

## **The Panama Canal Expansion Project: A Historical Review and Lessons Learned**

Karolina Zielinski  
Penn State University  
Black School of Business  
The Behrend College  
Erie, PA. USA  
koz5015@psu.edu

### **Abstract**

As globalization and demands increase, maritime transport must achieve efficiencies, be in tune with technological advances, and make continuous operational improvements to stay competitive in the market. This was no different for the Panama Canal. The canal enjoyed many years of success from its original opening in 1914. However, the need for expansion intensified as ships grew in size. A canal expansion is no small undertaking and effective project management practices were as critical to the success of the project as the cement used to expand it. Projects, regardless of size, are not resistant to challenges or roadblocks. Such was the case with the Panama Canal Expansion. Although the completion of the project was celebrated and the use of the expanded canal is beneficial to shippers and the Panama region, the canal expansion experienced significant cost and schedule overruns, as well as construction issues and contractor disputes during the life of the project. This paper describes the background of this mega project, including its objectives, a breakdown of estimated costs, project timing, a review of stakeholders, and an evaluation of the project's risk analysis. Additionally, this paper includes a post-project review which analyzes the project's results, observes the lessons learned, and provides recommendations from established project management techniques.

**Keywords:** *Panama Canal Authority (ACP), stakeholders, risk, expansion project*

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### **Introduction**

Considered one of the greatest works of engineering in history, the Panama Canal, completed in 1914, is a waterway connecting two major oceans: the Atlantic and the Pacific oceans. Depending on the destination, ships utilizing this canal avoided the need to navigate around South America's

southernmost tip, Cape Horn, which reduced travel time and cost significantly. It was a revolutionary solution in expediting transportation of cargo housed in thousands of shipping containers (Cho, Padelford, Gordon, Bray, & Worthington, 2018).

The canal has had various governmental “owners” since its implementation. Currently, and since the last day of the year in 1999, control is under the Republic of Panama, with the canal’s direction governed by the Panama Canal Authority (Autoridad del Canal de Panamá/ACP), an autonomous legal entity. Management of the canal includes responsibility for the administration, operation, preservation, maintenance, and upgrades to the canal (Cho, Padelford, Gordon, Bray, & Worthington, 2018).

The canal uses a system of locks where ships enter in either direction through multiple chambers which function like water lifts, raising the ships from sea level to the level of Gatun Lake. This allows the ships to sail through the Continental Divide. Larger vessels are guided by locomotives using heavy steel cables on both sides, which keep the ships centered in the lock through its controlled transit. It takes, on average, 10 hours for a ship to cross the canal from one end to the other—from Cristobal at the Atlantic end, to Balboa on the Pacific side, and vice versa. The traffic within the canal seems to vary with the rise and fall of the global economy. In 2013, the canal experienced transportation of approximately 213 million metric tons of cargo and “carries more freight than ever before because the average size of vessels has increased.” (Cho, Padelford, Gordon, Bray, & Worthington, 2018, para. 13).

### **The Project**

Years of success, keeping in mind the continuous operational improvements on construction throughout the years, were valued by Panama and its stakeholders. However, the need for developing a solution to accommodate increasingly larger ships to stay competitive in the international market was intensifying. The largest ships to have passed since the beginning of the canal’s existence were called “Panamax”, with a cargo capacity of 5,000 TEUs (Twenty-Foot Equivalent Units). The introduction and use of “Post-Panamax” ships were beginning to be more prevalent and these ships were able to carry a cargo capacity of 13,000 TEUs. These expansions in size made the ships too large to pass through the existing canal. In 2006, the Panamanian government, with support from the Panamanian people, finalized the decision on expanding the existing canal and building two lock complexes, calling it the “Panama Canal Expansion” or the “Third Set of Locks Project”. The project, set to commence in

2007, would increase (double) the waterway's capacity, allowing these bigger ships to pass through a newly created third lane of traffic (Cho, Padelford, Gordon, Bray, & Worthington, 2018).

Per the *Special Purpose Audit Report on the Panama Canal Expansion Program*, drafted by Deloitte, Inc. in September 2007, the following were the program's objectives:

“(1) to achieve long-term sustainability and growth for the Canal's contributions to Panamanian society, through the payments PCA makes to the National Treasury; (2) to maintain the Canal's competitiveness as well as the value added by Panama's maritime route to the national economy; (3) to increase the Canal's capacity to capture the growing tonnage demand with the appropriate levels of service for each market segment; and, (4) to make the Canal more productive, safe and efficient.” (Deloitte, Inc., 2007, p.7).

The expansion project had an estimated total cost of 5,250,000 Panamanian balboas (one balboa is equivalent to one USD), initially broken down by the following expenses (see Figure 1 below):

#### Cost breakdown of Panama Canal Expansion

Description	Estimated Amount
Construction of two new locks; Atlantic and Pacific	B/. 2,730,000
Water saving basins	620,000
Construction of channels	820,000
Improvements to existing navigational channels	290,000
Water supply improvements	260,000
Inflation during the construction period	530,000
<b>Total</b>	<b>5,250,000</b>

Figure 1: Figures obtained from the 2007 Special Purpose Audit Report issued by Deloitte, Inc.

The project was to take up to a maximum of eight years and was to begin in September 2007, with operations to commence in 2014, just in time for the canal's 100-year anniversary. Within the Panama Canal Authority's (ACP's) Proposal for the Expansion of the Panama Canal, a program schedule was developed using “a complex risk analysis model, and includes sufficient and adequate time contingencies to cover possible delays and interruptions” and “includes an appropriate period for commissioning, personnel

training, inspections, testing of operations, and commencement of transit operations.”  
(Panama Canal Authority, 2006, p.7).

The expansion project involved numerous stakeholders, both internal and external, who impacted the project’s success to varying degrees. The internal stakeholders included the major governmental entity involved, the Panama Canal Authority (ACP), and the sub-contractors, the Grupo Unidos por el Canal (GUPC), which was a consortium made up of four construction and dredging companies from Spain, Italy, Belgium, and Panama. Specifically, the ACP had the role of managing the project from beginning to end and the GUPC was responsible for executing the construction work on the main component of the project—the lock complexes. The external stakeholders included the customers, that were the various applicable international shippers and ports most impacted by the canal’s expansion, and the public, who included the people of Panama and environmental groups, to name a few (Guardia, 2015, pp. 34-37).

Within the proposal for the expansion of the Panama Canal, the ACP analyzed competition from other routes, both current and future. For instance, the Suez Canal is preferred by shippers originating from South and Southeast Asia; not only that, shippers are able to enter this route using post-Panamax vessels. The expansion program realized the need to gain and maximize its competitive advantage by offering a route which would handle these massive vessels to keep up with growing demand for world trade, as well as prevent other competition from entering the market (Panama Canal Authority, 2006). The ACP also analyzed technical and engineering aspects, including its capacity challenge, which considered the difficulty that the canal may face when volume of traffic increases. The ACP evaluated the maximum workable capacity that is feasible, without jeopardizing the level of quality, reliability, and service (Panama Canal Authority, 2006).

Aon PLC, a global firm that provides risk consulting, completed an analysis of the top risks associated with the project, and narrowed them down to the ten risks which would have the most material impact, in no particular order:

1. Channel disruption
2. Inefficient organizational structure
3. Environmental concerns

4. Poor communication
5. Project delays
6. Cost overruns
7. Change in project scope
8. Recruiting and retaining skilled labor
9. Employee safety
10. Inaccurate revenue projections

(Aon Enterprise Risk Management, 2005)

A project management office (PMO) was created within the ACP during the expansion program to consolidate talent—thus allowing for faster decision-making and project execution. The largest risk, per Ilya Marotta, executive vice president of the Panama Canal Authority, was “scope creep”, which is the result of continuous additions and modifications to the original scope plan. To address this, a robust system was in place to request any changes which could impact the cost and timing of the project. Essentially, only major and warranted changes were considered and approved. Weekly meetings of the project’s progress, including tasks which needed to be completed, helped to keep the project on track from a schedule and cost perspective (Parsi, 2016, pp. 56-58).

### **Project Results and Post-Project Review**

The launch of the newly expanded canal, costing at least \$5.25 billion (final cost is not yet confirmed as there were hundreds of millions of dollars/balboas in disputed costs) occurred on June 26, 2016. This was 18 months behind schedule from the original plan, which was originally set for 2014. The canal expansion resulted in the construction of a new set of locks and formed a third lane of traffic, and as intended, increased “the waterway’s capacity to meet the growing demand of maritime trade using larger vessels.” (Panama Canal Authority, 2018, para. 2). Although this primary goal was attained, it was not achieved without several hiccups and failures in the process. The major causes of the cost overruns and delays in project completion included lengthy negotiations, flawed concrete, water concerns, and disputes between the ACP and the GUPC consortium.

The ACP needed to select subcontractors for executing the canal’s construction via bidding. There were three major construction groups (each comprised of multiple companies) which finalized their

bids in March 2009, after 15 months of negotiations. The Sacyr consortium, led by Sacyr Vallehermoso, a nearly bankrupt company, expected to lose. Shockingly, it had won. Not surprisingly, this created suspicion, suggesting that some political and family ties may have played a part in influencing the selection process. For instance, a company within the Sacyr group was owned by the canal administrator's family at the time. Additionally, Sacyr made a low offer of \$3.1 billion, approximately a billion dollars below the next lowest offer. One can automatically trigger concern over something that is a "deal" rather than a realistic bid, as in this case. The consequence of this was the questionable durability of the concrete used. In the summer of 2015, the concrete in one of the Pacific locks unexpectedly suffered cracks due to extreme pressure causing water leaks. To fix this, the decision was made to insert steel reinforcement bars (Bogdanich, Williams, & Méndez, 2016). The misfortune was blamed on the ACP "cheaping out when selecting the contractor to handle this massive and massively important project" because "when you buy cheap, you get what you pay for" (Universal Cargo, 2015). As with the Superconducting Super Collider (SSC) case, there were politics interfering with the decisions being made that should not have been made in the first place. Managerial decisions should not depend on political interests.

Prior to the concrete pouring, there was a dispute between the GUPC and the ACP regarding the quality of concrete. The materials used to make the concrete did not have the properties necessary for sturdiness and reliability (Bogdanich, Williams, & Méndez, 2016). The dispute resulted in the GUPC consortium seeking "\$463 million from the canal authority to cover its losses from the long delays and poor-quality basalt. By February 2014, the hostility was such that the consortium simply stopped work, citing "the customer's repeated unwillingness to act in the spirit of collaboration." (Bogdanich, Williams, Méndez, 2016, para. 108).

The organizational structure of the expansion project had the Republic of Panama sitting at the top, with the ACP directly underneath, in collaboration with CH2M Hill, a global firm assisting the ACP with program management. The GUPC consortium was also part of this organizational structure, together with a team they created called the CUPC Works Management Team. The CUPC team reports directly to the GUPC, who in turn report to the ACP, ultimately reaching the President of the Republic of Panama. It is clear the structure makes up layers of an environment which is both tremendously political and fairly diverse (Guardia, 2015). The structure encompasses a matrix organization where groups/firms are organized by functions and project teams. Unfortunately, given the project size and

the politics associated with its completion, the organizational structure was not ideal. Though the ACP included a project management team of their own, they were the ultimate controller of the resources and decision-making. There was, it seemed, insufficient collaboration between the ACP and CH2M Hill in creating an environment with equally-distributed authority. A stronger matrix structure would place the authority in project management parallel to the functional departments, and thus would encourage closer collaboration (Pinto, 2016, p. 54-55). We will never know if objective, non-political input from CH2M Hill could have impacted the selection of the winning bidder.

The new lock design in the third lane of the canal requires tugboats to position and escort the large ships in the canal. Prior to the expansion, the canal used towing locomotives. What is of concern is the size of the locks, which tugboat captains have noted provide little margin for error and do not allow for confidently positioning the vessels safely without damage. The ACP even confirmed that the locks may be too small. According to union representatives, the ACP did not include input from canal workers during the planning phase. Additionally, adequate training on the precise maneuvering of tugboats was not provided, even though the canal workers were asking for it up until the day the canal was launched. Only once the canal expansion opened did training begin (Bogdanich, Williams, & Méndez, 2016). Training the pilots of the tugboats, as well as the other canal workers, should have been a priority and should have taken place prior to the arrival of the first large vessel in the expanded canal. Any preparations to mitigate the risks of vessel and canal wall collision, ineffective tugboat performance, and overall safety of the pilots should have been executed by the ACP.

### **Lessons Learned and Recommendations**

Although the expansion project included an analysis of the most critical risks, there seemed to be a lack of mitigation strategies. Specifically, the situation regarding the leaks in the concrete, or the construction of other faulty components, was not considered a risk for the ACP when it should have been. Though this was essentially considered a modification to an already developed canal, technical risks should not have been overlooked, especially considering how long ago the initial canal was constructed. An additional technical risk was the learning curve experienced by the tugboat pilots. A measurement and examination of all types of risks, including mitigating strategies and actions, should have been included in the planning phase.

Communication is a vital factor in determining the success of a project. Communication should have been increased and more transparent among all parties involved, especially with those carrying out the operations of the canal, the pilots, the canal operators, and other stakeholders. These individuals, with their years of experience working on the canal, understand the requirements of a well-functioning canal. Along those lines, more attention should have been spent on the cultural differences among the groups involved, especially within the GUPC.

A low bid may not produce the best value. The offer made by the Sacyr consortium should have been a red flag and should have triggered further investigation by the ACP on the quality of their past construction projects. Resources and technology used in a project should be critically evaluated, especially those of significant importance to the functionality of the canal—including the concrete.

Considering the vast size of this project and the number of internal and external groups involved, the risk of disputes is almost inevitable, which can consequently cause delays. Untimely, an ill-conceived project can not only increase costs and create a missed opportunity for revenue, but may not allow for an opportune time for the finished project to launch. Specifically, the canal missed out on taking advantage of the two years the Post-Panamax ships have been in existence since the time the canal was ready for service. It is critical for projects to adjust their completion date and/or their scope as technology advances. If the canal was already two years behind, perhaps the expansion should have been greater in scope to accommodate even larger ships that may be built in the future.



There are times when simply a change in leadership can inspire results. The aforementioned dispute caused hostility, low worker morale, and project delays. The new leader, Giuseppe Quarta, took over the role as chief of the GUPC and when he arrived in Panama in early 2015, he reassembled his workers and was able to get the project back on course. He defined what still needed to get done and motivated his team towards the finish line (Bogdanich, Williams, & Méndez, 2016).

A commitment to project kick-off at the execution phase, of course, when all necessary planning is complete, will help to meet the planned schedule. Dredging began in 2007, but actual construction of the locks did not begin until 2009, after a very lengthy and political process of negotiations and bidding.

The presence of a robust approval system to address scope creep concerns was something the canal expansion project did right and should continue to have in future projects. With a project of this size, only major and necessary modifications to scope should be considered based upon upper-level review. Additionally, the PMO's weekly meetings, albeit possibly commencing later in the project than it should have been, helped to discourage ambiguity and keep the project on track towards the finish.

### **Benefits**

The benefits of the expansion program impact the many aforementioned stakeholders. For the country of Panama and the Panama Canal Authority, the expansion increases transits, transit speeds, and ship capacity. As a result, it was possible to increase the toll costs with these added benefits, which has increased toll revenue and has boosted the overall economic activity in the Panama region. The benefits experienced by the shippers include lowered costs and time since they are able to carry significantly more cargo than before. As for carriers and ports, it is too soon to tell the benefits (USSA Global, 2016). "It is entirely possible that the canal will work as intended: that water will be found, that the concrete will last, that the big ships will come, and that the Panamanian people will celebrate their historic accomplishment. That is certainly the hope, even among those who have privately or publicly expressed concern about the canal's future." (Bogdanich, Williams, & Méndez, 2016).

## **Conclusion**

The intentions of the Panama Canal expansion were to address the increasing demand and rise in globalization in the maritime industry. Specifically, the purpose was to achieve sustainability and growth as well as to increase the canal's capacity, efficiency, and safety. The project required robust planning and a strong risk management program; it was critical for a project of this size to effectively and comprehensively plan for unknowns. Although one can argue that the project was appropriately planned for (this paper did not dive into all the planning details), it appeared, with the research conducted, that the project lacked a strong risk management program to adequately address risks, including the probability and impact of those risks. An effective risk management program includes risk mitigation strategies and anticipated remediation plans if issues were to arise. The cost and schedule overruns the project suffered were the most significant setbacks. The existence of a risk management program may have addressed the project's cost and schedule overruns more productively. Additionally, improvements in communication, organizational structure, quality of materials used, conflict management—to name a few—would have positively impacted the success of the project.

While simultaneously recognizing that the built locks may be too small (per the ACP) and pondering over the canal's future, was the canal worth expanding, considering that the size of ships will increase with time? In other words, will this expansion already soon be obsolete as the canal faces struggles to accommodate larger ships? Aside from its significant hiccups and failures, the expansion project had its moments worth celebrating. However, with these questions in mind, it is difficult to determine if the Panama Canal Expansion was large enough in scope, and if it was executed at the most opportune time.

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