

Project Management Evolution to Improve Economic Success of Infrastructure Projects

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Abstract

This document provides an overview of the infrastructure megaproject industry (IMPI), the financial implications of cost and schedule overruns, and the trend towards the future impacts these may have on the global infrastructure sphere. Definitions of project management and change leadership provide a framework for understanding the relevance to the subject matter. A sample of methodologies and best practices for change leadership and project management indicate the breadth of diverse approaches available in the industries. A cause analyses of megaproject overruns with accompanying solutions suggests areas of industry improvement, supported by first-hand experience by the author. The solution also indicates that change leadership should be included as a best practice methodology for Project Managers to utilize instead of a key influencing solution. The paper concludes that the IMPI must evolve to be able to deliver the infrastructure required in the future. This evolution will be through improving and expanding knowledge, experience and intellectual capital of public and private industry Project Managers while determining some next steps to progress the industry.

Keywords: Infrastructure, Megaproject Management, Project Management

1. Introduction

There is a knowledge gap in the infrastructure megaproject industry (IMPI) in the area of project management as it exists today. Past trends show on average, an 11% loss in major or megaprojects, across all industries, due to poor project performance. Analysis of past megaprojects in the infrastructure industry indicate project management as a contributing factor attributing to the losses. Project management relies upon methodologies, intellectual capital, knowledge, innovation, and experience to manage megaprojects. These foundations will be the global infrastructure project trend of the future. Current project management methodologies must change and expand to provide Project Managers with the required skills to succeed in the infrastructure industry. The projects will continue to evolve and grow to accommodate the infrastructure demands of cities and nations. These project management skills must expand beyond budget, schedule, quality, safety, and customer management to include knowledge and intellectual capital management, expanded life cycle integration, change management, operations and warranty management, and stakeholder management. This will require a change in the industry to leverage the already

available intellectual capital gained from successful projects, to improve megaproject delivery of infrastructure, and minimize productivity losses through expansion of the industry knowledge base.

2. Problem Statement

Megaprojects valuing over US\$1B in the global infrastructure industry are increasingly in the spotlight due to the scrutiny and public reporting of cost overruns and schedule delays. The consequences include negative financial results and damages to the reputation of major public and private organizations with the potential to impact nations on a global scale. This problem continues to be researched and documented without improvement.

3. Supporting Data

The global infrastructure megaproject budgets are estimated at 4% of the global gross domestic product per year (Flyvbjerg, 2014). The state of the global megaproject industry is well documented with research data indicating cost overruns in nine out of ten projects (Flyvbjerg, 2014). This can result in serious damage on national economies as demonstrated in Brazil with the hosting of the 2014 FIFA World Cup and the 2016 Olympics (Flyvbjerg, 2013).

In the results stated by the Project Management Institute (PMI, 2014; PMI, 2015; PMI, 2016; and PMI, 2017); megaprojects continue to show industry losses of more than 10% on average and as indicated in Table 1: Project Loss Trend. That equates to \$110 million loss for every billion dollars spent on projects. The loss is equalised across currencies, but can compound when projects encounter multiple currencies and exchange rates due to global economic impacts over the duration of a megaproject.

Table 1: Project Loss Trend

Year	\$ M Loss / \$1 B	Percentage loss
2014	\$109	11
2015	\$109	11
2016	\$122	12
2017	\$97	10
4 Year Average	\$109.25	11

Earlier analyses of project data found a similar conclusion of megaprojects failing to meet time and budget goals 85% of the time with an average schedule overrun of 70% and 60% overrun of budget. (Shenhar and Dvir 2007). Overruns of time or budget have been documented as high as 90% for infrastructure megaprojects (Banaszak, et al. 2017). Project ownership, public or private, is not a factor influencing the results and may be disregarded (Banaszak, et al. 2017).

The global infrastructure industry contains some of the largest megaprojects in either the planning stage or execution of the project life cycle process. In 2014, spending worldwide on infrastructure was \$4.2 trillion. By 2025 capital project and infrastructure spending is estimated to total more than \$9 trillion (PricewaterhouseCoopers, 2014). Current expenditure on infrastructure reflects a \$1 trillion shortfall against annual global investment demand, and by 2030 there will be a \$14 trillion shortfall. Developed and emerging markets are experiencing a surge in demand in the infrastructure sectors including transportation, freight, communications, water, clean energy and stable power. There is also a shortage in companies and experienced Project Managers that can deliver these project demands (Arcadis, 2016).

Demand for infrastructure megaprojects will continue to increase, therefore so will cost and schedule overruns. The industry will have a shortfall of funds to cover the projects and skilled Project Managers to execute the megaprojects successfully. In order for industry to mitigate losses, strengthening project management is a core requirement.

4. Methodology

This paper utilises qualitative research to support the author's own project and program management experience in the global infrastructure industry. Due to confidentiality agreements, specific personal references will not be used. Observations about the industry, as experienced, have been supported by external and published sources from various fields of expertise to emphasize the extent of study that has been done and the magnitude of the industry challenge. Data was gathered from past global industry projects to extrapolate future trends and determine where project management needs to evolve to improve the state of the industry. Additional fundamental knowledge areas that will improve project management expertise include change leadership, innovation, business management, negotiation and commercial management.

5. Definitions

A traditional project is defined as "a temporary endeavour undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end." (PMBOK guide, 2004) or "a temporary organization and process set up to achieve a specified goal under the constraints of time, budget and other resources." (Shenhar and Dvir 2007).

Megaprojects are defined as "large-scale, complex ventures that typically cost US\$1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people" (Flyvbjerg, 2014).

The action of project management, defined as "the application of knowledge, skills, tools and techniques to project activities to meet project requirements." (PMBOK guide, 2004) or, "Project Management is the set of managerial activities needed to lead a project to a successful end." (Shenhar and Dvir 2007).

Project success has varying definitions depending on methodology and industry. Project success can be measured "by product and project quality, timeliness, budget compliance,

and degree of customer satisfaction” (PMBOK guide, 2004). This definition fails to include the impact or outcome of the result which the Diamond approach, developed by Shenhar and Dvir (2007), looked to address. The Diamond approach utilises a diamond shaped framework that includes four dimensions: novelty, technology, complexity and pace (NTCP). As part of NTCP, the diamond approach includes five dimensions of project success (Shenhar and Dvir 2007):

- Project efficiency.
- Impact to the customer.
- Impact on the team.
- Business and direct success; and
- Preparation for the future.

The PricewaterhouseCoopers LLP (2014, p.5) definition of infrastructure includes:

- 1) Extraction – Oil and Gas, natural resources;
- 2) Utilities – Power Generation, Electricity, Gas, Water, Telecoms;
- 3) Manufacturing – Petroleum refining, Chemical, Heavy metals;
- 4) Transport – Rail, Roads, Airports, Ports; and
- 5) Social – Hospitals, Schools.

Change in business and industry has been observed by Kotter to be increasing there are three fundamental reasons for change (Kotter, 2017):

- 1) To increase revenues/ profits or decrease costs
- 2) To become more effective or more efficient
- 3) Or both.

Kotter updated the “Eight-Stage Process of creating Major Change” (Kotter, 1996); the updated process is considered the standard for change management and leadership (Kotter, 2017).

For this paper, the PMBOK definitions are utilised and augmented by Shenhar and Dvir, with Flyvbjerg providing further detail as it pertains to megaprojects and the expanse of the infrastructure industry beyond typical projects definition. The infrastructure focus is on megaprojects in sectors interfacing with transportation, as it is the author’s area of expertise. The supporting data and conclusions will apply to all infrastructure industries defined by PricewaterhouseCoopers LLP. The process of change management and leadership will stand as stated by Kotter (above).

6. Project Management as Intellectual Capital

Project Management is an intellectual capital commodity with its foundation being in knowledge and experience.

The industry is relatively young; starting in the 1950’s with military applications then dispersing to other industries as the positive affect and value of project management on delivery was realised (Shenhar, & Dvir, 2004). The outputs of project management are tangible and measurable. They include plans, reports, and schedules, tracking and monitoring elements and ultimately, a final deliverable or project goal. The ability to

manage projects successfully comes from the knowledge and experience gained by the Project Manager within their specific fields, over time. This experience includes the ability to utilise gained knowledge on future projects by developing an internal repertoire of best practices and risk mitigation to innovate, create continuous improvement, and ultimately project success. Megaproject management takes this experience to a higher level of expertise requiring further evolution from current practices in order to reduce project loss and ensure successful global infrastructure project delivery.

Traditional project management, in theory and practice, references the following methodologies that were developed as guidelines for execution and successful management of projects (PMBOK p. 2, 142, 156):

- PMI/PMBOK Method (PMBOK guide, 2004);
- Agile, Adaptive Life Cycles, Change Driven, Scrum, Kanban;
- Waterfall;
- Prince2;
- Critical Path Method (CPM);
- Critical Chain Method (CCM);
- Precedence diagramming method (PDM);
- Activity-on-node (AON);
- Six Sigma, Lean; and
- Program Evaluation and Review Technique (PERT) or three point estimating.

Other methodologies include:

- NTCP Model, or Diamond Approach (Orhof et al. 2013); and
- Strategically managed, aligned, regenerative, and transitional (SMART), (Hartman, 2000).

This list of methodologies is not exhaustive but is an indication of the vast approaches and variations of techniques that exist within the project management industry. Another theory that the above list indicates is that one methodology does not align with all project types (Shenhar and Dvir 2007), as methodologies are developed in response to a need in the industry.

Understanding infrastructure megaprojects as defined earlier, provides an indication of the substantial scope and requirements, and emphasises that Project Managers must rely on a multitude of methodologies, in addition to experience, innovation and personal intellectual capital to drive a project to a successful delivery.

7. Change Leadership Best Practices

Like project management, change leadership is evolving as an industry. Change leadership's management and focus is on organisational change and transition while incorporating appropriate project management methodologies. Change leadership "programs were six times more likely to succeed if they were structured around readily understandable themes (Blackburn et al. 2011)" comparable to the structure of Kotter's enhanced 8-Step Process as Figure 1: Accelerate: 8-Step Process (Kotter, 2017) demonstrates:



Figure 1: Accelerate: 8-Step Process

Source: Kotter, 2017

From the author's experience of organisational transformation and megaproject management there are seen to be parallels and applications of the change leadership methodologies that can be applied to megaproject management. Both rely on knowledge, experience, and intellectual capital applications from the Project Manager or Change Leader. Both are struggling, with cost overruns, delays and define success it's as it relates to the initiative goal or outcome. McKinsey (2011) has published that "Only 30 percent of change programs succeed. The leading causes of failure are employee resistance and management behaviours that do not support the desired changes" (Blackburn et al. 2011). IBM has analysed change leadership and suggested the following solutions for improvement change project success (IBM Global Services, 2008):

- 1) Strive for a full, realistic awareness and understanding of the upcoming challenges and complexities, then follow with actions to address them.
- 2) Use a systematic approach to change that is focused on outcomes and closely aligned with *formal project management methodology*.
- 3) Leverage resources appropriately to demonstrate top management sponsorship, assign dedicated Change Managers and empower employees to enact change.
- 4) Allocate the right amount for change management by understanding which types of investments can offer the best returns, in terms of greater project success.

IBM's (2008) published results indicated that out of over 1500 interviewed, only 41 percent of projects were considered successful. Of these successful projects only 20 percent indicated achievement of an 80 percent success rate. The more solutions that were utilized in the change leadership the higher the success rates recorded.

In the data review and analysis completed for this paper, the initial focus was for a convergence of change leadership and project management. Through this process, the author determined that change leadership would be a valuable process methodology to include in the successful delivery of megaprojects although not the only leading element of project success.

8. Megaproject Overruns: Cause Analysis

The magnitude of cost overruns for megaproject in infrastructure, as previously stated, are on-going as owners continue to award projects to meet the growing global infrastructure needs but don't change the way megaproject management is conducted. The knowledge base is established and unchallenged but there needs to be a change in the way megaproject management is executed. The author reviewed data of cost and schedule overruns in various industries, public and private ownerships, located in various global locations, and delivered under different contractual systems. The data included the infrastructure megaprojects listed below (Allport et al. 2008, Cantarelli 2011, Flyvbjerg 2014, Siemiatycki 2015):

- London: The Jubilee Line Extension
- The London Underground Public Private Partnership (PPP)
- Docklands Light Railway
- Channel Tunnel
- New York Subway Upgrades
- Paris Light Rail (RATP)
- Boston's Big Dig
- Toronto Spadina Subway Extension
- Toronto Union Station Revitalisation
- Toronto PRESTO fair collection card
- Denver International Airport

Of the project results data reviewed, consistent themes and conclusions emerged for causes of megaproject overruns of budget and schedule. The results are summarised as follows:

- 1) Lack of project management and controls including:
 - a. Poor organization, inadequate communication, flawed performance management, poor commercial and contractual management, limited talent management (Changali et al. 2015);
 - b. Projects led by Managers without experience (Flyvbjerg, 2017);
 - c. Lack of leadership, constraints on qualified resources (Patmore, 2017);
 - d. Leadership changing throughout the long project cycles leaving leadership weak (Flyvbjerg, 2017);
 - e. Lack on integration (Allport et al. 2008);
 - f. Only managing to time and budget constraints (McManus, 2016);
 - g. Inappropriate delivery methods (McManus, 2016);
 - h. Poor procedures adopted by project owners (Banaszak, et al. 2017); and
 - i. Technical Challenges including (Siemiatycki, 2015):
 - i. Scope changes;
 - ii. Handover Problems;
 - iii. Poor project reporting and performance monitoring.
- 2) Poor upfront planning (Shenhar and Dvir 2007, Changali et al. 2015, Banaszak et.al. 2017, Siemiatycki, 2015), in the form of:
 - a. Optimism bias and strategic misrepresentation (Flyvbjerg, 2014, Siemiatycki, 2015);

- b. Overly optimistic budgets, bad assumptions, aggressive value engineering and owners not questioning the process (Patmore, 2017);
- c. Incomplete preapproval studies, inaccurate forecasting, inflation (Siemiatycki, 2015);
- d. Poor project planning and execution (McManus, 2016); and
- e. Not including operations, maintenance or end use stakeholders and interface partners (McManus, 2016).

3) Insufficient Risk Management:

- a. Late identification and resolution of errors or risks (Patmore, 2017);
- b. Risk transference and isolation management without collaboration (McManus, 2016);
- c. Project delays, unforeseen events and no management plan (Siemiatycki, 2015); and
- d. Long planning horizons and complex interfaces (Flyvbjerg, 2017).

Secondary cited causes of project failure include:

- 1) Definition of success only follows the triple constraint model or iron triangle of: on time, within budget, within performance goals (Shenhar and Dvir 2007).
- 2) The notion that one type of project management methodology fits all types of projects and following text book methodologies will achieve project success (Shenhar and Dvir 2007).

Through the research process of the summarized themes and conclusions, the results for cost and schedule overruns indicate many generalised causes, but nothing specific and consistent. This broad range definition also provides insight into the complexities of project management, in that there isn't one element that is predictable in unsuccessful projects. This may be due to the term "project management" being too broad to use as an exact cause for megaproject overruns (Cantarelli, 2011). The solutions will be complex and multi-faceted. Ahiaga-Dagbui (et al. 2015) concluded that "cost overrun research has largely stagnated in the refinement and advancement of the knowledge area. It has largely been superficial and replicative. A significant paradigm and methodological shift may be required to address this perennial and complex problem faced in construction project delivery."

9. Solutions for Infrastructure Megaproject management

In researching the IMPI for causes for cost and schedule overruns, various solutions were suggested and include:

- 1) Project Management and Controls
 - a. The focus on strong theory and good data is intended to help bring the field forward academically and professionally (Flyvbjerg, 2017);
 - b. Provide training of government Megaproject Managers, as exemplified by the Major Project Leadership Academy, Oxford England (Flyvbjerg, 2014);
 - c. Developments in strategic management research, broadens the notion of stakeholder management to better consider pressing issues of future generations and the natural environment (Flyvbjerg, 2017);

- d. Owners need to improve procedures and help drive innovation vital to promoting change, stop scope creep, rework and delays through slow decision making (Banaszak et al. 2017, Allport et al. 2008, Omega Centre, 2012);
- e. Manage more than just time and budget and include the functional goals in the project success criteria. Include an independent assessor on behalf of the owner to monitor the project status on all requirements (McManus, 2016, (Omega Centre, 2012);
- f. Apply the appropriate delivery method for each project instead of the same for all capital projects (McManus, 2016);
- g. Provide a new delivery model for megaprojects aimed at securing innovation and flexibility in projects (Flyvbjerg, 2017);
- h. Openly sharing the megaproject status and holding stakeholders of involved businesses and agencies accountable (Flyvbjerg, 2014);
- i. Creation of an independent governing entity to oversee the effective management of large-scale projects funded and delivered by governments (Flyvbjerg, 2014);
- j. Employing lean construction tools for collaborative decision making and global sourcing of materials for availability and efficient pricing relying connected inventories (Banaszak et.al. 2017).

2) Upfront Planning

- a. Consider the projects' legacy to include long term benefits, skills development, economic improvement, knowledge expansion and building of capability in the industry (McManus, 2016);
- b. Involve operations and maintenance experts from the beginning of the project as these decisions will affect the total cost of ownership (McManus, 2016, Allport et al. 2008);
- c. Invest to improve performance and innovation so Engineering Procurement Construction (EPC) firms have incentive to depart "from tried and true" (Banaszak et al. 2017);
- d. Implement procedures to curb "Optimum bias" and "strategic misrepresentation" (Flyvbjerg, 2014).

3) Risk Management

- a. Relational Contracting includes pooling of delivery risk and sharing of profits or balancing of risks (Banaszak et al. 2017, McManus, 2016);
- b. The owner needs to define rules that force accountability upon bidders. Owners should also provide some predictability for future available funding. (Allport et al. 2008);
- c. Creative use of insurance by offering incentives to work to avoid claims (Banaszak et al. 2017);
- d. More attention to lessons learned on positive projects (Flyvbjerg, 2014).

10. Perspective: Inside the Infrastructure Industry

From a project management perspective inside the infrastructure industry, megaproject management needs to evolve to include integration management, change leadership, and project conception planning. This definition of a megaproject expands to include service operation and delivery while managing stakeholders, phasing interfaces, and adapting to real time risk management. Due to the long life-cycle of megaprojects, Project Managers require an understanding of technological advancements and external impacts that allow for continuous improvements. To achieve all of this, Megaproject Managers in the infrastructure industry will need to rely on years of experience, knowledge and intellectual capital gathered from previous projects to be able to deliver megaprojects. Despite all of the recognised skills, and the decades of experience, there are not any guarantees that the projects will be considered a success.

The industry requires a motivational push to improve megaproject delivery. Awareness of the project status in the developed nations is a first step in accountability. Another step is valuing megaproject management as a unique skill set supported by knowledge, innovation, and experience aligned with engineering, architecture and planning. These skills are critical for industry success. The industry needs Project Managers that are trained, through education and project experience in the public sector as owners. These skills are equally critical in the private sector, as project implementers. Having exposure to theory and in-process projects is critical to understanding the complexities of megaproject management. An understanding of people, commercial, contractual and integration management from concept to warranty completion is crucial.

From personal project experience on the London Underground Jubilee Line Extension, the London Underground PPP, the Dubai Light Rail Metro project, and various rail transportation projects in Ontario, Canada, the above-mentioned findings align with projects within the authors' local environment as reported in newspapers and corresponding news sites. The upfront planning requires re-evaluation on the governance and supported business cases to ensure the projects are based on accurate estimates and technical evaluation. Infrastructure planning struggles to succeed when based on political agenda instead of expert analysis and ridership demand. This can result in ineffective projects proceeding and leaving voids in other areas of infrastructure. News publications continue to report on project overruns, councils voting against the experts and consultant's findings. Millions are spent on countless studies in an attempt to achieve the answers or platforms provided in election campaigns.

Canada is expanding the Alternate Financing and Procure (AFP) model to utilise risk transference and allow for private funding of public infrastructure. This is still in its infancy and has experienced success and failures. It is not a solution of one fits all and AFP continues to need refining to determine the correct megaproject use for successful implementation. It is a system that continues to struggle with the success of on budget on schedule delivery. This is an example of developed cities and nations appearing slow to learn from the lessons learned from others. For instance, the Jubilee Line Extension as private partnerships (PPP) project was fraught with challenges and on structure, governance, risk alignment and goal definition (Allport et al. 2008). AFP's and PPP continue to be executed and continue to struggle with the challenges experienced.

The infrastructure sector is finding limited private firms capable of bidding of delivery of the megaprojects resulting in AFP's including PPP to bridge the resource and investment gaps (Garemo et al. 2015). Alternate delivery structures such as PPP's, or variations of Design,

Build, Finance, Operate, Maintain (DBFOM) are better at motivating project delivery goals but still focus on change notice and risk aversion which are included in the pricing. AFP's and PPP's tend to be slow to react, unequalised in skill to workload, and are not structured for efficiency in project delivery (Siemiatycki, 2015). PPP's have their limits including no guarantee in higher productivity, or successful project deployment, and operational success. The efforts required to deliver complex PPP projects are extreme. (Garemo et al. 2015). For PPP's to be effective, public governance needs appropriate structure and financing guarantees beyond yearly budgets, and election cycles (Garemo et al. 2015).

Developing and expanding the knowledge and intellectual capital requirements of Megaproject Managers will be the starting solution point improve project success. Oxford University has started the knowledge improvement process by providing educational and practical field training for government Megaproject Managers through the Major Project Leadership Academy, (Flyvbjerg, 2014). The megaproject industry needs to expand to international under graduate schools and include private business management, as cost and schedule overruns apply to both public and private infrastructure (Siemiatycki, 2015). The experience quotient must include multiple and different methodologies, and diverse project experiences to make megaprojects successful (Gallup 2012). To generate a certification for Megaproject Managers, the following requires consideration in addition to education:

- Project management experience and proven track record of project delivery prior to certification;
- Demonstrate an understanding of the project life-cycle from concept to operation, involving the urban planning, social (live, work, play), economic impacts, for society;
- A level of business acumen with an understanding of project impact to the success or failure to the owner, delivery organization and end user;
- The ability to innovate and implement continuous improvement;
- Commercial and contractual management and reporting;
- Negotiation experience of project contractual items and claims;
- Change leadership and application including a combination of the change solutions stated earlier through the life cycle of a program;
- Understanding of technological applications to project success and the correct implementation of these systems (example: 7D Building Information Modelling (BIM));
- The ability to streamline processes and avoid project waste with repetitive functions;
- Structuring projects with qualified people in the correct positions to deliver the project effectively; and
- Applied and proven stakeholder management.

11. Conclusion

Project management is a relatively young industry, borne out of necessity and it continues to evolve. Where engineering and architecture have been subdivided into specific classifications including civil, structural, industrial, operational, institutional, commercial, or transportation, project management is in the midst of a divergence of skill sets depending on project type and industry application.

“Breaking from the insanity of repeating unreliable project-delivery practices is crucial if the sector is to raise productivity and deliver projects on time and to budget. Yet right now it is clear that we do not have the incentives or structures in place to drive this change”
(Banaszak et al. 2017).

This paper concentrated on the Infrastructure industry with a focus on megaprojects. The findings indicate that, for the infrastructure industry, *one of the crucial areas of improvement to reduce continual losses is project management. Specifically, the experience and training of Project Managers in public and private infrastructure.* Project management alignment with change leadership is not enough to solve the documented project losses, and would not be the pivotal element to improve the overall success of megaproject delivery. With the other areas of expertise required for megaproject management success, change leadership will have a place in megaproject delivery in the operations and end user implementation. To this end, change leadership methodology shall be considered in terms of best practice to be included in megaproject delivery and not as a key influencing feature to a megaproject’s success.

Understanding the change leadership best practice methodologies for implementation on megaprojects is one area of a larger skill set required. Project management of megaprojects needs to evolve to go beyond the standard scope, cost, quality and customer management to include:

- Extensive applicable experience;
- Innovation and complex problem solving;
- People leadership;
- Enterprise risk management; and
- Expanded knowledge and intellectual capital of project delivery gained through education and practical experience.

Project Managers of megaprojects need the ability to employ numerous project management methodologies and need the experience to recognise and implement the appropriate methodology for each stage in the expanded project lifecycle. They also need to take into account the emotional needs of stakeholders and team members and not rely solely on the technical project management methodologies and processes. (Gallup 2012).

“The soft stuff is hard” (IBM Global Services, 2008)

To move forward with an integrated global project management process more work is required to evaluate the need for a recognized governance or certification and alignment of the standards across countries. How will this be planned, controlled, evaluated and monitored? Who will be the governing body to plan and control it? Will Oxford University’s program expand and align with leading educational institutions globally to spread the intellectual capital and continuous improvement for the industry? Is there enough motivation for public and private industry to embrace this change?

For infrastructure megaprojects, *the definition of a project needs to expand to align with the procurement models and lifecycle.* This will include the conceptual planning and business cases, as well as the responsibility for handover commissioning, and end user satisfaction and intended use. This aligns with expanding the definition of a successful project to include operations and the goal achievement of the end user.

To do this, owners need to share information, experience and lessons learned from successful megaprojects (Siemiatycki 2015). London's Crossrail megaproject as an example to provide best practices and improve project implementation. Other examples of successful projects include London's Docklands light rail, the Guggenheim Museum Bilbao and Paris-Lyon High Speed Rail projects (Flyvbjerg, 2014).

Expanding the conclusion, as stated by Youker, (2017) *"As the Project Management profession moves into working on many different types of projects we are going to have to move to a new level in the project management body of knowledge and develop extensions that define the differences in requirements and approach for different kinds of projects such as construction, new product development, and information systems."*

To mitigate the demonstrated cost and schedule overrun problem, a united global project management industry requires evaluation of the initiated solution and an expansion plan to address megaproject management in locations as led by the UK. *Planned and controlled expansion will be key* to reduce the loss factor, savings that can be applied to the anticipated infrastructure funding shortfall and allow implementation of infrastructure projects to meet the growing needs of developed and developing nations.

Acknowledgements

The author would like to thank the industry reviewers for their time and contributions. This publication reflects the views only of the author.

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