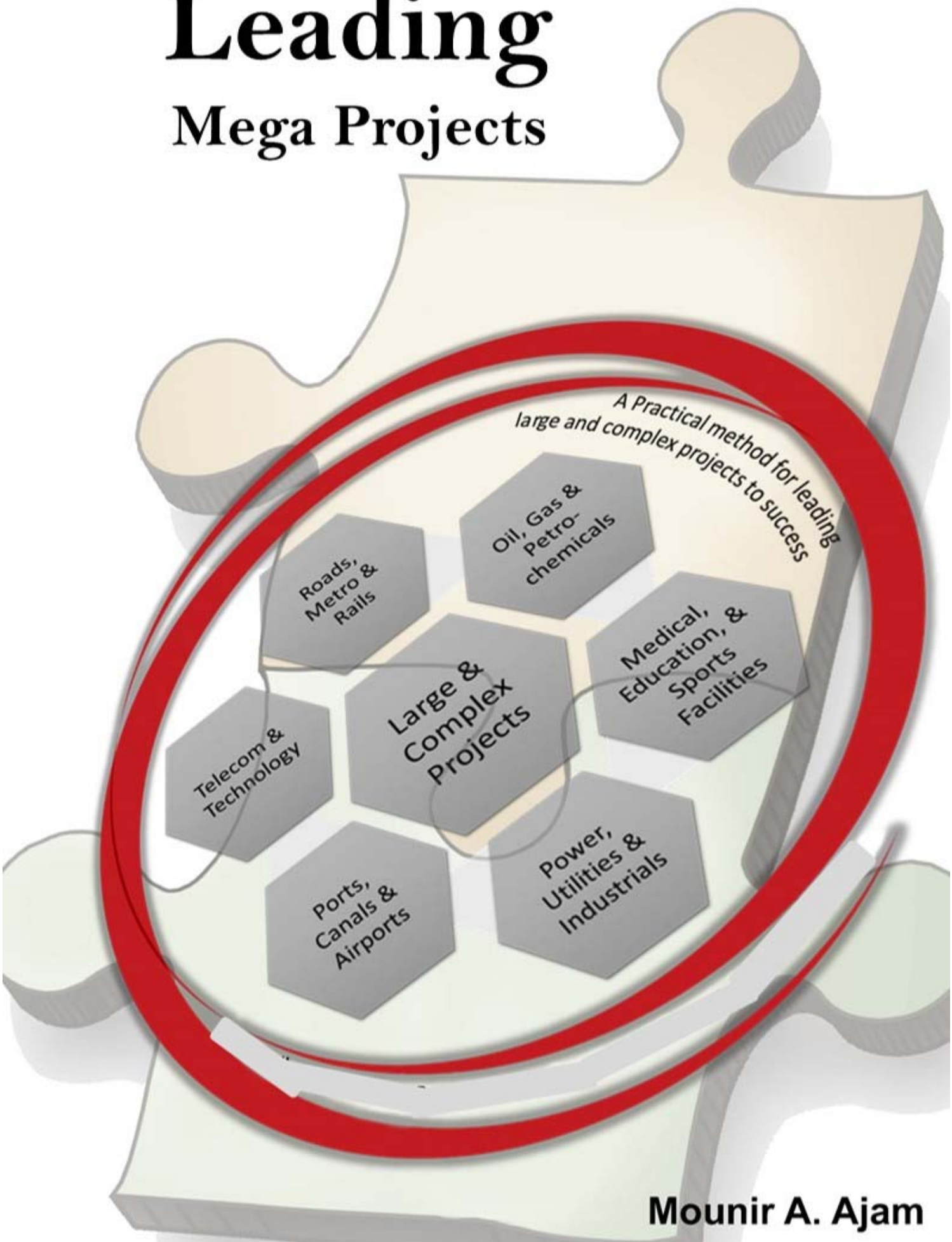
Leading
Mega Projects



Mounir A. Ajam

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About the Author

Mr. Mounir A. Ajam is an entrepreneur, author, speaker, coach, advisor, consultant, volunteer leader, and project management thought leader.

He is the author of *The Inheritance (a Story of Friendship, Community, and Project Management); Project Management Foundation*; *Redefining the Basics of Project Management*; *Applied Project Management*; and *Project Management beyond Waterfall and Agile*. He is also the author of two e-books series, *Adaptive Project Management, and Tailored Methods* series, and *CAMMP™ Case Studies & Simulations Series*, the latter series focuses on micro and small projects.

He is a senior executive with more than three decades of outstanding global and practical experience in capital project industries such as engineering, construction, petroleum, utilities, project management, and management consultancy. He has worked on projects worth billions of United States dollars in North America, Europe, Southeast Asia, and West Asia. His experience includes working small and multiple projects and large and complex projects, including megaprojects.

Mr. Ajam is a co-founder and the Chief Executive Officer of SUKAD LLC, a project management provider with registration in the United States, Lebanon, and the United Arab Emirates; founded in the UAE in 2004. Also, he has initiated **the Uruk Initiative** to generate interest among project management professionals from around the world to come together and form a technology startup. This startup is for the development of an online solution and platform for managing projects, with CAMMP™ as the core project management methodological approach. We envision one of the solution to use this book as a knowledge source for a megaproject version of the solution. The Uruk Initiative is in the startup phase, as we write these words.

Mr. Ajam and SUKAD play quite an active role in the project management community through various professional activities that are open to community members at no cost. He is heavily involved with the project management community at the regional and global levels. Globally, he has served in different roles

and capacities, including serving on the Global Advisory Group to the Project Management Institute (PMI®) Registered Education Provider program (2005 to 2007) and as a judge for many PMI® educational awards during the same period. He also served on the 2008 PMI® EMEA (Europe-Middle East-Africa) Congress Project Action Team. Mounir is a graduate of the PMI Leadership Institute Master Class (Class of 2007).

In West Asia, Mounir served on the board of directors for the PMI chapter in the Arabian Gulf, 2004. He led the effort to establish a PMI chapter in the United Arab Emirates. He also led the effort and established the Global Project and Process Management Association (GPPMA) in the UAE. He served as GPPMA board chairperson for three years.

Mounir is an advocate of project management and recognizes its strategic value. He contributes to project management growth by publishing professional papers and articles on numerous platforms. These platforms included PMI Congresses, *Construction Week Magazine,* Dubai Quality Group, DKV Experts Channel, PMForum.com, Wamda.com, and other publications. However, in recent years, he has been the principal author of the SUKAD Applied Project Management blog site (http://blog.sukad.com), and the Applied Project Management YouTube Channel (https://www.youtube.com/sukad).

For more information about Mr. Ajam, please refer to his personal page at www.mounirajam.com or connect with him on LinkedIn, https://www.linkedin.com/in/mounirajam/.

About SUKAD

SUKAD Vision is ***Project Management for All Aspects of Life!***

SUKAD Mission is ***Be an Agent of Change and a Catalyst for Development!***

SUKAD was established in Dubai, United Arab Emirates, in 2004. In 2012, SUKAD registered in Lebanon, and in early 2019 in the United States. From these legal entities, SUKAD has been providing services, mostly in ***West Asia*** but also on a limited basis in Africa, Central, and Southeast Asia. SUKAD is highly recognized as a leader in ***project management services;*** with a significant percentage of revenues acquired through repeat business and referrals from leading organizations.

With the USA registration, SUKAD has started to shift its focus to advanced learning, tailored organizational solutions, knowledge creation, knowledge sharing, media and publishing, and online learning and coaching. For more information about SUKAD, and SUKAD Knowledge and Innovation, please refer to www.sukad.com and www.sukadway.org, respectively. SUKAD, with Mounir, is leading the launch of the Uruk Initiative and SUKAD will be the largest shareholder in Uruk.

A Tale of Two Projects

1.1. Introduction

It is time to shift from literature review to actual case studies. In this chapter, I will focus on two case studies of megaprojects that have many similarities but the opposite outcomes. Unfortunately, we do not have all of the operational details to discuss the objectives' success of these projects (see textbox), but we know enough to present various aspects related to the management of these two projects. There are many lessons learned to understand and share via the comparison between these two megaprojects. We will also learn about the power and value of organizational project management and the influence of project management maturity and culture of the organization leading them.

Project Success

Earlier in the book we touched on project success and later we will dedicate a part of a chapter to this topic.

If you recall, we listed four dimensions of project's success which are: *product technical success*, *project management success*, *project delivery success* and *objectives success* (Ajam, 2017). The last two dimensions could not be assessed until post project completion; especially the one dimension on the success of the objectives.

In these two case studies, we do not have information post the projects' facilities completion to assess the third and fourth dimensions. Therefore, the focus here is mostly on project management.

In the next chapter, we will touch on a few other case studies but not to the same level of details.

For confidentiality reasons let us call these projects the Asian Project (AP) and the North American Project (NAP).

1.2. Common & Differentiating Features

It would be easier to compare these two projects in a table for a side by side comparison. Table 3 includes the common or similar features, whereas Table 4 presents the differentiating features.

Note 1. The overall venture and the project management team (PMT) was led by the 50% partner. However, the venture used an integrated team with members from the 40% partner and one or

two managers from the 10% partner.

Note 2. The overall venture and PMT for the greenfield facilities were led by the 60% partner, but this project also had an integrated team with resources from both parties. The PMT for the refinery work was by the 40% partner.

Table 1: Case Studies, the common or similar features

	The Asian Project	**The North American Project**
Industry	Petrochemicals	Petrochemicals
The facilities	New facility with a portion inside an existing refinery[1]	New facility with a part inside an existing refinery
Projects capital cost	About US$2 billion[2]	About US$2 billion
EPC schedule	About 33 months	About 36 months
Sponsoring organizations	Three companies: 50/40/10[3]	Two companies: 60/40
Management	See Note 1	See Note 2
Procurement	Global	Global

Note 3. The refinery work for AP was led by the lead partner (owner of the refinery), the one leading the overall venture. Whereas for NAP, the refinery work was led by the second partner (owner of the refinery) with the right for oversight from the lead partner.

Note 4. Since the project was on an island, where the refinery existed as well, it required reclamation work to extend the island to accommodate the new facilities. However, despite the reclamation, the site was still small with not enough space for all of the required labor (at peak) or lay down yard.

Note 5. The site was large and with open space to accommodate the necessary labor (at peak) and plenty of room for laydown yard.

Note 6. Basically, AP had owners in the United States, engineering in Europe, construction in Asia. Whereas the NAP had owners, engineering, and construction in the same country. One of the owners was also local to the site whereas the other owner North American office was in a different state/province.

[1] In both cases, the refinery was owned by one of the partners.

[2] Approximate cost in 2019 value.

[3] The 10% partner was a company partially owned by the 40% partner.

Note 7. Due to the site's limitation, island, and labor availability, among other factors, the project depended heavily on modular construction. Offsite facilities built on site but most of the onsite facilities (process units) were modular construction at two major offsite locations in neighboring countries. In other words, three construction sites were working in parallel; on the island and the two fabrications yards; more on this in the next part.

Table 2: Case Studies, the differentiating features

	The Asian Project	The North American Project
Refinery work	Note 3	Note 3
Project site	Island in Asia, See Note 4	Mainland North America, See Note 5
Dispersed teams (Note 6)	Main partners headquarters in the United States	Main partners headquarters in North America; but parent organizations in Europe
Estimating	All estimates[4] carried out by the project owner team	Not sure on the early estimate but the final estimate was partially based on the bid price.
Preliminary engineering[5]	Process (Onsite): licensor Offsite: internal project owner (different from EPC)	Same company as the EPC Contractor
Contract, commercial aspects	Reimbursable, cost plus incentives[6]	Fixed price, initially open book[7]
Contract, scope	One contract, EPC	One contract, EPC
Contract, responsibilities	Main contractor: EPCM Construction: joint venture (consortium)[8]	Main contractor: EPCM Construction: general contractor (single company)[9]
Engineering	Europe	North America; a few hours by car from the construction site
Construction	Modular, Note 7	Stick built on site; mostly

1.3. Performance Results

Before I share the performance results (do not peak), reflect on these two tables and the various conditions

[4] Conceptual/feasibility estimate; development/planning estimate; and final funding/definitive estimate.

[5] Also known as FEED; front end engineering design

[6] Incentives for cost, schedule, and safety

[7] During the bidding process, the project owner team had the right to see the estimated costs details, but upon contract award the books were closed.

[8] Contract issued from EPC contractor.

[9] Same situation, contract issued from EPC contractor.

of each project. Can you speculate which one had favorable features and factors that should produce success and the one with more challenging conditions and factors that could lead to failure? One hint, one project was successful and one a failure. Keep in mind, in this case, the success and failure are for one dimension, project management, and not the objectives success or the other dimension.

Ready for the answer?

If you are like the vast majority of my audience when I discuss these projects in conferences or events, the vast majority would say the North American Project had the favorable contribution factors, and the Asian Projects had the challenging factors. Consequently, NAP was a PM success, and AP failed. A few contrarians would say the reverse, and they would be correct. NAP failed, and AP succeeded, project management wise.

Here are some of the numbers.

1.3.1. North American Project

The final capital costs were more than 110% of the approved budget. This number did not include the operational readiness work since that team was part of a different budget and although we do not have the details, they incurred significant challenges due to schedule. In term of schedule, the project was at least nine months behind the original schedule of 36 months; so about 25% delay in term of duration.

The above performance affected production, due to the nine months delay, and the number floating around was a production opportunity loss of about $2M per day[10] of delay. You can calculate the overall impact of 270+ days delayed.

1.3.2. Asian Project

The final capital cost of the project was at 98% of the budget, an underrun. However, a disclaimer is needed

[10] Today's value of money

here. The project was done pre-Euro era. The project was funded in US dollars, but all expenses were in seven different currencies due to the teams dispersed between three countries and procurement using a few of the leading currencies at that time. It happened that during the project, the US dollar experienced heavy pressures and reduced valuation in comparison to the other currencies, which led to a 12% impact on the overall project cost. This risk was owned by executive management and the management reserve and was not allocated to the project management team.

In term of schedule, the project was completed about one month behind the original date; technically about a 3% time extension, which is considered success since it is within the parameters. As you recall, this project was performed using a cost plus incentive contract (incentives for cost, safety, and schedule) with a cap on the amount of the incentive. The contractor earned most of the incentive and was also awarded a "replicate project" in a different country.

1.4. Contributing factors

What contributed to the above performances? I will list the challenges and opportunities for each project first, then offer our assessment.

1.4.1. NAP Challenges

The following are some of the significant challenges facing the North American Project; not in any particular order.

1.4.1.1. PMT Size & Competence

The project team size was too small for this particular projects and lacked the necessary competence[11]. In other words, the project owner team was not adequately staffed. Merrow had stressed the need for

[11] Please note an earlier discussion on Mounir the plumber. By saying this team lacked the necessary competence it is not a criticism of the people; only stating the fact that most of the team members did not have the necessary level of project management experience and not a single one had megaprojects experience; except a contract employee hired during the engineering stage.

adequate staffing and indicated that a lack of proper staffing has negative consequences on the project outcome (Merrow, 2011)[12]. Why was not the project adequately staffed? Here are a few reasons:

- Lack of resources and strong project management function in the owners' organizations (both partners). The organizations did not enough project management professionals to assign to the project.
- Overconfidence or over-dependence on the fixed price culture is thinking that most project risks have been transferred to EPC contractor. This point related to the challenge identified earlier as the 'illusion of risk transfer.'
- Most of the members of this PMT had engineering experience (not project management) and on small projects (not large projects or megaprojects). The largest project handled by either of owners[13] before this project was about 20% the size; so magnitude of scale.
- There was no dedicated project control staff, owners did not see the need until trouble started to show, at about 35% engineering progress. At that time, the contractor had started to mobilize the construction team; too early.

1.4.1.2. Early Mobilization of Construction

The EPC contractor mobilized the construction team to the site too early, where there was not enough engineering work done to sustain the team level of effort. Lack of enough work affects team productivity and morale, especially when these challenges appear at the start of the

Project Control

In this context, project control refers to scope, cost, and schedule control, which also include change management, among other related aspects.

Organizations with good project management maturity view project control as a critical function on projects; it is like the navigator role on an airplane or ship without proper navigations, on a continuous basis, the team would not know where they are or how to get where they need to go.

[12] This was one of the challenges identified in the last chapter.

[13] The European parent organizations of the project owners must have done large projects but not their North American subsidiaries.

work. In a way, almost upon the start of the project and you would be behind schedule and burning cash since the construction contractor had already mobilized. This was one of the factors that led to disputes between EPCM and the construction's general contractor.

1.4.1.3. Lack of Integration

Another one of the challenges related to the 'EPCM and C' contractors was the lack of full integration in term of strategy or execution approach. Here is a story to explain. The construction contractors progress measurement system and construction approach are that they use weekly work packages and they would not start working on a work package until all materials are available. This way on a Monday they start work, by Friday evening they should be done, and quality control will come and verify completion. If the work is not 100% done, the contractor will claim zero progress on that work package; so it is 0 or 100. The EPCM approach was different, and they did not subscribe to this approach, which may seem OK, but it was not. The scenario exploded due to shoes; not the shoes you put on your feet but piping shoes. Since process projects have a lot of piping on pipe-racks, the use something called shoes where the pipes rest on, which is necessary for thermal expansion and contraction of the pipe. The EPCM ordered the wrong shoes, which means the construction either had to delay the work until the shoes are replaced, or will have to install the pipes and later on they will come back lift the pipes so they can put the shoes. This is double work and affects the sequence of work and productivity.

There were other issues similar to this one, but maybe this one was the cutest because the EPCM dropped the shoes, so the C maybe had to throw the shoes at them.

The above might be symptoms, whereas the root cause is lack of proper planning and alignment of the implementation approach.

1.4.1.4. Schedule

This challenge here relates to the previous one, but we separate due to criticality. The contract between the project owner and EPC contractor clearly mandated the need to have ONE integrated schedule

between the EPCM team and Construction Team. However, in reality, they did integrate their project planning and control functions, including scheduling and schedule control. Consequently, the construction contractor was following their own schedule, which appears to align at the high-level but it was not. Since the project owner did not have any project control or a schedule expert during the contract negotiation and even after engineering and construction starts, the owner's team did not discover this crippling errors until the damage was done. After that point, it was a recovery plan and re-baselining every six to eight months.

1.4.1.5. Not Learning the Lessons

The best way to explain this is via another story. At the time of the project, China was booming and many European and North American manufacturers, were shifting some of their manufacturing operations to China. This project was buying valves from one of these companies. By a convenient coincidence, before placing the order, an alert came from a petrochemicals conference that flanged valves from this factory had defects. The project owner team passed the message to the contractor, the contractor chose to dismiss it, "this is a company with a good reputation," was the EPC contractor position. The owner felt this was a risk, they asked the contractor to reconsider, but since the contract was fixed price, they could not mandate a change unless they would be willing to pay extra. To mitigate the risk, the owner requested extra valves for quality testing (destructive tests).

What happened?

Sure enough, all tested valves were defective, which it goes without saying the impact in term of schedule. Sure, the owners did not pay the extra cost of replacing the valves but paid dearly in delays.

1.4.1.6. Change Management

I will keep this part short with a high-level view. After contract award, the project owner deleted a

complete process unit[14] with a cost that is about a few percentage points of the total cost. Many other changes added costs. If one assessed the total cost impact of changes as a percent of the total, the result was about 5 or 6%; which appear to be normal or acceptable. However, to assess impact, we do not use mathematical assessment (the addition and deletion canceling each other). The true impact would look at the absolute value of the additions and deletion, which in this case would have resulted in more than 10%, which would have a significant impact on productivity, cost and schedule as CII have shown in their various best practices. Not to mention the cumulative impact of changes. More on this concept in the leading practices chapter, later.

In parallel to the above, the project owner added a full cogeneration unit, but to minimize the impact to the main EPC contractor, it was awarded to another contractor. This action led to another layer of coordination and interface, especially with two contractors working on the same site and possibly getting into each other way.

1.4.1.7. The Results

All of the above challenges, especially the ones between the main contractor and construction contractors, led to dispute and claims. The dispute and claims ended up escalating to the project owner, and became lack a blackmail scenario, "pay us, or we will have to slow down the project," which is what ended up happening and resulting in nine-months delay. Here, I cannot help it reflect on the challenge of the fixed price culture, the illusion of risk transfer, the competence and capacity of the project owners. Almost all of the challenges mentioned in the earlier chapter were invited by Murphy to visit him in his new house. Initially, Murphy had the master bedroom and now claiming the whole house.

1.4.2. NAP Opportunities

As we highlighted earlier, in the tables, the project on land with enough space, the site was only two hours

[14] For those who are not familiar with process industry, a major petrochemical plants would consist of many process units, typically in a train of units.

by car from the engineering office, the construction contractor was well known and with a good reputation, and the EPCM contractor was part of a global conglomerate. The project did use 3-D modeling to help in the design work. There were end-users, operation representatives involved but here the team was also small, like the PMT.

There were other opportunities and positive factors. However, the dominance of the challenges overshadows the opportunities.

1.4.3. AP Challenges

For the Asian project, the story is almost a 180 degree from the above. Here are the major challenges, without expanding the details:

- The project was put on hold after discovery phase (feasibility) since the partners had not finalized their agreements (refer to Shaping in the tailored approach later in the book), and felt that the economic conditions and down cycle.
- The front end definition work (definition stage, preliminary engineering) was in two locations, the project owner home offices working the definition of the offsite and utilities and a licensor site in a different state/province.
- The engineering and construction were continents apart.
- Despite the island reclamation work, the site was still too small to accommodate traditional, stick-built construction.
- The modular construction is an opportunity but with significant secondary risks, such as shipping risks, construction sequencing risks, among other complexities. For example, the insurance company insisted on having representatives present every time the team was loading or unloading one of the huge modules, and there were close to 200 major modules.
- The currency fluctuations which we discussed earlier.
- Lack of trust between the EPC contractor and project owner because the budget was mandated by the owner.

- Onsite work, about half of the labor resided on an accommodation camp on site, but the other half, management team, technicians, etc. had an hour, two-way commute every day just from the shore to the site; not including commute on the mainland.
- Lack of safety culture among the construction labor, yet the project owner subscribes to strict safety management rules and included a safety incentive.
- There were many other challenges but what we list here would be considered the major factor.

1.4.4. AP Opportunities

We will list the opportunities here, and I will also be brief[15].

- Around the world, many project owners shy away from cost-plus, reimbursable cost contracts. In West Asia, where I had been working for the last couple of decades, cost-plus is rare, if it exists. Merrow states that fixed-price contracting is almost exclusively used in West Asia[16] on megaprojects (Merrow, 2011). The cost plus incentive contract was indeed a challenge initially, however, the PMT was able to convert into an opportunity and allowing the team to build relations and work in an integrated way. The primary catalyst to overcome this challenge was team maturity and transparency.
- Due to the above, the project owner team and contractor team worked in a highly integrated way, below the senior management. What we mean here is that each party had a project director, engineering manager, construction manager, and project control manager. However, the second tier, the resident engineers, project control, and other staff worked closely together in total transparency. What helped here is the nature of the cost-plus contract where everything was open and the incentives. The contractor management promised to pass part of the incentives to their

[15] I put more emphasis on the challenges of the North American Project, to explain what could go wrong. I also want to put a great deal of emphasis on the good things, to be positive but to also learn. However, Section III is mostly dedicated to what should be done and Section IV offer the tailor approach. In other words, we are not diluting the focus here.

[16] What many call Middle East.

staff.

- Modularization was a significant factor for success despite the complexity and secondary risk. For a starter, instead of cramming thousands of workers on one site, they were spread to three sites, and two of them were fabrication yards with high skill labor and plenty of space. The net result of this action is improved productivity and faster progress. However, a best practice like this does not come easy. The team had to do significant planning, including sequencing of the installation of the modules that had to be installed in a certain sequence. The sequence mandated fabrication and delivery of the modules in the right orders, due to lack of laydown space on the island. These requirements kept impacting the work backward, which meant engineering had to progress in the right sequence to support the construction sequence. There were many other actions needed to ensure proper fit-out.
- The project team extensively used best practices, such as constructability reviews, zero incident techniques, team building (internal and external), change management, front end planning among other factors. The owners were members of CII (the Construction Industry Institute); also utilized the benchmark services of IPA (Independent Project Analysis).
- End-users involvement very early. For example, the product quality manager (the one that would be in the operating organization responsible for the chemicals products), the maintenance manager, and other key personnel were in the engineering office from day one; start of engineering.
- Implementing project control and change management even during the front end; before full funding and EPC awards. To enable project control during this phase, the team used the budgetary estimate (the second estimate on the project life cycle; post-contract award, the team used two steps change management process via the use of a change control board. All changes were submitted to the board and the board will either reject or approve for assessment only. Once the change assessment is done, the board will make the final recommendation to approve or reject.
- There were numerous other actions, which would take too long to list and discuss.

1.5. Performance Conclusions

I think it is clear now why the Asian Project was a project management success and NAP failed. I will list the vital contribution factors here and close with a conclusion.

- The use of best practices (from CII and IPA). For AP, the partners were quite familiar with both CII and IPA and capital projects best practices. Further, they did use many of these practices. On the other hand, the partners of NAP were not as familiar and did not explicitly implement any of these practices.
- The team size and experience. I had mentioned the team size for the North American Project, which was inadequate. On the other hands, the PMT for AP included many highly skilled project management staff (gathered from many countries where the lead partner operates) and also had adequate numbers. For example, both projects were about the same size, but the PMT for AP was more than three times the size of the NAP team.
- Senior stakeholders' involvement: in both projects, there were involvements at the vice president level, but even here there were significant differences.
- Communication and reporting: on one project, the monthly report was an email, on the other project, the report was extensive with highly useful information. I am sure you can guess which report belonged to which organization.
- Flying blind (project control): I had touched earlier in a textbox on the role of project control. NAP management did not see the need until the damage was done and at that time they hired a contract employee (external consultant) to join the team. In contrast, AP had a project control team of three people on the owner side and about 10 on the contractor side, working together. Also, one of the owner project control team members was the one leading the estimating effort, so this person knew the project intimately.

I can list many more factors, however, if you analyze them, you would likely come to, or agree with the conclusion I am sharing in the chapter closing.

1.6. Chapter Closing

As a champion of the need for standardization and project management methodological approach, I hope you do not take what I am about to say here out of context.

Both projects followed a project management method or a project life cycle model with stage gates, that is appropriate to capital projects. The same is true for many of the projects analyzed by IPA, CII, or the various references that we have reviewed. Yet, we have seen the different outcomes. In a way, it is like you give a new driver a race car only to drive into a wall. In other words, methods, tools, cars, are not enough to win the race. Putting the race car in the hands of a seasoned and expert driver, could win the race or at least be globally ranked. The same thing in project management, all project life cycle could look the same but what is under the hood?

In the project management context what is under the hood is two things. One it is the organizational project management system, which is the governance, policies, methods, procedures, guidelines and all of the technical components to support the management of the projects and programs. With this OPMS we need the organizational knowledge base, competence, and capacity to lead megaprojects. All of these are part of what is under the hood, or maybe the brain of the organizational project management. All of these could or should lead, to a higher level of project management maturity. Notice I said could and should, how can we change this to would lead? That is culture! The culture to excel via the proper due diligence, shaping, planning, professional development, competence, leadership, and so on. Culture is the heart of organizational excellence.

Therefore, project management maturity and organizational culture are the brain, heart, and soul of megaprojects excellence. These two factors, starting at the top of organizations and throughout the various level and spread of the organization, are what make the difference. They would be our indicators and triggers to ensure we adequately staff our projects and organize them for success[17]. Maturity and

[17] We dedicate a chapter for organizing project for success later.

culture are the results of building the right project management function that has the right level of competence and capacity[18]. They would empower organizations to seek the learning and leading practices from organizations like CII and IPA[19].

In the end, as a champion of methods and tailored approaches, organizations must build and sustain their organizational project management system and enforce it by building the maturity and the right culture.

[18] There is also a dedicated chapter for this later.

[19] You guessed it, there is a chapter for this as well.