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Megaprojects, Mayhem and More:

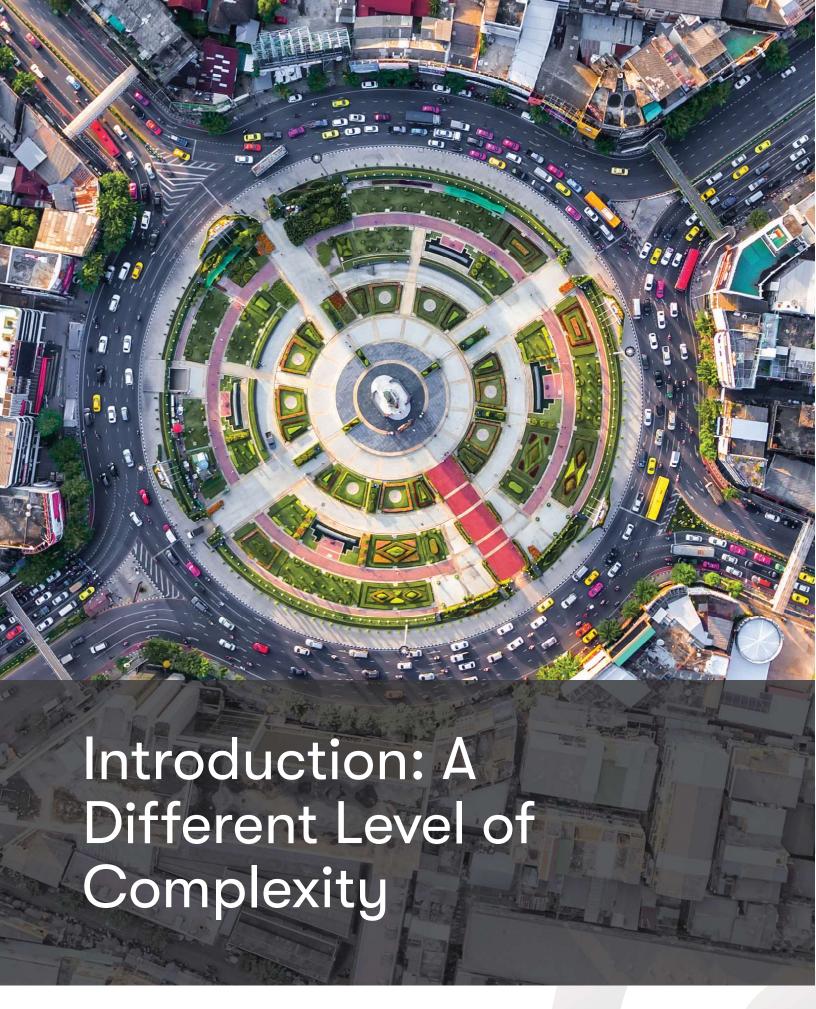## How Lessons Learned From Megaprojects Can Be Applied to Complex Strategic Projects

Guidebook

The Power of Perspective

Executive Summary

Megaprojects can either make or break a government. In this in-depth guidebook, we look at several of the most controversial megaprojects from the last 30 years, including the Athens Olympics, the NHS National Program for IT and the Channel Tunnel. The guide looks at the definition of a megaproject; the pitfalls encountered in their implementations; why some go wrong and others succeed; and strategy and governance. It also looks at the four key characteristics of a megaproject and examines the "break-fix model" paradox, among other elements.

Introduction: A Different Level of Complexity

A megaproject is widely accepted to be a large-scale complex venture that costs more than $1 billion, which takes multiple years to execute and involves multiple public and private stakeholders, impacting millions of people. Megaprojects have the ability by definition to change the lives of millions of people, and the lasting social and economic effects on countries and continents will be felt for generations (Flyvbjerg, 2014).
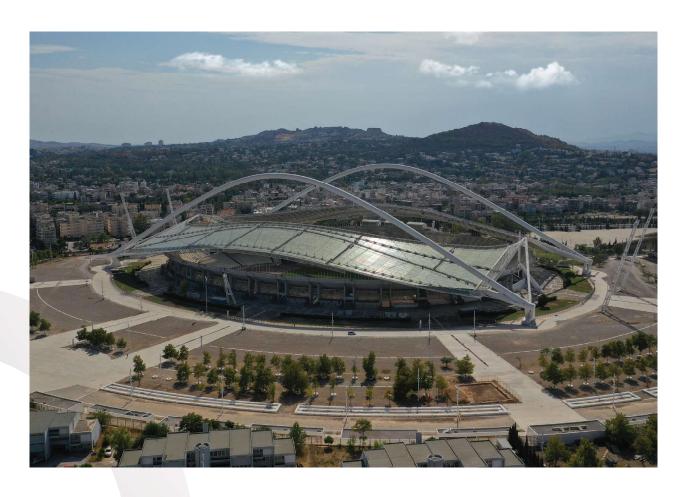
Megaprojects are a different type of project to manage regarding their level of aspiration, complexity, expected times and stakeholder interests (Kardes et al., 2013). "Mega" originally comes from the Greek "megas" meaning large, vast, significant, tall and important amongst other adjectives (Flyvbjerg, 2014).

Megaprojects transform landscapes rapidly and profoundly in very visible ways. Megaprojects are morphing into a regular delivery model for goods and services in a vast range of business sectors, such as infrastructure, water and energy, information technology (IT), supply chains, enterprise systems, banking, defense, air and space exploration, urban regeneration and significant events.

CHAPTER 1

Impact

The impact of megaprojects can be positive, leading to great economic benefit as was the case with the Panama Canal. However when they fail, the outcome can be catastrophic as seen in the 2004 Athens Olympics, a megaproject which was later identified as a large component of the Greek 2008 financial crisis. Currently, it is estimated that megaprojects account for 8% of global GDP, a sizeable figure which is set to increase to 24% by the end of the decade. Megaprojects will be responsible for delivering the infrastructure the planet needs to match the current population growth and ever changing social demands of the world's inhabitants.

In the five years between 2004 and 2008, China invested more on infrastructure than during the whole of the 20th century, which was described by The Economist as "the biggest investment boom in history".

Megaproject Characteristics

Gellert and Lynch (2003) classify megaprojects into four types:

1. Infrastructure
2. Extraction
3. Production
4. Consumption

Furthermore, megaprojects are characterized by complexity, uncertainty, ambiguity, important political or external influences, dynamic interfaces and long time periods (Kardes et al., 2013).

Megaprojects are not only massive; they are continuously growing even more in a historical trend with no end in sight in terms of value. The magnitude of infrastructure projects has grown by 1.5% to 2.5% annually for over a hundred years. Therefore, dealing with an increasing scale is a continual issue in megaproject management, which has to be addressed correctly to succeed.

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Megaproject Characteristics and Descriptions

Element	Characteristics and Descriptions
Size	Large scale project (huge scope) Technologically and logistically demanding
Cost	Exceeds one billion US dollars
Time	Exceeds 5 years long in duration Program urgency
Success	Different objectives Fail to meet cost estimations, time schedules, and anticipated project outcomes Goal-orientation (technical, financial, time) Poor performance in terms of economy, environment, and public support Leads to cost overruns and lower-than-predicted revenues that hinder economic growth instead of advancing it
Complexity	Requires management of numerous, concurrent, and complex activities Contains a large element of technological innovation
Impacts	Impacts on the community, environment, state budgets Socio-political impacts
Singularity	Unique, no megaproject looks like another
Stakeholders & shareholders	Attracts a high level of public attention or political interests The nature and number of project owners Conflicts, poor cooperation between partners
Uncertainty	Associated with high risk
Implementation owner	Requires multidisciplinary inputs from many organizations A "virtual enterprise" for execution of the project
Knowledge	New subject of research

Megaproject Performance

Success in megaproject management is often defined as projects that are delivered on time, cost and benefits. Unfortunately, the harsh reality is that if only one out of ten megaprojects is delivered on budget, one out of ten is on schedule, and one out of ten delivers on its benefits, then approximately only one in a thousand projects is a success, if we collectively assess on target performance for all three (Flyvbjerg, 2014).

Only 7.8% of all megaprojects meet their deadline and are on budget, but only 0.5% of them ever deliver the benefits expected of them. (PBC Today, 2019.) Megaprojects almost always run over budget, over schedule and fail to deliver the benefits that were expected of them, but still multiple new megaprojects are proposed and undertaken every year.

One of the key metrics for success in megaprojects is the need to identify a roadmap in delivering a clear strategic vision combined with an exhaustive business case review. The due diligence across all aspects of the project should be forensic in its approach.

Megaproject Failure

The potential for megaprojects to fail is vast. If there was one key capability an organization needs to develop above all other concepts for project managers in megaprojects it would be the ability to adapt to complexity (Shehhar & Hoizmann, 2017). Complexity can be change in the original scope, unforeseen social, economic or political issues or assumptions, which have the ability to make managing the project more difficult.

Megaprojects often fall at the first fence due to poor planning and no viable business case. Megaprojects are inordinately complex to understand, manage, track and deliver upon but very few organizations know how to assess complexity and thus then develop a plan to counteract and manage the inevitable curve balls which will come their way during a project. One of the major causes of failure is the decision-making behavior of organizations and it is often due to a combination of psychological and behavioral reasons. The root cause of this is linked to the concept of optimism bias in which biased judgment and advice is provided by experts in their fields, who tend to create overly optimistic scenarios and circumvent known risks and unforeseeable uncertainties.

Management teams and project sponsors also tend to underestimate the cost and fail to assess the associated risk with technological novelty and complexity. Sometimes there are also political motivators influencing this behavior. Regardless, the common pitfalls and failures are repeated time and time again.

Megaprojects are often deemed too big to fail and thus continue to run until completed, often running over budget and not in line with the original scope. Megaprojects continue to be a vehicle for delivering large-scale infrastructure. Policy makers are drawn to the scale of these projects as they create and sustain employment.

Another issue that arises in megaprojects is they fall into the paradox called "break-fix model" (Flyvbjerg, 2003: 1-10). It's often stated one of the reasons for failure in megaprojects is the personnel running the project have no previous experience in successfully delivering megaprojects. The experience simply isn't there to address the complexity and uniqueness of the project environment. The paradox is that in essence the project has to hit a breaking point during the project lifecycle for the project team to acknowledge this reality. Only after this can the project team re-evaluate and pivot away from the overly optimistic assumptions in project initiation and planning.

In 2013, McKinsey estimated that by 2030 the world will need to spend $57 trillion on infrastructure projects in order to keep up with growing populations, and to support growing levels of GDP (McKinsey & Co, 2015.) "They are notoriously difficult to manage, and often fail to achieve their original objectives" (Juliano Denicol, 2020). Understanding what causes megaprojects to fail is our best chance to better plan for future undertakings.

Megaprojects have multiple inter-connected elements that lead to unknown unknowns so effective decision-making is flawed. Optimism bias, which could also be considered delusion, is when project executives or sponsors are almost blind to the truth and underestimate the costs as well as overestimating the benefits and likelihood for success. Often internally in the pre-project phase the costs can be understated and the long-term benefits overstated. Megaprojects also have an exhaustive list of stakeholders with different interests, agendas and desired end goals.

Strategic misrepresentation is also a driver of poor performance. This arises when risks are ignored or morphed in order to represent a more beneficial outcome. The reality is that many megaprojects are flawed from the outset and have no business justification and they are often deemed too big to fail or cancel when significant sunken cost is already invested.

The NHS National Program for IT was the largest failed IT megaproject in history. The project was undertaken in 2003 with an estimated completion date of 2005 and was initially forecasted to cost £2.3 billion, but in 2011 it was cancelled as it was deemed unfit for purpose and the costs had already ballooned to £12.7 billion (Henrico Dolfing, 2019.) The massive loss of taxpayer money was, and still is, one of the largest failures of the modern British government and it most certainly made government-led megaprojects an unfavorable talking point for many British civilians.

Megaprojects are sometimes a first of their kind and new technologies are developed and implemented in never seen before ways. These technological novelties can be extremely hard to plan for and to manage, and there are no lessons learned for these unique projects. An example of this is the Seattle Route 99 tunnel project, which used the world's largest tunnel boring system, nicknamed 'Bertha'.

This machine had never been used before, so there was no backup available if it broke. All replacement parts would need to be custom built and any faults would need to be fixed with no prior knowledge. Needless to say, Murphy's law materialized and the machine did encounter many faults and caused massive delays and cost over-runs of the project.

With increasing moving parts, comes increased risk. Megaprojects don't just cost massive amounts of money, they also involve numerous parties and contractors which adds to the complexity of the project. The relationships that exist between these many parties is key to the success of the project, and the interactions between them must be carefully managed.

During project planning, goals and objectives are set and budgets are forecasted but projects need to be flexible and the project management approach needs to be adaptive. The flexibility of a project during its lifecycle is quite often predetermined at the outset and can be constrained through things like centralized decision-making and limited delegation. This is very commonly seen in government-led megaprojects as the approval processes for changes is extremely formal and requires many levels of approval before implementation.

CHAPTER 3

Strategy and Governance

The strategy delivery model is one of the most important parts of megaprojects due to the size and complexity of the projects being undertaken. With so many interconnected partners and stakeholders, clear guidelines as to how they will work together and carry out the project is crucial but is quite difficult to define.

Megaprojects will typically encounter pitfalls throughout the project lifecycle because they did not examine the cross-partner capabilities and interconnections that are required to carry out the project. And as a result, partners and stakeholders do not have clear systems of communication or co-operation and the model of project delivery and strategy is flawed.

How a megaproject is to be governed and how the governance structure will develop over time must be decided upon and understood by all from the outset. Outlining a clear structure, both formally and informally, will encourage accountability.

Projects are most often successful when there are consistent project champions who are dedicated to its continuation and completion. Defining the project leadership structure helps to keep the project on track and can be similar to utilizing bonuses to ensure people work towards the desired outcome. As megaprojects have multiple partners involved, the leadership team must develop the project culture and create alignments throughout the supply chain, encouraging behaviors that act in the interests of the overall project, rather than to individuals benefits.
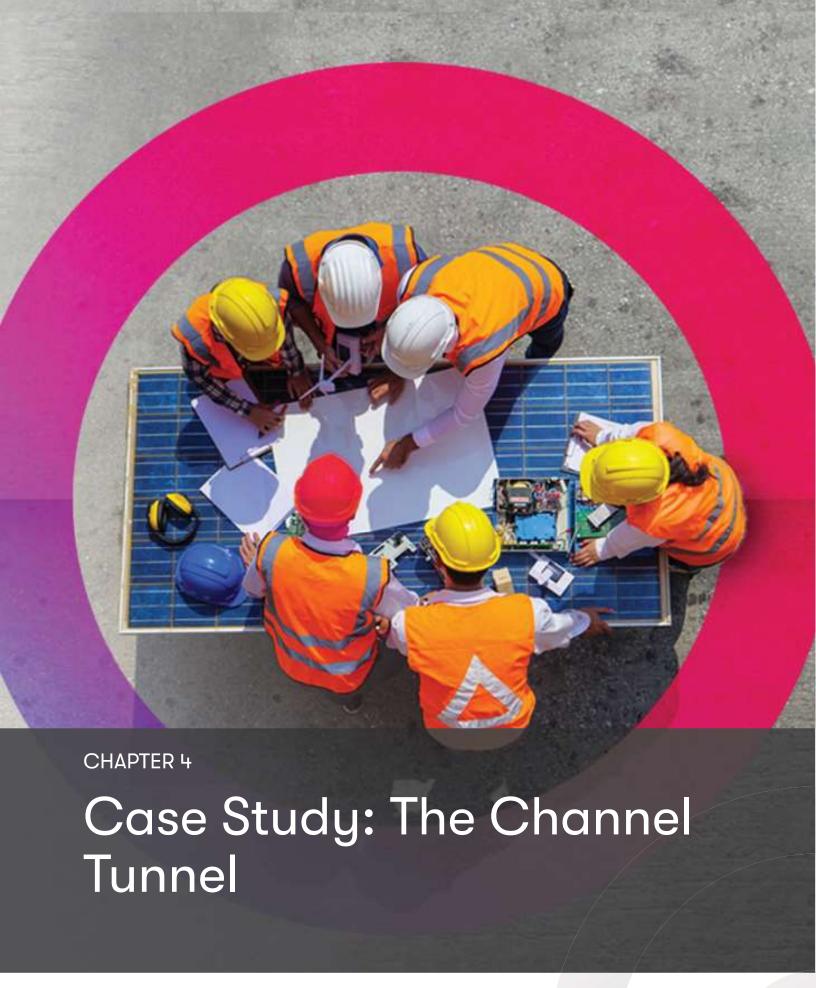
The two key segments in the development of teams on megaprojects that often fall short are the competencies & capabilities of the project team. It can often be simply a case of hiring the wrong people for the job, and the people are the ultimate driver of project success.

Another issue affecting megaprojects is that of stakeholder fragmentation, which occurs when the number of parties involved, and thus interactions between those parties, reaches un-manageable levels. It can be extremely difficult to maintain alignment when you have multiple partners, with hundreds or thousands of individuals involved across the supply chain.

Complexity

Project complexity is a major challenge for megaproject managers. This challenging aspect of megaprojects results from several factors such as tasks, personnel, and funding and the interaction of many sources of unc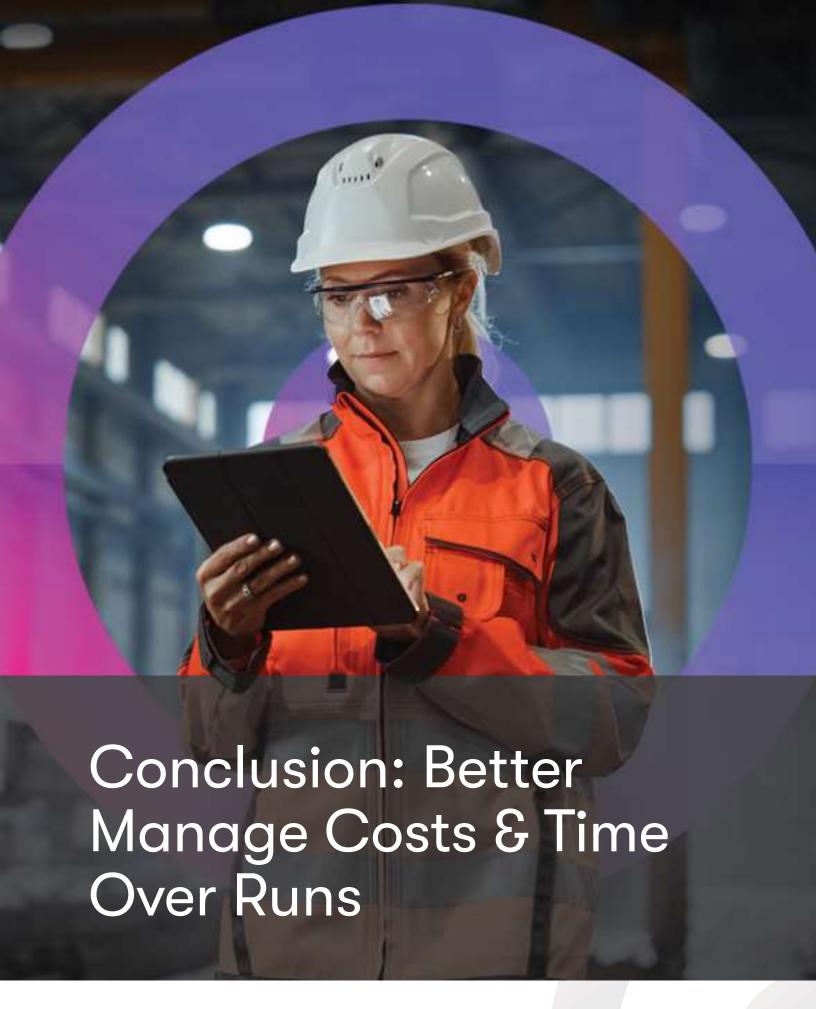ertainty (Kardes et al., 2013). Numerous studies indicate that the number of participants, the interests of stakeholders, multi-nationality, costs overruns, country risks, along with significant levels of public attention or political interest, are the principal factors that lead to complex megaprojects (van Marrewijk et al., 2008).

Case Study: The Channel Tunnel

The Channel Tunnel was opened in 1994 as an undersea rail tunnel connecting Britain with mainland Europe. In the beginning, this project was promoted as significantly beneficial both economically and financially (Flyvbjerg, 2014). During the public offering, the private owner of the tunnel, Euro-tunnel, convinced investors by ensuring 10% as a fair allowance for the possible impact of unexpected circumstances on construction costs (Flyvbjerg, 2014). In reality, costs increased by 80% for construction, and actual revenue was only 50% of the estimated revenue (Flyvbjerg, 2014). With the benefit of hindsight, the reality is this project had no business case, a negative return on investment (ROI) and simply should have never been undertaken.

The Channel Tunnel presented both technical and social complexities that were not estimated adequately before starting the project. Undoubtedly, for being the longest undersea tunnel globally, technical issues happened mostly because of the place's intricate design, engineering, and geology. Likewise, social issues were brought by the poor coordination among the considerable number of contractors and employees, who were once up to 15,000 people. The key lesson learnt here is that front-end planning should be meticulously analyzed before giving the green light to a project.

Conclusion: Better Manage Costs & Time Over Runs

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Megaprojects will continue to be a necessity of humankind and are no small feat. But, with so many megaprojects being publicly funded there needs to be better management of costs and time over runs, as we expect taxpayer money to be utilized in the most effective manner.

Risk and uncertainty will always be prevalent in projects and project management. We simply cannot plan for every possible outcome but reducing complexity and increasing flexibility can help to negate some of the added risks.

CHAPTER 5

How Cora Helps E&C Go Digital

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E&C firms are faced with two challenges. On the one hand they each need to radically speed up the process of digital transformation.

After all, innovation and the efficiencies that follow are as fundamental to E&C as they are to every industry. And that's how you mitigate against cost and time over runs.

But that's the second of their challenges. Before that, and first of all, they need to identify what the structural and organizational problems are that need fixing.

Because that's the best way to make use of the technologies that will allow industry to better manage megaprojects in the future.

The Cora solution allows organizations to digitize and centrally manage complex capital and operational projects, providing users with immediate visibility.

This provides senior management, project managers and relevant stakeholders with the control, governance and insight to make better – and more profitable – decisions.

Strategic functionality

The strategic functionality required to optimize capacity, prioritize and track the benefits of your business plan, inform all stakeholders and integrate across the business technologies to achieve maximum performance from your portfolios of work.

Portfolio Selection

Auto-select the preferred portfolio based on your criteria and compare alternatives, ensuring your portfolio delivers the maximum return.

Scenario Planning

Make Portfolio balancing easy, while ensuring strategic alignment, capacity planning and global efficiencies across the enterprise.

Top-Down Budgeting

Logically split budget across your portfolios. Easily track forecasting from execution against portfolio budgets to measure performance.

Prioritization

Using criteria, based on your requirements to score and weight projects, slice-and-dice data to come up with a repeatable, reliable and robust portfolio scoring mechanism.

Better Decision-Making

Increase return on investment, eliminate "CEO-specials" or "good-hunch" and enable decisions on the portfolio to be made with clarity and without guesswork.

Business Intelligence

Embedded "BI" provides powerful data and insights that enable fast, informed decisions accessible to everyone via shared dashboard and interactive reports.

Strategic Capacity Management

Easily understand requirements for the year ahead and maximize usage of global resource pools.

Benefits Realization

Plan and track benefit realization across the organization.

Execution functionality

The essential functionality required to automate your PMO, providing you with the ability to plan, prioritize, execute and evaluate your project portfolios.

Engine

A full set of tools needed to create, plan and manage your entire portfolio of projects.

Finance

Manage your project finances from initial estimate through to actual spend.

Document Management

Attach or link documents to projects, risks, tasks & registers. Annotate documents with mark tools directly within the application.

Forms

Turn free-format text into structured, reportable data.

Registers

Completely customizable logs for managing actions, lessons learned, decisions & more.

GIS Mapping

Plot projects on a map, visualizing activity location and identifying synergies.

Dashboards

Project and program level, visualizing the health of your portfolio; personal dashboards provide a digital "to-do" list.

Reporting

Suite of reports that are used by various roles to extract and publish information in just a few clicks.

Mobile

Mobile apps for Android and iOS. Access and update key project activity from anywhere.

Resources

Plan resource requirements for your project; track variation between planned and actual resources.

Workflow

Design and manage the approval of data in Cora Forms and Cora Registers.

Portal

A flexible framework that provides access to data contained in Cora PPM to a wider audience.

Integration

Facilitates easy integration with any enterprise technology architecture, allowing for a central, enterprise PMO platform, providing one version of the truth.

Scheduling

Solid, sophisticated scheduling throughout project lifecycle, including inter-project and inter-program dependencies.

Progress Management

Ensures automatic digitization and tracking of corporate goals.

Satisfied Clients

"Cora PPM gives us a single version of the truth. We've got 50+ countries in which we work, with 12,000 people in our part. We have in the region of 40,000 live projects every day. Cora PPM provides us with insight into all of those projects."

Phil Howe

Project Management Excellence Lead,

Honeywell

"We have specific timelines, deliverables, stakeholder communications, risks and mitigations, all of these tasks need to be delivered and managed, Cora has helped us and supported us to be successful."

Alejandro Gutierrez

Senior Engineer,

Boston Scientific

"We save time and money and deliver quality information and Cora's solution enables us to do this."

Mark Cain

Program Manager,

NHS Digital

"It works well at a low level for project planning, risk and issues, change logs, benefits tracking, weekly reports, etc. Then the PMO can roll up and summarize that low-level data into a full program/portfolio view."

Justin Leese

Program Director, Local Full Fibre Networks,

Department for Digital, Culture, Media & Sport

"It has an extremely customizable PPM solution, which is what we needed – a solution that would fit to the way our business processes operate."

Mark Ruettiger

North America Operations Manager,

Automated Logic

"With Cora, we're able to sit around the table at senior management level and understand where we are much better than previously."

Paul Moody

Director of Global Engineering,

Allergan

"Cora really allows us to drill down into information so we can give our senior management the key decision-making information to make informed decisions on all our schemes."

Ian Thrupp

Head of Planning and Project Controls,

WSP

"Cora gives us that single source of truth to what's going on in the organization and also gives us the ability to prioritize what's really important to us, allocate resources and funding for those projects to help move us into that strategic position is invaluable."

Sarah Malin

Head of Program Management,

CityFibre

The Value

Digitize your programs and lifecycles, gain greater insights, more informed decision-making, and streamline your governance and reporting.

Strategic Insights
Roll out failsafe, strategically-aligned projects that utilize resources and deliver maximum value.

See The Full Picture
Quickly view data dashboards that visualize the health of your portfolio and drill-down to focus in on any issues.

Support Governance
Ensure the right people have the right oversight with multi-level access protocols.

Easily Scale
Small to large, local to global, all in the cloud.

Complete Control
Manage scope, financials, progress and quality of project delivery in one centralized system.

Seamless Collaboration
No matter the team – internal or contractor, desk-based or mobile – integrations make workflows seamless.

$20 BILLION
Worth of projects managed on Cora PPM.

400,000+
Projects live on Cora at any one time.

50+
Countries where Cora is in use.

1
Platform & version of the truth.

Author Bio

John McGrath is a project management professor at DIT (Ireland). John also designs and delivers executive education programs for industry. His track record includes lead project management work with over 150 global companies and government agencies, including the London and Rio Paralympics, United Nations and the World Bank.

John is passionate about engaging project teams, building trust and fostering collaborative interactions with competing stakeholders and he also has extensive experience in deploying enterprise PMO systems.

John is the Course Director for the MSc in Project Management at TU Dublin. Previously John lectured in Project Management at NUIM, TCD, UCD, Smurfit Business School and Brunel University.

John has also served as the Events Director for the Irish Chapter of PMI, Irish Ambassador and Global Life Science Lead for the Agile Business Consortium.

John is the founder and Editor of the PMO Roadshow, Ireland's only Project Management Magazine. He has published papers in academic and industry journals and has presented at over 100 international project management conferences.

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