Effectiveness. New York: McGraw-Hill

, Flyvbjerg B, Skramis-Holm M K, Buhl S (2002). Underestimating costs in public works projects: Error or lie? Journal of the American Planning Association, 68(3): 279–295

Flyvbjerg B (2006). From Nobel Prize to project management. Project Management Institute Journal, 37(3): 5–15

Flyvbjerg B (2007). Cost overruns and demand shortfalls in urban rail and other infrastructure. Transportation Planning and Technology, 30: 9–30

Flyvbjerg B (2016). Introduction: The Iron Law of Megaproject Management. Oxford: Oxford University Press

Flyvbjerg B, Garbuio M, Lovallo D (2013). Delusion and deception in large infrastructure projects: Two models for explaining and preventing executive disaster. California Management Review, 51 (2): 170–193

Geraldi J G (2009). Reconciling order and chaos in multi-project firms. International Journal of Managing Projects in Business, 2(1): 149–158

Grandia J (2016). Finding the missing link: Examining the mediating role of sustainable public procurement behaviour. Journal of Cleaner Production, 124: 183–190

Grudinschi D, Sintonen S, Hallikas J (2014). Relationship risk perception and determinants of the collaboration fluency of buyer–supplier relationships in public service procurement. Journal of Purchasing and Supply Management, 20(2): 82–91

Hersey P, Blanchard K H (1977). Management of Organizational Behaviour. Englewood Cliffs: Prentice Hall

Hobday M (2000). The project-based organisation: An ideal form for managing complex products and systems? Research Policy, 29(7-8): 871–893

Hu Y, Chan A, Le Y (2012). Conceptual framework of program organization for managing construction megaprojects — Chinese client's perspective. In: Proceedings of Engineering Project Organizations Conference. Rheden

Hylighen F, Joslyn C (1995). In: Audi R, eds. Cambridge Dictionary of Philosophy. Cambridge: Cambridge University Press

Isa H, Hassan P, Takim R, Mat M, Ithnin Z (2010). How adequate is adequate? A case of the adequacy in determining client requirements in the construction of four public hospitals in Malaysia. In: Proceedings of W092-Special Track 18th CIB World Building Congress. Salford: 248–261

Jelodar M B, Yiu T W, Wilkinson S (2016). A conceptualisation of relationship quality in construction procurement. International Journal of Project Management, 34(6): 997–1011

Jensen N, Wantchekon L (2004). Resource wealth and political regimes in Africa. Comparative Political Studies, 37(7): 816–841

Jorre J D S (1972). The Nigerian Civil War. London: Hodder and Stoughton Ltd

Kamara J M, Anumba C J, Evbuomwan N F O (2002). Capturing Client Requirements in Construction Projects. London: Thomas Telford Publishing

Kellert S H (1994). In the Wake of Chaos: Unpredictable Order in Dynamical Systems. Chicago: University of Chicago press

Killick D (2004). What do we know about African iron working? Journal of African Archaeology, 2(1): 97–112

Kometa S T, Olomolaiye P O, Harris F C (1995). An evaluation of clients' needs and responsibilities in the construction process. Engineering, Construction, and Architectural Management, 2(1): 57–76

Lenfle S (2011). The strategy of parallel approaches in projects with unforeseeable uncertainty: The Manhattan case in retrospect. International Journal of Project Management, 29(4): 359–373

Love P E D, Simpson I, Smith J, Regan M, Olatunji O A (2015). Understanding the landscape of overruns in transport infrastructure projects. Environment & Planning B, 42(3): 490–509

Love P E D, Smith J (2016). Toward error management in construction: Moving beyond a zero vision. Journal of Construction Engineering and Management, 142 (11): 04016058

Lundin R, Soderholm A (1995). A theory of the temporary organization. Scandinavian Journal of Management, 11(4): 437–455

Manning C, Fruehan R (2001). Emerging technologies for iron and steelmaking. Journal of Materials, 53: 36–43

Markus M L, Tanis C (2000). The enterprise systems experience — from adoption to success. Framing the Domains of IT Research: Glimpsing the Future through the Past, 173: 207–173

Matusevich M (2003). No Easy Row for a Russian Hoe: Ideology and Pragmatism in Nigerian-Soviet Relations, 1960–1991. Trenton: Africa World Press

McGregor D (1960). The Human Side of Enterprise. New York: McGraw Hill

Mohammad-Hasanzadeh S, Hosseinalipour M, Hafezi M (2014). Collaborative procurement in construction projects performance measures, case study: Partnering in Iranian construction industry. Procedia: Social and Behavioral Sciences, 119: 811–818

Murphy P (1996). Chaos theory as a model for managing issues and crises. Public Relations Review, 22(2): 95–113

Murray P (2003). The Saga of Sydney Opera House: The Dramatic Story of the Design and Construction of the Icon of Modern Australia. London: Routledge

Naoum S, Egbu C (2015). Critical review of procurement method research in construction journals. Procedia Economics and Finance, 21: 6–13

Norem J K (2001). Optimism and Pessimism: Implications for Theory, Research, and Practice. Washington, D.C.: American Psychological Association

Ogunlana S O (2010). Beyond the 'iron triangle': Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects. International Journal of Project Management, 28(3): 228–236

Olaniran O J, Love P E D, Edwards D, Olatunji O A, Matthews J (2015). Cost overruns in hydrocarbon megaprojects: A critical review and implications for research. Project Management Journal, 46(6): 126–138

Olaniran O J, Love P E D, Edwards D J, Olatunji O, Matthews J (2017). Chaos theory: Implications for cost overrun research in hydrocarbon megaprojects. Journal of Construction Engineering and Management, 143(2): 05016020

Olatunji O A, Ajayi S O (2017). Rurality, Nigeria's massification policy on access to basic education and turnover causations amongst teachers. Australian and International Journal of Rural Education, 26: 3–17

Oyeyinka O, Adeloye O (1988). Technological change and project execution: Evolution of Ajaokuta Steel Plant in Nigeria. International Development Research Centre, Canada

Packendorff J (1995). Inquiring into the temporary organization: New directions for project management research. Scandinavian Journal of Management, 11(4): 319–333

Pich M T, Loch C H, Meyer A D (2002). On uncertainty, ambiguity, and complexity in project management. Management Science, 48(8): 1008–1023

Pinto J K, Mantel S J (1990). The causes of project failure. IEEE Transactions on Engineering Management, 37(4): 269–276

Pinto J K, Slevin D P (1988). Project Success: Definitions and Measurement Techniques. Newtown Square: Project Management Institute

Priemus H (2010). Mega-projects: Dealing with pitfalls. European Planning Studies, 18(7): 1023–1039

Pryor R G L, Bright J E H (2007). Applying chaos theory to careers: Attraction and attractors. Journal of Vocational Behavior, 71(3): 375–400

Rausch E, Barber E, Warn J (2005). Leadership in project management: From firefighter to firelighter. Management Decision, 43(7/8): 1032–1039

Reichl L E (2004). The Transition to Chaos. Berlin: Springer

Reigeluth C M (2004). Chaos theory and the sciences of complexity: Foundations for transforming education. In: Proceedings of Annual Meeting of the American Educational Research Association. San Diego

Relle B, Gilge C (2013). How to successfully manage your mega-project. https://www.kpmg.com/US/en/IssuesAndInsights/ArticlesPublications/Documents/how-to-manage-mega-project.pdf

Robertson R, Combs A (2014). Chaos Theory in Psychology and the Life Sciences. London: Psychology Press

Schuldberg D (2011). In: Runco M A, Pritzker S R, eds. Encyclopedia of Creativity. San Diego: Academic Press

Sellnow T L, Seeger M W, Ulmer R R (2002). Chaos theory, informational needs, and natural disasters. Journal of Applied Communication Research, 30(4): 269–292

Shafritz J, Ott J, Jang Y (2015). Classics of Organization Theory. Boston: Cengage Learning

Shenhar A J, Dvir D (2007). Project management research — the challenge and opportunity. Project Management Journal, 38(2): 93–99

Shepherd D A, Patzelt H, Wolfe M (2011). Moving forward from project failure: Negative emotions, affective commitment, and learning from the experience. Academy of Management Journal, 54(6): 1229–1259

Smith J, Love P E D (2004). Stakeholder management during project inception: Strategic needs analysis. Journal of Architectural Engineering, 10(1): 22–33

Smith W K, Lewis M W (2011). Toward a theory of paradox: A dynamic equilibrium model of organizing. Academy of Management Review, 36: 381–403

Spencer S M, Norem J K (1996). Reflection and distraction defensive pessimism, strategic optimism, and performance. Personality and Social Psychology Bulletin, 22(4): 354–365

Tannenbaum R, Schmidt W (1958). How to choose a leadership pattern. Harvard Business Review, 36: 95–101

Turner J R (2008). Handbook of Project-based Management. New York: McGraw-Hill Professional Publishing

Walker D H (1995). An investigation into construction time performance. Construction Management and Economics, 13(3): 263–274

Williams P H (1964). The industrialization of nigeria. In: Proceedings of the Oklahoma Academy of Science: Geography. 215–218

Xenophon (1869). The Anabasis or Expedition of Cyrus and the Memorabilia of Socrates. New York: Karper and Row

Xie Y, Zilberman D (2014). The economics of water project capacities and conservation technologies. In: Proceedings of Agricultural and Applied Economics Association 2014 Annual Meeting

Zervas T, McMullan J T, Williams B C (1996). Developments in iron and steel making. International Journal of Energy Research, 20(1): 69–91