



STRATEGY GUIDE FOR LARGE CAPITAL PROJECTS

WHAT YOUR PMO IS NOT READY FOR

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Strategy Guide for Large Capital Projects – What your PMO Isn't ready for

Dear Reader,

Please find enclosed our white paper.

When you do 30 or 40 projects over \$100 million in multiple industries, you will see the same patterns that make seemingly simple but large projects fail.

Project managers are pretty good at managing scope, schedule, even budget, at a summary level with spreadsheets, online project management tools, and Microsoft Project. Most of their work is weekly meetings, action items, reports, and putting out fires. Technical project managers get to add reviewing and approving technical documents and engineering decisions on top of that. Oh, and if you have external vendors and contractors you add in layers of procurement, contract management, invoicing and maybe even permits.

Those projects usually range from IT/software, process improvements, or strategic initiatives with an organizational change management need, and sometimes even engineering and construction projects. But those projects rarely spend more than a few million dollars a year. Many large industrial facilities will only spend \$10 - \$20 Million a year on capital upgrades and maintenance projects.

So how do you take a project management team equipped to handle several million dollars a year of projects, often limited to internal resources, and have them successfully execute ten million dollars of contractor work every month on a single project for several years? Even better, what if you have a portfolio of multiple large projects each lasting 3-5 years and totaling over a billion dollars of capital asset build outs?

The full process of how to execute a portfolio of large capital projects fills a book for each discipline and every industry has different organizational, bureaucratic, technological, legal, and regulatory hurdles to address.

This report explores the common pitfalls, gaps, and adjustments existing corporate PMO's face when scaling project execution by orders of magnitude beyond what they normally do. Not to mention we could write a book explaining how annual budgeting, financing, financial controls, and governance are probably not equipped for your PM to approve ten-million-dollar invoices or approve and control spending \$100 million a year for 3 years straight on a single large project.

This report focuses on what the PMO can control or influence. And it will touch on what corporate finance, accounting, and leadership are responsible for supporting project delivery on time and on budget. If you want to know more, email info@StrategicScience.org.

This white paper includes the following deliverables:

- **Current state assessment** of Capital Projects Management and Project Controls at owner companies whose core business is not executing extremely large capital projects.
- **Summary Gaps, Recommendations, and Action plan** for competitive delivery of multiple large capital projects simultaneously using best practices.

In a complete, detailed study for a specific company we would also include:

- Company specific business requirements in stacked ranking from key stakeholders.
- Company specific current state and future state process flow diagrams.
- Company specific gap analysis of current state and business requirements.

Finally, we appreciate that it's a busy time. Hope this white paper is to your advantage and let us know if you'd like any help.

Thank you,

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EXECUTIVE SUMMARY

Capital project stake holders and PMO leadership teams rarely enjoy an environment of consistent portfolio size and needs. Instead, they are often ramping up or down with the market and changing business.

We have identified the following business requirements to manage a PMO program of large, high risk capital projects:

(Differences from typical EPMO)

1. Acceptance that large capital projects require a different culture and discipline than small projects or an EPMO.
2. Clearly divided & defined roles and responsibilities that allow for quick decision making and delegation of responsibility.
3. Predictable and standardized roles, processes, tools, and practices.
4. Roles, processes and online collaboration tools that result in consistent communication and notification of project status and expectations to stakeholders and project teams.
5. Fully utilize existing tools and figure out manual processes to determine needs for new tools. Then obtain and configure new tools that fill gaps (Schedule, Staffing, Doc Control)
6. Adopt the roles, processes, and tools of large capital projects:
 - a. Project controls role owns project finance and PO tracking.
 - b. Program Integrated Master Schedule that shows all stages of every project in a single place – Business approvals, Engineering, Procurement, Permitting, Construction, Start Up, Close out. Every Capital Project is in one place so you can manage the program.
 - c. Project Document Control. Make sure the correct technical information is approved and utilized by the right people at the right time and does not delay projects.
 - d. Program Resource planning. Make sure they have enough people and the right people before you need them. Be they internal or contractors.
 - e. Program Risk Management – Holistic view and tracking of risks and risk budget on all projects in one place.
 - f. Program management. All data and projects statuses roll up to Program level visibility and control.
7. Large multi-year capital projects are high risk, will go over budget, and need to be financed by means insulated from disruptions to corporate cash flow from revenue.

On smaller projects and programs these needs are often met as needed by ad hoc efforts of individual project leaders. With deliberate effort a disciplined PMO using best practices can provide consistent results for multiple high risk, large and complex projects simultaneously.

Table of Contents

| | |
|---|----|
| What your PMO is not ready for | 1 |
| Executive Summary | 3 |
| 0 Study Approach..... | 5 |
| 01 Cost Cashflow Forecasting..... | 8 |
| 02 Project Financial Reports..... | 11 |
| 03 Project Financial Governance..... | 13 |
| 04 Project Lifecycle..... | 16 |
| 05 Project Development & Approval..... | 19 |
| 06 ERP | 22 |
| 07 PO Lifecycle..... | 25 |
| 08 PO Tracking & COntrol..... | 28 |
| 09 Invoice approvals and delivery receipts..... | 30 |
| 10 Division of Responsibility..... | 32 |
| 11 Project Data Flow & Data Integrity | 34 |
| 12 Document COntrol..... | 36 |
| 13 Program Scheduling..... | 37 |
| 14 Project & Program COntrols | 38 |
| 15 Project Change ManagEment..... | 40 |
| 16 Program Management..... | 42 |
| 17 Action Plan..... | 44 |
| First Steps..... | 44 |
| Second - Band AIDS..... | 45 |
| Third - Minimum Viable Product | 45 |
| Fourth – Complete the Fundamentals | 47 |
| Fifth - Testing and Continous Improvement..... | 48 |



0 STUDY APPROACH

0.1 WHAT WE DID AND HOW WE DID IT



Stake Holder Input

- Interviews
- Group Meetings
- Follow up meetings, calls, emails.
- Review of stakeholder tools, templates, documents & reports
- Consultant attendance at team meetings.
- Stakeholders review and comment of draft study deliverables.
- Participation in execution and governance of multiple capital programs.

This study is an meta assessment of common practices observed at many companies across multiple industries in recent years that notes the patterns common in Capital Project roles, processes, tools and practices at companies where capital project delivery is not a core competency; from the perspective of Project Controls, Program Management, the PMO and Project Strategy.

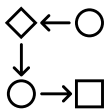
Which specifically means the ability to plan, organize, control, and forecast scope, deliverables, schedule, budget, cost, staffing, procurement, contracts, document control, communications, stakeholder engagement, division of responsibility, staffing, risk, and project closure for a program or portfolio of large capital projects costing over a hundred million dollars, up to multibillion dollar projects.

0.2 STAKEHOLDERS

We formally and informally interviewed the stakeholders on their role, responsibilities, business process and experiences with past and present capital projects. Stakeholders varied from project staff, EPMO, engineering, construction, finance, accounting, procurement, executives, facilities, construction, contractors, and vendors.

0.3 CURRENT STATE

The current state assessment for capital projects was assembled from interviews and group meetings with critical stakeholders. Sixteen process groups of interest were identified and drafted into process flow diagrams. The process flow diagrams were reviewed with subject matter experts and stakeholders and marked up for revision with notes for improvements. Company specific data and process flows are not included in this white paper.



Current State

- Based on Process flow diagrams developed for many companies.

0.4 BUSINESS REQUIREMENTS



Business Requirements

- Over 60 Ranked Business Requirements.
- Ranked by importance, need, urgency, and difficulty.

Business Requirements represent the list of responsibilities that need to happen to make large capital projects predictably hit their scope on time and on budget bringing timely ROI to business strategy.

Initial business requirements were taken from interviews, process flow diagrams and supplemental meetings and provided documentation. Often staff highlighted issues, difficulties, and gaps. We then compared the needs of the team to common business practices used by owners in large engineering, procurement, and construction project portfolios.

A list of over 100 common business requirements has been identified for competitive quality execution of a large capital project program. These requirements were reviewed with project management stake holders and prioritized in a stacked ranking in terms of importance, must have priority, how soon needed and how difficult to implement. These rankings vary between different organizations with different capabilities and needs.

0.5 GAP ANALYSIS

The gap analysis came together in several ways. Staff and example documents both highlighted a series of gaps, issues, and challenges to project controls and program management on previous and current projects. In addition, the business requirements highlighted gaps from the current state detailed in the process flows.



Gap Analysis

- Multiple gaps on each of the 16 process groups.

These gaps came together in a matrix organized by process listing several interrelated gaps in each of the 16 processes.

0.6 FUTURE STATE & RECOMMENDATIONS

The future state is what it looks like when gaps are addressed, and doable business requirements and recommendations happen.



Future State

- Program Management and Project controls to predictably hit scope, schedule, budget on multiple large projects simultaneously.
- Over 100 recommendations to achieve future state.

The basic future state is to create a world class Large Capital Project Program Management and Project Controls capability for the duration of the capital projects program. If you are going to spend several hundred million dollars on projects, you should learn how to do it well.



Action Plan

- Road map of prioritized recommendations to get greatest value to Capital Program.

0.7 ACTION PLAN

Section 17 fleshes out a recommended plan of action for a comprehensive and necessary implementation of the recommended future state.

0.8 PROCESSES

For the sake of clarity, this report is organized by the 16 identified project process groups. Connecting the dots from current state to business requirement, gaps, and recommendations for each process group.

0.9 DEFINITIONS

Capital Project – a Large Project that delivers a **capital asset** (piece of property) to the organization. Typically, this is a facility, facility modification, or piece of industrial equipment.

CAR – Capital Asset Request – a financial control process and document like a PO, but for Capital Assets.

Program – a Collection of related projects.

(Project) **Portfolio** – a collection of programs and Projects within an organization.

PMO – Project Management Office – the team within the organization responsible for planning, organizing, and managing projects.

EPMO – Enterprise Project Management office – in large organizations with multiple PMO's, the EPMO is the one that answers to corporate leadership, typically the highest level PMO aligned with the Strategy Management Office, finance and HR.

PO – a Purchase order is a document that acts as a financial control on the purchase of goods or services from suppliers outside the organization.

Project Controls – a Professional Discipline also known as **Cost Engineering** that is responsible for the quantitative measurement, control, and forecasting of projects, programs, and Project portfolios. Project Controls is responsible for the numbers, schedule, forecasting, reporting, change control, risk management, and coordination with finance and accounting while the Project Manager spends up to 65 hours a week in meetings, phone calls and firefighting.

01 COST CASHFLOW FORECASTING

CURRENT STATE

Most Project Managers don't have much budget to manage. Because most projects are small, and the labor is often internal resources. Capital projects are a different animal. And large projects are different than projects of a few million \$ or less.

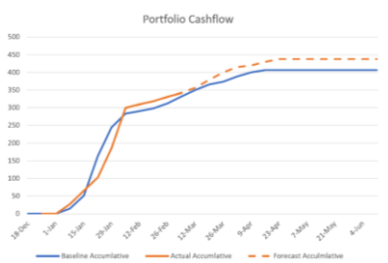
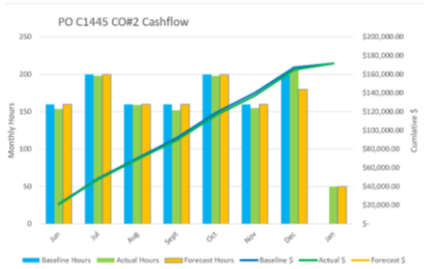
When was the last time you had to generate an accurate Project baseline cashflow forecast for a \$500MM over 5 years? Project controls experts and cost engineers do that every day.

Cashflow is often the front and center challenge to Capital Project Controls. This is often the only metric executives have to judge a capital project (it's a parametric for schedule progress – are you spending budget fast enough?). Weekly and sometimes even monthly cashflow forecasting has been a challenge for most companies. But finance needs the cash on hand to pay the project bills.

Cashflow is simply knowing how much money is being spent on the project every day through the end of the project. Typically, this is easily tracked in either internal costs of timesheet, payroll, and allocations or more likely external costs of contractor purchase orders and invoices for services, equipment, & construction.

The most effective cashflows come from building and maintaining a cost loaded schedule that is one to one with every purchase order and estimate you have on the project.

Honestly, I've seen many, many projects that don't track cashflows and don't know how much money they are spending month to month. You can get away with this when the project is a few million dollars total. Bu surprises exceeding ten million dollars a month tend to get the CFO's attention.



Business Requirements

- Regular Cashflow forecast and variance reporting should be normal for the PMO.
1. Per business need, cashflow plan, forecast, and changes should be made at weekly/monthly level of precision. This is a good practice that displays competence and earns trust with executive stakeholders.
 2. Project Cashflows must be apples to apples with corporate financial forecasts and treasury expectations to fund the project.
 3. Cashflows should match project schedules and supplier information. Ideally reflected in a cost and resource

loaded integrated master schedule reflecting project estimates made by SME's.

4. There should be notification of any and all costs hitting capital projects before invoice (i.e., forecasted well in advance). Because money comes from somewhere.
5. There needs to be adequate staffing to maintain accurate cashflow week to week.
6. The cashflow process should be organized and simplified to use as few manhours as possible.

GAPS



Gaps

- You need accurate cashflow forecasting, purely so the business has time to come up with the money.

1. Actual costs consistently missing cashflow forecasts.
2. Cashflows supported with multiple reports from multiple systems and multiple departments that are difficult to reconcile.
3. Cashflow projections and processes that are not consistent, transparent, detailed, or auditable across projects and locations.
4. Inconsistent communication and notification of use of project funds.
5. Financial analysts already have a full-time job before capital projects start. Large projects/PMO need their own project cost/financial analysts.
6. Clear formal process or standards for planning, baseline, updating forecast, or updating actuals for cashflow and project cost.



Recommendations

- In short, you need to gather all the information and track every individual cost to have an accurate project cashflow.
- A competent PMO needs the skill of forecasting accurate cashflows and controlling costs.

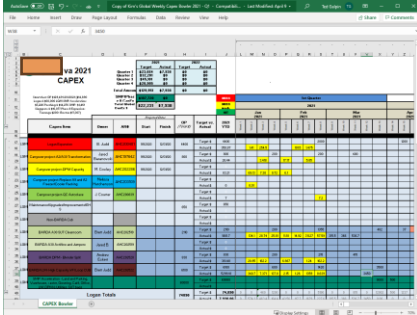
RECOMMENDATIONS

1. To hit accurate cashflows, contractors and suppliers need to provide predictable invoice dates and amounts with updated cashflow estimates. This means they need to maintain schedules that are aligned with cost reporting. Cashflow reporting requirements need to be a formal deliverable defined in the contractor's scope of work, contracts, POs, and budgets. Basic cashflow forecasting should not be a PO change order after the project starts.
 - If your contractors and suppliers lack that ability, that's what a project controls subject matter expert is for.
2. ERP / Enterprise accounting & finance software is the primary source of truth and needs to be updated to the latest project forecasts. Projects need to be organized and transparent in corporate financial systems.
3. Develop a standard process and tools (start with a spreadsheet and evolve to bigger and better software) to model every known past and future invoice from every PO in the project backlog. Populate it with vendor data, contracts, PO Terms. If you don't know how to do this, learn how. If you don't have the time, hire a

contract consultant for the duration of the project to handle it.

4. All Capital Project POs and invoices should funnel through project controls staff. Project Managers cannot control POs owned and processed outside of the project.
5. Project Controls should assume full-time responsibility for Capital Project Cashflow forecasting & actuals reporting. This may require a new hire or capitalized contractor.
 - On large capital projects the project management workload will balloon, requiring multiple people and will cost a few percent of the overall project budget.
 - Or just do it with a single overloaded PM unable to control the project and see how late and over budget the project goes. Either way it costs time and money.
6. Cashflow standard process and tools need to include annual budgets, project lifetime plan and budget, baseline of approved budget cashflows that rebaseline with each approved project change.
 - The cashflow tool should operate in detail and be able to reconcile each PO invoice forecast to actual invoice amount and week/month.
 - Budgeted but unapproved POs should be tracked in cashflow forecast as an intended project cost.
 - Projects will maintain a weekly updated forecast and show variance of forecast to baseline.
7. The long-term goal is to get into a rhythm with the project team and corporate finance of constantly updating and understanding the cashflow as a live document that will change as project schedule milestones move. This may require training finance, as construction is rarely a statically predictable business. Now multiply that across the whole portfolio.

02 PROJECT FINANCIAL REPORTS



The image shows a screenshot of a financial spreadsheet, likely a project financial report. It features multiple tabs at the top, including '2021 CAPEX'. The main area contains a grid of data with columns for various financial metrics and rows for different projects or categories. The data is color-coded, with yellow and blue highlights. The spreadsheet is displayed in a window with standard software controls.

CURRENT STATE

The recurring corporate financial reports and dashboards tend to be an information silo owned by accounting or finance, meaning the projects are often stuck using their own tools and software. Usually, it's a basic spreadsheet or siloed software system maintained by the Project Manager in their spare time; updated well after PO's come in. Maybe or maybe not it makes it into the monthly report. At worst, there are multiple PO owners (usually whoever has access to the PO system), the PM can't access the PO's and invoices as they come in, and the project has minimal access to project financial data.

Most organizations are somewhere on the spectrum between a spreadsheet that finance never sees, or an information silo on the general ledger that the PM can't access.

And this tends to be a duplication of information in the cash flow, just if in a different and often unaligned form.



Business Requirements

- Reports and Dashboards Should be accurate from week to week.

BUSINESS REQUIREMENTS

1. The report's purpose and target/baseline needs to be clearly defined.
2. Must match weekly cashflow tools/documents.
3. Should be easily updated from cashflow tools (copy/paste).
4. Report Scorecard/Dashboard is a weekly/monthly deliverable.



Gaps

- Report needs accurate and detailed information from projects.

GAPS

1. What is the target in the report, what is the process and owner?
2. Coordination between projects & finance.
3. Cashflow and report need to be aligned.
4. Projects need to effectively support finance & accounting reporting cycle.

RECOMMENDATIONS

1. Make sure the report target number, process, and owner are agreed upon (is it annual budget, approved projects, latest rebaseline, ERP or EAC Forecast?
 - a. You can and should update the project forecast and variance from target regularly and in real time for project transparency to corporate governance.



Recommendations

- Project Controls owns reports for capital projects.
 - Try to only have one project cost & forecast tool. Otherwise keeping multiple documents straight will eat time and cause problems.
- b. If more than one owner, make sure they communicate changes to target numbers.
 - i. To be safe run reports often, looking for unexpected changes from other silos.
 2. Weekly coordination meeting between project controls & finance.
 3. Report should be fed (ideally mapped) to capital projects cashflow tools.
 4. Project controls to manage weekly process of managing POs, project costs, and updating forecast – data to be kept in project controls cashflow tool/financial model.
 - a. Because of duplicate data, the project should try to only use one financial reporting and forecasting tool, so there is one source of truth and streamlined data integrity.
 - b. Budget variance, actuals, and cashflow can all be the same spreadsheet / database.

03 PROJECT FINANCIAL GOVERNANCE

CURRENT STATE

Corporate finance will be monitoring business costs and forecasts, including capital projects; often in a spreadsheet, Smartsheet or ERP for individual sites to show their project forecast vs target, as a subset of overall business finance modeling.

At so many companies corporate finance makes their own project financial forecasts that are not communicated to project teams. Or projects know their current forecasts are different from what finance has and do not give them updated forecasts. Or worse, both. The project and the business information need to be aligned. And that alignment cannot be director or VP level sharing contradictory slide decks. The actual analysts need to talk on a regular basis.



Business Requirements

- Project Financials should be accurate from week to week with any variances clearly explained.



Gaps

- Consistent notifications of updates between finance and project teams.
- Reconciliation of variances between teams takes extra work.

BUSINESS REQUIREMENTS

1. Corp Finance uses the ERP and accounting system as the source of truth.
2. Finance and accounting will get actuals from the general ledger as part of invoice approval and AP rules. But project managers and contracts control when invoices arrive, and the project forecasts. There are multiple financial information owners that need to coordinate.
3. Project forecasts are ideally live systems but need to be updated and communicated consistently per the accounting and finance calendar to support corporate finance.
4. ERP financial forecasts need to match project information.
5. Reports are based on the accounting calendar.

GAPS

1. Too many reports. Project actuals need to come from one place, so decision makers are aligned. The CFO needs to have the same numbers the PM Sees.
2. Need notifications when corporate finance makes corporate project forecasts that don't match the PMO project forecasts.
3. Weekly, manual reconciliation between different financial, accounting, PO tracking, reporting and forecast software. How many sources of truth are there?



Recommendations

- A solid project report should translate and align to a solid corporate financial report.
- Enhanced communication between finance and project controls will improve quality and reduce surprises.

4. Finance and Projects need enhanced collaboration.
5. Limited visibility of accounting calendar impacts outside of accounting and finance – how does project coordinate?

RECOMMENDATIONS

1. Use ERP as source of truth for actuals.
 - PO Owners are responsible for getting invoices entered at the right time to hit actuals and AP proactively.
 - Finance and Projects need to agree to use the same ERP reports with the same data times for actuals.
 - The project needs to be set up with its own cost account(s) in the ERP accounting system to track the correct budget and actuals effectively.
 - At minimum – you have to be able to run ERP reports for a given project. Some accounting systems are not set up to track projects, and it may take effort and creativity to get project costs from the ERP.
2. Make sure Project Controls is treated as a finance role for software access privileges, and either gets notifications of changes, or has direct access to financial system daily so there is warning to identify and reconcile any unexpected updates.
 - PMs need notification of costs they don't control.
 - PMs need notification of corporate finance updates to forecasts and actuals, and links to latest dashboard, and to check the dashboard accuracy after every update.
 - Depending on the organizational rules, the project controls staff may be a finance department employee(s) seconded to the project.
3. Maintaining a detailed cashflow PO tracking tool. It should keep track of all weekly details before they show up in the business forecasts and need explanation.
 - If you control surprises, you will know about them before they show up in an executive report made by a different department.
 - PMs, PO owners need to get comfortable controlling costs and updating forecasts on a weekly basis.
 - Mapping cashflow forecasts to program schedule dates makes this easier.
4. Project Controls staff and corporate finance need to have regular meetings and collaboration to keep project controls and finance aligned.

5. Project Controls needs to be aligned with the accounting calendar to understand and support financial reporting and accounting close timing.

04 PROJECT LIFECYCLE



CURRENT STATE

Currently the project lifecycle is a matter of leadership prioritizing project requests, generating the business case, ROI and Capital Asset Request (CAR), fitting them into the annual budget, getting approval, cutting POs and managing various parts of the project and project changes – design, procurement, construction, Purchase Orders (POs), commissioning, hiring, training, operational readiness and close out; on time and under budget.

A Capital Asset Request (CAR) is a financial control to govern capital projects, much like an annual department or business unit budget, and goes through a very similar process. Except this is a capital asset, usually a facility with its own business case and ROI. Depending on financial rules, size, schedule, and budget the CAR will be authorized by executive approval or even the board. Most large organizations have a version of a CAR, but it may have a completely different name.

With larger projects, budgets are significantly larger, more complicated, harder to plan, and higher risk. Approvals are harder to get. It is common to lack visibility of the big picture of the portfolio of capital projects, and how both existing projects and proposed projects interact and compete for resources, space, attention, and funding.



Business Requirements

- Ability to both visualize and manage the **VUCA** of a large capital project program.
- **V**olatile
- **U**ncertain
- **C**omplex
- **A**mbiguous

BUSINESS REQUIREMENTS

1. Planning and tracking of unapproved project proposals.
2. Projects need to be well defined and communicated so they can be approved on schedule. Delayed approvals hurt project ROI.
3. Processes for changing or splitting scope, schedule, budget easily with appropriate approvals at all stages.
4. Ability to predictably staff capital projects with appropriate resources.
5. Formal approved CAR dates should be aligned with the project schedule and maintained in systems and dashboards if they are used as controlling documents for corporate governance.
6. Standard WBS / Project naming and coding to map project data between project tools, systems, and documents.
7. All phases of all projects need to be staffed with appropriate resources. You need the right people in the right place at the right time to execute projects on time, hit cashflow and ROI.



Gaps

- Recognize that program management process and tools start at project request, go through proposal, approval, and through financial close out after start up.



Recommendations

- Use Program management best practices and controls throughout the entire Project lifecycle, before the business case and through financial close out of all POs and AR.
- Training and documentation on what everything in ERP means and what departments use what outputs when.

GAPS

1. When project backlog and unapproved projects are tracked separately, it is hard to see the big picture, see where new projects fit into the program. That delays decision makers and approvals, adversely affecting project schedule.
2. Some projects may need engineering or design support as part of a business case. The business case itself may be a project requiring a budget and contractors.
3. CAR's limiting Program level change management, right sizing CAR's, prioritizing scopes between CAR's based on Business Case maturity before getting approval.
4. The program needs staffing plans to make sure all projects have enough people at the right times.
5. Uncertainty with CAR date changes and CAR updates.
6. Often there is no standard project WBS, making comparison of projects and organizing portfolios haphazard.
7. Staffing plans and resource management are last-minute, ad hoc.

RECOMMENDATIONS

1. Have tools to track project proposals. Ideally, you would have a program or enterprise level schedule for tracking proposed and approved projects.
2. Treat each Project proposal and business case like a project. It should have a scope, schedule, probably a budget, and due dates for deliverables and milestones like approvals.
3. Develop processes with leadership buy in for change management of project proposals to split up or combine CAR's before and after approval, understanding how finance and accounting systems will deal with it.
4. Have project staffing plans that meet the requirements of the program schedule included in the CAR.
5. Review documentation training of CAR dates and ERP outputs used by other departments. Do an Audit of CAR dates on open CARs in CAR tracking and make sure they are correct for how they are being used. Schedule change management should flow through CARs for good governance. Or Car should be closed and superseded by project governance documents post approval. Either way all levels of the organization should agree that the current project scope, budget, cost, and schedule are including all changes.
6. Develop a standard WBS for organizing and mapping project data (Scope, schedule, budget, POs, risks, resourcing – also can/should be organized by WBS.
7. You need a staffing plan and resource management capability. You need to know the resource requirements of every project, and the time commitments of every project team member. You need warning and advance notice when extra resources are required in the future and have time to find them and include them in your budgets.

- a. Nobody wants millions of dollars in cost and months of delays, because you didn't manage to bring in the right six figure talent at the beginning.



05 PROJECT DEVELOPMENT & APPROVAL

CURRENT STATE

You get a project request, build a business case, go through the Capital Asset Request (CAR) process, and get a budget approval approved in the financial system. After that it is an inconsistent process of getting everyone organized and up to speed on a given project.

BUSINESS REQUIREMENTS



Business Requirements

- You have to keep project stakeholders and staff in the loop, especially when they start.



Gaps

- Project information for project teams is inconsistent and not always timely.

1. The project charter, capital asset budget approval process and financing for large capital projects are different than small projects that take less than 9 months.
2. Strategic large multiyear capital projects need to be financed in such a way that they are protected from fluctuations in revenue or corporate cash reserves (i.e., budget cuts and layoffs).
 - a. Delays during the project risk quality and increase cost from starting and stopping project and contractors. Prevent what you can control.
3. Projects, CAR's PO's need to be approved fast enough to hit quarterly and annual project budgets.
4. Project Controls and Finance need to be in the loop to keep cash flow, reports, ERP and project systems aligned.
5. Project Stakeholders and staff need notification of project approval/start, and documentation required to understand project.
6. Estimates need to include all scope, including all capitalized assets and hidden costs. And estimates need to be consistently organized and coded so you can compare estimates. Ideally require industry standard like CII codes from all vendors and internal teams.

GAPS

1. Capital Asset Budget Requests need to be built on real numbers, not a political game to try and get enough money before executives change their minds and cancel the project. Asking for hundreds of millions of dollars before t you have a detailed scope and estimate.
2. Estimates based on incomplete information do not give you the right budget and create problems.
3. Multiyear projects self-financed by monthly revenue are at risk for budget shortfalls and corporate inability to pay

the contractors. Canceling PO's is not productive for project delivery.

4. Need accurate plan and forecast of project approvals.
5. Tracking and notification of CAR's and CAR approval is inconsistent.
6. No process for notification to resources after CAR approval. How do you mobilize staff?
7. No estimating standards on projects, some costs get missed. So many plants forget IT costs until construction is finishing up and the IT director asks – so where do we put the IT infrastructure? Is there an IT closet?



Recommendations

- **Project Initiation** Process and Notification – When a CAR is approved the project needs to be fully staffed, and all project staff and stakeholders including finance, IT and other secondary parties need to be informed so they can do their part.
- **Project Execution Plan** – At the beginning of a project, the cradle to grave of project scope, schedule, budget, procurement plan, staffing plan, risks, RACI, communication plan should be available to all project team members.

RECOMMENDATIONS

1. Capital Projects happen in phases. The Capital budget approvals should also happen in phases, allowing financial governance, control of project progress, and easily delay or cancel projects strategically. This is traditionally called a stage gate process with multiple steps each with its own approval. The timing of the steps must be carefully scheduled so CAR approvals do not delay the project and impact ROI or business case.
 - a. 1 - Feasibility study and conceptual design - get a few million dollars to hire an engineering firm, bring in consultants, and really define the scope and conceptual design
 - b. 2 – Basic and Detailed design – this is giving up the ten million dollars or more to have contract professional engineering do full design.
 - c. 3 – Procurement of major equipment – is usually critical path, and for most facilities will be a significant cost (20%-50% of Project cost)
 - d. 4 – Construction Contract – is an estimate based on ideally 90%-100% engineering design complete with a proposal price from construction companies. This would be the remaining item that allows you to see the total project cost.
 - e. 3&4 Can be combined at risk with a high contingency budget.
 - f. 5 – Don't forget to include a budget for post construction commissioning, training, and turnover.
2. There are many options to finance projects to guarantee project funding, the most obvious being a bond, loan, cash investments to cover the project, a siloed reserve fund, grants, etc. A financial backstop will protect project delivery from corporate volatility in profit and loss.
 - a. Additionally, each project should have a 20%-30% contingency/unknown scope budget at the project manager's discretion. Depending on governance, a program steering committee may serve as a check and balance to PM contingency decisions.

- b. Additionally corporate governance should have a capital project portfolio management reserve budget of 20% of portfolio value to use to support projects with significant unknown costs beyond contingency. This is standard practice, and management reserve budgets are often utilized, even with every best practice being well executed. Surprises and Black Swans hit every portfolio.
- 3. Include project proposal, scope development, corporate approval as part of program schedule as to make project approvals easier to track, predict timing, and show impact of delayed approvals.
 - a. If you know it takes executives months to decide, build that into the schedule from the beginning. Be pessimistic about schedules and budgets, because things will go wrong, and you will need contingency time and money.
- 4. Project Proposal tracking should include project controls and corporate finance participation so they can build it into forecast models.
- 5. When a CAR is approved a Project Initiation Document should be issued to all project staff and stakeholders.
 - a. Project Initiation form should include the process to complete Project Execution Plan.
 - b. Project execution plan is everything PMs and Project Controls own – Scope, Schedule, Budget, Staffing, Procurement Plan, Risk, RACI, etc.
- 6. **Standard Estimating Templates** should help capture all scope and costs at the front end of the project. The project kick off meeting should include all stake holder for a final review of scope, schedule and estimate for a final scrub of missing items (the same meeting should have happened before the CAR as well). Project funding stage gates help control this risk.
 - a. Estimates should also use standard cost codes, ideally organized around the WBS making baseline and comparison 1:1 between projects. Again sticking to industry standard coding like CII codes saves manhours and contractor fatigue.

CURRENT STATE

ERP (Enterprise Resource Planning software – think SAP, Oracle, JDE, Sage, Microsoft Dynamics) is usually the corporate finance and accounting system for approving and tracking capital assets. Here, ERP also means the software that holds the accounting general ledger. The ERP or related systems store project budgets, actual costs, and end dates to capitalize assets (and figure out taxes, amortization, and depreciation). The ERP is used as the source of truth by finance (and hence, anyone viewing financial reports) for project costs and Purchase Order status. All information in most ERP's is at least a day old – because of race conditions in the data integrity management. So, an invoice submitted today will often appear in ERP reports tomorrow as a committed cost with today's date (That may seem obvious, but I have seen executives fight over reporting variances caused by one day of data).

The key takeaway here is the finance and accounting system(s) determine the rules of the game and your meta strategy (what works best within the rules you are given) - where financial information is stored, when it is processed and available, and who has access to it. If you are being judged on monthly costs and enter an invoice into the system a day early or day late, it can create confusion and political headaches within your organization. Learn the accounting rules and software.



Business Requirements

- ERP is the budget & Cost source of truth.

BUSINESS REQUIREMENTS

1. ERP is the source of truth for project cost coming from the general ledger. It is also the most reliable source of actual costs available to project staff.
2. ERP is source of truth, because accounting. This includes project name, PO naming, vendor names, end dates, etc.
3. Different Project staff need access to ERP to manage budgets at the Portfolio, Program, CAR, Project, sub project and change order levels.
4. Budgets are often controlled in ERP at CAR and Sub CAR level. Projects need to map to CARs easily.
5. Budget owners need notification when costs hit ERP.

GAPS

1. Too many finance and reporting tools that duplicate ERP and create data integrity issues and race conditions in reporting (i.e., Smartsheet)



Gaps

- Who can do what in ERP is not fully explored or trained to team members.



Recommendations

- Push ERP to its limits.
- Get project team ERP access, trained up to fully utilize ERP and maintain good data integrity on budget allocations, dates, and any other features in ERP.

2. Projects need consistent and recognizable names in software systems – People have problems keeping track of what projects use what names. Especially when the project is named differently in every piece of software.
3. Access to ERP and ERP roles are not meeting project needs to manage budgets & cost.
4. Process and clear team understanding of who and how budgets are reallocated between CAR's and Sub CAR's.
5. Currently no known notification processes or automation from ERP.

RECOMMENDATIONS

1. Use the exact same ERP query/reports as Finance does. Databases get complicated quickly, and if you use something different, your report may not be pointing at the same data their report is. At the same time, track your actuals against your cashflow and forecast, so you know when finance has numbers that don't look right.
2. Come up with a standard for intuitive and useful project names. And use the SAME PROJECT NAME everywhere, in every system, every report, email subject, time sheet, CAR, SOW, PO. Ideally there is also a single project number. (Because people search by keywords)
 - a. Really this means choosing a good project name that is easily visible in email subject lines and ERP reports, and making sure that is the name used in the CAR and ERP. Otherwise over a few years and a few hundred million dollars your project will be known by many, many names, and tracking data, communications, and records will be a nightmare.
3. Get training on ERP Roles and make sure the right people have the right roles to manage ERP data properly.
 - a. Capital Project PMs should have ERP access to Project/CAR, Sub Project/Sub CAR, WBS detail, allocation and reallocation of money within the CAR and Project, and date changes.
 - b. Project Controls should have similar level of access to Capital Project PMs, if not more. PM's rarely have time to get trained up on ERP systems, that's what project controls professionals are for.
 - c. Sub CAR/Sub project, and PO delegates will need role or ability to track their costs directly in ERP. That is, if your POs are owned by anyone other than the PM, which is not advised.
 - d. If Finance & Accounting will not grant read/report access to the general ledger for project tracking, you have a problem and will need to negotiate full-time support from finance staff to support the project. In streamlined organizations, project controls have the exact same access as financial analysts, down to the general ledger journal

entries. Project control needs access to guarantee that the correct costs are hitting the project and conduct project accounting audit. Project controls should also be trained on how to coordinate journal entries with accounting.

4. Depending on the ERP, in lieu of a WBS in the ERP, Capital Projects may consider Sub CAR's (or whatever semantic/rule your ERP has) as a cost breakdown structure to track budgets and costs (i.e., Design, construction, major equipment POs, start up, and sub projects).
 - a. Again, a stage gate process is recommended for getting a good estimate and not going through CAR change requests.
 - i. That means break up stages of the project – Concept, detailed design, construction, are sub projects with discrete budgets that are separate to control project development.
 - ii. Having a WBS based cost break down structure allows apple to apples comparison between projects, portfolio management, cost loading of schedules, detailed cashflows that map to the PO's, reports, schedules, CAR, Estimate, etc.
 - b. You want to track costs at the PO level. Because Purchase Orders are the easiest key data field that automatically maps to both the PM's mind and the ERP. Structure and organize your PO's carefully against your WBS.
5. Find out if ERP can send out notifications, set up dashboards, batch out automated reports every morning, or set up robotic process automation in windows with something like MS Power Automate or Copilot.
 - a. Push the ERP to its limits and see what features it can do, what features are not being used, what outputs are going to other departments.
 - b. Often in getting software to do things, when the IT admins say "No", what they often mean is either they don't know how, or they don't like to share. Been there, done that with a dozen companies. Most ERP's have all the features you need, figure out how to make them work on the front end of the software. Please don't spend money on customizing software unless you can afford full time software engineering staff to maintain and update it.
 - c. Get project controls trained to be a subject matter expert in the ERP software. And have important lessons shared with Capital Project PMs.

07 PO LIFECYCLE

CURRENT STATE

When it comes to getting Purchase Orders, usually Sourcing/Procurement/Purchasing controls approved suppliers. They set up contracts, terms & conditions, and initial SOW for any supplier. All suppliers are subject to the same contract terms and conditions, regardless of the product or service provided.



Business Requirements

- Procurement/Sourcing will control all POs up to point. And then it's the project's problem.

BUSINESS REQUIREMENTS

1. All suppliers and POs (should) go through corporate procurement.
2. POs are the source of all external project costs.
3. Once the POs are approved, Procurement often hands off all PO management to the PO owner.
4. Contracts are often a one size fits all template built for supply chain, but you need appropriate terms, conditions, and contract structure for project contracts.
5. PO approvals should not be a bottleneck to project execution and schedule.



Gaps

- After approval, PO control is inconsistent at best.
- Standard supply chain and purchasing contracts are not appropriate for most capital project PO's, especially consultants, contractors, engineering & construction.

GAPS

1. Indirect sourcing can be a bottle neck, both on qualifying new suppliers and getting POs processed.
 - a. Supplier qualification criteria for supply chain may not work for specialty consultants and contractors.
2. Standard Purchasing T&C's do not include cashflow forecasting from suppliers. But projects need this.
3. If Procurement/Sourcing does not track open POs, who does?
4. Standard supply contract Ts & Cs are not friendly or effective to engineering & construction contracts.
 - a. Most procurement contracts are not built for engineering or construction and will leave your capital projects at risk.
5. \$1MM or similar threshold on PO approvals may not be practical for a Capital Project Program with CAR's that assume dozens of POs over approval threshold. Do your senior executives want to approve 20 high dollar project PO's next month after already approving the CAR?
 - a. Delays in PO approvals kill project schedules. If executive approval of PO's delay project critical path, either find alternative processes to manage it, or be ready to issue project change orders directly to the executive PO approvers delaying the project.



Recommendations

- Schedule the Prequal and onboarding of capital project contractors when developing the CAR.
- Create standard SOW language for cashflow forecasts from supplier.
- Develop a contract template that fits large capital project needs. Both for engineering services and construction.
- Include procurement/sourcing in the schedule like any other contributing project stakeholder.
- Create process and delegated approval limits for large capital projects around PO's and Invoices so a busy executive does not bottleneck project schedule critical path.
- If you know executive approvals will delay schedule – build anticipated delays into project schedule and be transparent about them in scheduling and reporting.

RECOMMENDATIONS

1. Include procurement/sourcing as soon as possible in project development.
 - If you want new suppliers, get them on the approved vendors list ASAP. Long before you get the CAR approved.
 - If you have new suppliers, be ready to add extra **months** to the procurement schedule for supplier qualification. Unless you can expedite the process.
 - Be ready to prepare subcontract arrangements through approved suppliers to expedite for schedule.
 - Also understand that many specialty contractors that support capital projects may not qualify as vendors under supply chain criteria – because they are contractors, not supply chain vendors.
 - Include procurement/sourcing on project procurement planning and project initiation as early as possible in the project lifecycle.
 - Build and manage a procurement schedule to set expectations from indirect sourcing and have them update progress weekly in schedule to keep them engaged in their project role.
2. SOW terms and conditions need to include a cashflow forecast that determines the estimated cost and date of every invoice from supplier. And the supplier should provide an updated project report and cashflow forecast monthly with an advice copy of the invoice.
 - Do not let your contractors slack on monthly reporting.
 - If your contractors cannot support monthly reporting, bring in a consultant to plug that gap.
3. Projects must be set up to track and manage all POs within the project. This requires procurement to share all PO information with the project, and ideally all current and future POs in scope to be tracked in schedule and cashflow forecast.
4. Ask procurement/sourcing to allow and help create a Capital Projects contract that is appropriate for engineering and construction. This is where consultants are helpful. AIA standard contract is a great template to start from for construction, and it provides an excellent structure for tracking costs, earned value, and resource loading schedules for cash flow forecasting.
5. Engage with PO Approval Stake holders (executives) and discuss how many POs and PO change orders they wish to approve for large capital projects. With changes to a dynamic program, there could be several \$1MM+ approvals every month for a year or longer.

Then try to set up a streamlined process of PO approvals and Invoice approvals that will not be bottlenecked by executives unprepared to support capital project needs.

- It's not unusual for PM's to issue multiple, even dozens of PO's over \$10MM over the course of a year, depending on how the scope breaks out.
- It's not unusual to get multiple invoices over \$10MM in a given month on a large project.

08 PO TRACKING & CONTROL

CURRENT STATE

In most companies there are many people that can create a Purchase Order, and get it approved to bill the project without notifying the project. This results in multiple PO owners hitting the project budget without the project manager knowing. There is often no formal process or role for managing project POs. POs are managed ad hoc. Because large capital projects are not a core competency of most companies that don't sell projects.



Business Requirements

- Need to track and control POs for accurate project cashflow and accounting.

BUSINESS REQUIREMENTS

1. Project are going to have many large POs that will impact weekly and monthly cashflow.
2. There might be multiple PO owners.
3. POs drive cashflow, that is how it works.
4. Each individual PO owner impacts cashflow, whether they know it or not.
5. POs should be closed out when the scope of work is complete.
6. The size and number of POs should be deliberate to easily manage and bring value to the project.



Gaps

- Project PO management is new to the organization.

GAPS

1. There is rarely a PO management role on projects. If you are lucky the PM knows how to do this.
 - Some projects will order thousands of tracked items. With potentially hundreds of PO's.
2. PMs lack visibility to POs hitting projects.
3. No formal PO Cashflow tracking on projects.
4. PO owners need to be managed to hit cashflow.
5. There are often a suspicious number of open POs.
6. The issue of how large POs should be and how many POs there should be is curious and appears to be driven by how difficult it is to push through a PO approval (when should people be gaming the system of financial controls on purchase orders?).



Recommendations

- Project Controls often takes responsibility to manage PO owners and get PMs visibility to Project POs.

RECOMMENDATIONS

1. Procurement Management
 - Delegate as much procurement as appropriate to prime contractors to manage. Put it in the scope of your prime Construction Contract and let their more experienced team manage material tracking, equipment tracking, and subcontracts.

- As appropriate delegate POs out to construction, contractors, and suppliers to manage the amount of PO tracking and material management done by project staff.
 - Be careful on how you Bundle, split up, or subcontract PO's, there is a balance between tracking costs, over reliance on contractors, and working the corporate bureaucracy.
 - All POs that are direct to the owner be tracked by Project Controls.
2. Project Controls/Procurement/Accounting adding Capital Project PMs as Approvers in Procurement Systems on all project POs to give PMs visibility.
 3. Project controls to track POs cashflows individually and have them role up to project level reporting.
 - Project controls running regular reports to find existing and new (surprise) POs.
 4. Project Controls should work closely with PO owners, so they keep up with project lifecycle, keep updated cashflows, and close out POs.
 5. Audit and close out inactive POs. Set up process for project close out that includes POs.
 6. There should be standard guidance to structure, size, and number of POs.
 - Specifically, One PO per supplier (scope) on a given CAR is the starting point.
 - Design, Construction, Major equipment, Validation, contractors, etc.
 - However, if a supplier is supplying multiple unique scopes, breaking out scopes as distinct PO's can make cost tracking easier to understand.
 - Bundle or split up scopes as different PO's as makes sense to those managing the PO's.
 - If you are running a large number of smaller PO's, be ready to explain why to corporate financial controls that may think you are trying to game PO approval limits.
 - Change orders expanding scope to an existing PO will simplify bookkeeping and invoicing. Adding additional PO's may result in complicated and confusing billing and invoicing.
 - Lastly – organize PO's one to one with the structure of the WBS, estimate, schedule, reports – So you can build PO cashflows from the schedule, manage cost variance off the estimate, give detailed analysis explaining cashflow, etc.

09 INVOICE APPROVALS AND DELIVERY RECEIPTS

CURRENT STATE



Business Requirements

- Understand the meta and rules of how invoices are received, approved, and hit cashflow so you can control each of those steps on your project.



Gaps

- PO owners control project actual costs with little coordination.



Recommendations

- To show up in financial reports, invoices and invoice approvals must be handled in a timely fashion.
- Project controls will start coordinating PO owners so there are no unexpected surprises in the cashflow forecast or actuals any given Monday.

Invoices and delivery receipts entered into the ERP/Invoicing/PO/AP System often determine the actual general ledger date of when product or service was delivered and hits cashflow (GAP accounting rules as applied by your controller). Payment of the invoice happens later per AP rules and PO T&C's. Invoices and delivery receipts may not be controlled or approved by the Project Manager - that means PO owners and delivery receiving clerks' control when actual costs hit the cash flow. And sometimes vendors don't tell you when they are shipping. Organizational accounting rules control if cashflow date is the accrual date, delivery date, or payment date. Everyone needs to understand and agree on what the rules are and what the numbers mean.

BUSINESS REQUIREMENTS

1. PO owners and whomever receives deliveries control invoice approvals and delivery receipt dates in the PO system.
2. Delivery receipts often show up in ERP on the following business day, or predictably according to accounting rules.
3. You should only receive items that have been verified by project staff and inspected by an engineer if a technical piece of equipment. And you don't want a random employee signing for a delivery and accepting damaged equipment or materials.

GAPS

1. PO owners may not know their delivery receipts and invoice approvals directly control cashflow, or what the consequences to cashflow are.
2. Delivery receipts and invoices must be entered by week end accounting cycle to hit the correct week.
3. Once a delivery is formally received you accept the condition of the equipment, including any shipping damage.

RECOMMENDATIONS

1. Manage PO owners so they forecast and enter invoices and delivery receipts appropriately and can be explained when they hit cashflow.

- a. Establish relationship and communications between Capital Projects Team and receiving dock to manage those invoice receipts.
 - b. Project Controls can also get cashflows and schedules from suppliers to make cashflow forecasts and manage PO owners.
 - c. Coordinate with suppliers and let them know what the appropriate invoice and delivery timing is.
 - d. Be very careful managing this process if your ERP automatically pays vendors upon delivery receipt. (A common supply chain payment process automation not meant for capital projects).
- 2. Project Controls should track all expected PO deliveries and invoices by week (in cashflow forecast tool) and remind PO owners to receive deliveries and approve invoices on time per schedule and forecast.
- 3. Coordinate very carefully with suppliers and receiving docks for delivered equipment so you can control acceptance and receipt of expensive and delicate items.
 - a. Project best practices are to have an obviously different delivery location for project equipment and materials, so proper acceptance, receipt, quality control and material control can happen.

10 DIVISION OF RESPONSIBILITY

CURRENT STATE

Projects have been executed ad hoc, informally, with documentation and processes fitting the needs of the individual PM and project. Which worked fine spending a million dollars a month. Spending a couple million a week on much larger projects creates a larger level of complexity that carries much higher risk for trying to run projects off the top of your head.



Business Requirements

- You need to know who does what, who is responsible for what, how decisions are made, why they are made, and they need to be documented and dated so everyone can agree on direction.



Gaps

- Historically small projects have had ad hoc and shared responsibilities on decisions with small financial risk. It is very easy to make a million-dollar mistake by yourself on a large project.



Recommendations

- Well defined division of responsibility on capital projects between Global PMs, Project controls, finance, sourcing, site

BUSINESS REQUIREMENTS

1. With a program of large capital projects, there needs to be a predictable and standard answer to the following questions:
 - a. Who owns the project?
 - b. Who owns the scope and budget?
 - c. Who owns the schedule & need by dates?
 - d. Who owns POs?
 - e. Who approves POs, invoice approval, delivery acceptance and receipts?
 - f. Who controls costs?
 - g. Who changes or reallocates the budget?
 - h. Who approves supplier submittals?
2. Need clear hand offs.

GAPS

1. Division of Responsibility on small projects is usually ad hoc and fluid depending on the project needs and individual availability at the time. This has created ambiguous roles with overlapping responsibilities and authority.
2. Handoffs are not well defined. Things get lost and forgotten easily.

RECOMMENDATIONS

A predictable and consistent division of responsibility should be decided and communicated for capital projects. In addition, every project should have a RACI chart specific to that project.

Basically, on capital projects PMs are responsible for everything, and need notification if not approval authority on most project decisions, including anything that hits the general ledger.

1. For capital projects:
 - a. Project Managers own projects.
 - b. Project Managers own the CAR.

engineering, and other stake holders

- Clearly define project roles and responsibilities by individual, and don't leave gaps.
- Develop a **RACI** chart for every project (who is **R**esponsible, **A**ccountable, **C**onsulted, **I**nformed).

| Step | Project Initiation | Project Executive | Project Manager | Business Analyst | Technical Architect | Application Developers |
|------|--------------------|-------------------|-----------------|------------------|---------------------|------------------------|
| 1 | Task 1 | C | A/R | C | I | I |
| 2 | Task 2 | A | I | R | C | I |
| 3 | Task 3 | A | I | R | C | I |
| 4 | Task 4 | C | A | I | R | I |

- Project Managers own the Sub CAR/subprojects but may delegate control.
- Project Managers are responsible for all project POs even if they are not the PO owner/requestor.
- Project Managers should be approvers on POs delivery receipts, and invoices, May delegate as appropriate with Project Controls support.
- Project Controls will control costs for Capital Project Managers
- Project Managers own Project Budget
- Project Managers are responsible for assigning supplier submittals to the responsible engineer/manager/stakeholder.
- Any changes to the Scope/schedule/budget that change the CAR approval limits require CAR change approval process.

- Define handoffs between Project Managers and site Engineering/facilities/operations.

11 PROJECT DATA FLOW & DATA INTEGRITY

CURRENT STATE

Knowing what data is used to manage the project, where it goes, and who looks at it is important for project management and project controls.



Business Requirements

- The PM should be controlling the project and know what's in the system before finance runs their reports.
- Controlling means organizing, scheduling, tracking, measuring, documenting and forecasting on a daily and weekly basis. This is also the primary function of Project Controls.



Gaps

- Need documentation of how and where data flows.
- Problems have arisen from people not pushing the right buttons at the right time.

For the purposes here – this is project performance data. Most of which is associated with the ERP, PO system, and project management software (Schedules, Kanban, Reports, etc.).

Data flows from suppliers to either spreadsheets or the above software.

BUSINESS REQUIREMENTS

1. This is about people knowing how items and information show up in reports. Which lets you know both the consequences of pushing buttons, and where to look to see if someone else pushed a button.
2. Project data integrity matters for accurate reporting – Garbage in = Garbage out.

GAPS

1. List of data relationships that are not common knowledge: (though these vary with different organization and systems).
 - a. Most data entered today does not show up in ERP reports until tomorrow.
 - b. Smart Sheet and most modern software have a track change function that PM's and analysts can use forensically.
 - c. ERP is the source of truth for Capital Projects.
 - d. Smart Sheet/Excel/Google Sheets actuals and reports are literally copy/paste from ERP.
 - e. Procurement delivery receipts are what drive actuals in ERP, and hence spreadsheets and reports.
 - f. If PO owners are late entering delivery receipts in Procurement every Friday, the Monday cashflow will be wrong.
 - g. If PO owners are later accepting delivery receipts, nobody knows unless they look for it in the following report.



Recommendations

- Data integrity doesn't happen by accident. You need project stakeholders that understand the whole data lifecycle or be stuck with incomplete and incorrect reports and people making decisions on bad information.

- h. If nobody is tracking a schedule of deliveries and invoices, nobody will know what to look for Monday morning, unless you start interrogating every PO owner on the project and hope they remember.
- i. If it is not in the ERP, it is sitting on someone's hard drive in an MS office document.
- j. ERP Sub CAR budgets may be reallocated with correct access.

2. Project Data integrity is dependent on the users.

RECOMMENDATIONS

1. Make sure the people using these systems, reports or pushing the buttons understand where it goes, why it goes there, and who will see it and ask questions.
 - a. Anyone that can impact the project needs to be trained on how to support the project.
2. Use this information when building project processes to ensure project data integrity.
 - a. This applies to ERP, technical document control, financial reports, schedules, project scope, everything. To run a large project is to become a librarian of project information. And these days the information tends to sit in dozens of different systems and digital vaults.

12 DOCUMENT CONTROL

CURRENT STATE

Project staff are setting up multiple Box sites, SharePoint sites and Teams sites ad hoc and upload documents without any standard file structure, managed review flows, or version control.



Business Requirements

- You need to be able to find the right document at the right time to make the right decision.

BUSINESS REQUIREMENTS

1. You want to know that the right people have the right document at the right time to make the right decision. This is especially true when you are asking contractors to buy or build things for you. Giving contractors the wrong technical documentation ends in mistakes, rework, delays, extra costs.



Gaps

- Small Projects are challenged by document control and review cycles. Large projects scale the challenge to multiple FTEs of workload.

GAPS

1. Project document control, especially for the purposes of controlling, distributing, and approving technical documents, engineering transmittals and construction submittals, is an informal volunteer process.
 - a. That's how you end up with a second project to fix all the mistakes made on the first project.



Recommendations

- Bring in a project document control professional.

RECOMMENDATIONS

1. Document Control requires full-time attention. On large projects it could take multiple people in excess of 80 hours a week of work. You need a Project Document Control subject matter expert. A competent document controller or Doc Control Manager should be able to evaluate existing tools, and then adopt one to control the flow and storage of technical documents on project Box or SharePoint sites, if not new software.
 - a. With time, a contractor can set up a system, get it going, train local hires to maintain it and do the role for sustainable long term project doc control.
 - b. Depending on project size, complexity and existing tools, the program will often benefit from procurement and set up of a best of breed Project Management software suite that includes high performance document control tools.
 - c. Don't underestimate the value of high-quality Document Control. This is a very high-risk place to go cheap.



Business Requirements

- Large Capital Projects require a single integrated master schedule that includes the supplier schedules so you can see how they affect each other.



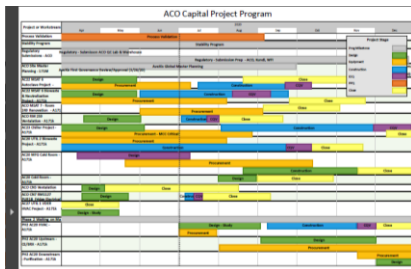
Gaps

- Existing schedules are offline, single user, siloed and cover limited project scope.



Recommendations

- Database driven Integrated Master schedule that covers every capital project cradle to grave.
- You can fit a \$200MM Program of Large Capital Projects on one page:



13 PROGRAM SCHEDULING

CURRENT STATE

Suppliers sometime provide schedules showing their scope. The design services firm provides a design schedule. Construction provides a construction schedule. Equipment suppliers provide milestone dates. PMs often fill in gaps by making multiple standalone schedules in MS Project or spreadsheets.

Current schedules are stand alone, siloed, lack critical path, and lack visibility of the whole project, let alone visibility of multiple projects or the portfolio.

BUSINESS REQUIREMENTS

1. As stated above, a schedule for the business case and CAR project front end can give more predictability to the process and project lifecycle. It's the industry standard way to keep track of multiple large project proposals simultaneously.
2. A Program/Portfolio schedule is necessary to manage a program of large capital projects, see the critical paths, and control the cashflow.

GAPS

1. No schedule exists for the weeks or months of project work before the CAR is approved.
2. There is not an integrated project schedule that shows the critical path between business case, CAR, design, procurement, installation, commissioning on a project.

RECOMMENDATIONS

1. Integrated cost and resource loaded master program/portfolio schedule that shows every project from cradle to grave. Once you get that going it can act as a PM force multiplier – directly supporting project and portfolio strategy, cashflows and staffing plans.
2. This is like document control; initially you will need a schedule subject matter expert to set it up and run it.
 - a. Ideally a contractor can get you going in an expert power tool like Primavera for as long as you want, and train staff as needed.
 - b. Alternatively, a good consultant should be able to find a lighter weight portfolio scheduling and PM software that can provide sustainable long-term utility and configure it such that PMs and Project Controls can maintain it. Avoid MS Project, as it is not a robust or reliable portfolio management tool, it's limited as an entry level schedule builder.



14 PROJECT & PROGRAM CONTROLS

CURRENT STATE

Often there isn't any project controls. Usually, a site financial analyst works overtime trying to support project cashflow forecast, actuals, and variance analysis. Some companies that are used to capital projects may have full-time Project Controls doing cost work.

Though often project controls means the integration of estimate, schedule, cost, PO's, risk, staffing, forecasting and reporting. For the minimum viable product – the core skill here is project cost control supported by estimating and scheduling support staff. Though if you have the right unicorn, some project controls experts can run estimating and project controls out of the schedule in the right software.



Business Requirements

- Program controls is a full-time role that forecast and tracks every PO, Goods receipt, invoice, and knows when and where every dollar hits so every variance in the Monday smart sheet is known before Monday.



Gaps

- Often, there are no project controls.
- Project controls is a project finance role that addresses many of the requirements in this report.

In many cases this may be only one person providing project controls for all the projects, so the role is effectively “program controls.”

To control something, it's a matter of having a target, an actual measurement, and understanding when and why actuals are different than targets. And using those variance trends to create higher quality targets and communicate the how and why those actuals and forecasts evolve over time.

BUSINESS REQUIREMENTS

1. Maintain Project Cashflow forecast, actuals, variance analysis & explanation.
2. Accurate and explainable weekly Project Report.
3. Accurate and explainable weekly Corporate Financials.
4. Tracking of Project financials across project lifecycle.
5. Program level analysis and support for Project development & approval
6. Program level analysis and coordination of ERP.
7. Program level control of PO lifecycle.
8. Program level tracking and control of POs.
9. Program level tracking and control of Delivery Receipts.
10. A role that has responsibility and time for these business requirements.
11. Program level understanding of project financial data integrity.
12. Program level checks and balances to project change management.

13. Full time project & program controls support to program management.



Recommendations

- Empower project controls with the responsibility for the business requirements listed.
- Provide as much training, access, and support as possible to allow staff to thrive in the project controls role.

GAPS

Without being overly redundant – the above business requirements do not get full-time attention from a dedicated resource responsible for them. The business requirements are the job description.

RECOMMENDATIONS

You need full-time project controls. This can be a contractor or full-time internal role. The above business requirements are the starting point for the role and responsibilities for the Project & Program Controls role.

Give project controls staff the ERP access, authority, training, and support to tackle all those business requirements, and bring in some help if you want it to happen faster/better.



15 PROJECT CHANGE MANAGEMENT

CURRENT STATE

Project change management is the process for approving, tracking, and controlling changes to projects. Usually focused on changes to scope, schedule, cost and risk.

Often change management is inconsistent and managed at the PO level, as there was much flexibility unless an ERP or PO approval was triggered. It rarely managed at the schedule, project controls, or CAR level.

Right sized processes for project change management of scope, schedule, budget and risk at all levels of tracking and approval are needed.

On most projects, if the PM gets hit by a bus, there is inadequate documentation for a replacement PM to figure out what is happening, let alone a project audit.



Business Requirements

- Project change management is a check and balance to changing what happens, how long it takes, and what it costs.



Gaps

- Previous Change management lacked documentation, tracking, and has not had support from project controls or program management.

BUSINESS REQUIREMENTS

1. Any risks, technical or engineering changes or decisions need to be documented in the project document control. As a matter of project record
2. Changes that affect scope, schedule or budget need to be reviewed, approved, recorded, and flowed through a rebaseline of the project execution plan (Scope, schedule, budget, staffing, risk, etc.) and all impacted project management and project controls tools.
3. Before approval, a complete analysis of the impact on program (all projects) scope, schedule, and budget needs to be made and considered as part of the approval process. Somebody will have to pay for it, and they are usually not project staff.

GAPS

1. Changes and decisions made to scope, risks or engineering are not consistently recorded in project document control.
2. Lack of notification of changes to project controls, documents and program schedule.
3. Formal process for approving and rebaseline of changes to scope, schedule, budget, risk at appropriate levels (PM, steering committee, executive, CAR rebaseline)



Recommendations

- Adapt updated project change management rules and integrate them into project controls and program management practices.
- Make sure that any change that affects scope, schedule, or budget is fully reviewed with project controls.
- All project changes need to be documented, tracked, and communicated to all project stakeholders.

RECOMMENDATIONS

1. Include project procurement control and records management in any formal communications of scope, technical or risk management decisions.
2. Notify Doc control, Project controls and schedule of approved change orders so project management and control documents and tools may be rebaselined and forecast updated.
3. Include project procurement, project document control, project controls, Program schedule, Program manager in assessment of any change request.

16 PROGRAM MANAGEMENT

CURRENT STATE

Capital Program Management is new to many companies. In the past every project was an island, only rolled up for financial reports.

Prepare for the future of delivering multiple large capital projects at one or multiple sites simultaneously. This means a Program manager role, and development of a program and project management organization (PMO) with standards, not just ad hoc project managers using ad hoc tools.

BUSINESS REQUIREMENTS

Fundamentally Program Management is the role of looking at a group of projects holistically, seeing how they interact, conflict, seeing the patterns in project execution and supporting corrective action.

At minimum the Program Manager is responsible for providing project managers with what they need to succeed and maintain a program level understanding of progress and performance that is communicated to the business.



Business Requirements

- The Program Manager makes sure the projects have what they need to succeed.
 - PMO's exist to create consistent standards of data and performance so projects can roll up in reporting and share best practices.
1. Manage Program weekly Cashflow.
 2. Manage Program weekly Report.
 3. Manage Program weekly Financials.
 4. Manage Program and Project Lifecycle.
 5. Manage Program Projects Development & Approval.
 6. Manage Program ERP (AR's, Sub AR's).
 7. Manage Program PO Lifecycles.
 8. Manage Program PO Tracking & Controls
 9. Manage Program Goods Receipts
 10. Manage Program Division of Responsibility
 11. Manage Project Data Flow and Data integrity.
 12. Manage Project Document Control.
 13. Manage Program Scheduling.
 14. Manage Program Controls.
 15. Manage Project and Program Change.
 16. Coordinate and support Project Management within the program.
 17. Manage Program Risk.
 18. Manage Program Resource Planning.
 19. Uphold Program Quality and Safety.
 20. Program Stakeholder Engagement.



Gaps

- The Program manager is brand new. The entire program structure, processes, tools, culture is a gap.



Recommendations

- This is a change to the organization and needs to be communicated and managed as such. Winning hearts and minds will take work.
- Set up the Program Manager to succeed. Needs a scope, schedule, budget of how to get the program built and achieve its objectives.

GAPS

This is unfamiliar territory for many organizations. The Capital Program Manager is effectively responsible for managing and coordinating all the content of this report. It's a gap to be filled.

RECOMMENDATIONS

Use the above Business Requirements as a starting point. Give the Program manager the authority to develop or obtain the people, processes, and tools necessary to fulfill the business requirements. And if needed capitalize the costs as part of the capital projects. That's where contractors come in handy, they plan on leaving when the project ends.

Using a PMO approach to developing a Program management capability is recommended. That means having a consistent and predictable process, tools, templates and expectations for projects and project managers and project controls.

This will be a project in and of itself and should be organized and executed as such. Additionally, this is a cultural change and would benefit from organizational change management methods.

17 ACTION PLAN

This is what I would do if it were me.

FIRST STEPS

First, accept that increasing the size and cost of the capital projects by an order of magnitude or more is a significant change to the experience of most corporate EPMO's and project management teams.

Building the capability to manage a \$100MM plus program of large projects is an additional culture change with new things to learn and figure out.



First Steps

- Large projects involve lots of change to how things are done, utilize cultural change tools to make the changes less painful and easier to adopt.

Organizational/Cultural Change Management will be a necessary part of getting the culture and people in the organization to accept and work with these unfamiliar words, processes and tools.

ORGANIZATIONAL CHANGE APPROACH

Project stakeholders and team members will need communication and resources to adapt to these changes. We recommend using the proven **ADKAR** Model:

- **Awareness** of the need for change.
- **Desire** to participate and support the change.
- **Knowledge** of how to change.
- **Ability** to implement required skills and behaviors.
- **Reinforcement** to sustain the change.

Every person will go through a version of this process with every change the Program makes. From supporting cashflow with a weekly cadence on invoice tracking to closing out POs, updating schedules, and delegating tasks to a growing capital projects team and PMO.

ADKAR does not need to be a big, fancy rollout with a team of consultants. It is just a proven model for communicating change and getting user acceptance. Tell them why it is important, what is in it for them, let them know what they need to do, teach them how to do it, and then follow up as appropriate until they get it.

That feels obvious when you read it. But so many things fail because people skip those steps.



Band Aids

- Project Controls and Program Management need to quickly get high profile needs addressed.

SECOND - BAND AIDS

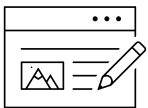
First, you must get some basics going to address the coming change.

Project Controls – A dedicated cost analyst can take responsibility for Cashflow and get Financial Reporting under control.

- Build out scalable spreadsheet-based tool(s) that will track planned delivery receipts on all POs on active Capital Projects.
 - This may become a culture change exercise to elicit forecasts from PO owners.
- Make sure the cashflow forecast or Report can easily feed (copy/paste) the ERP/Financial reports (map data and format).
- Figure out the “go to” reports for obtaining actuals (ERP, Reporting tools), and hunting down open PO data for forecasting.
- Project controls and finance to collaborate and share information, get those black swan surprise forecast entries communicated from finance to project controls.
- Get project PO owners trained on weekly Delivery Receipt cycle.
- Continue looking for opportunities to give PMs better visibility and control of project POs.

Program Management – Get a program manager in place; and get them up to speed.

- Need a planning and tracking tool for proposed projects.
- Help determine the best/most realistic projects to utilize the current annual budget and hit portfolio target spend.
 - Is it realistic to hit target spend given lead time on project approvals?
- Start looking at staffing and resource needs for the remaining annual project backlog.



Minimum Viable Product

- Build the project tools you need as you need them. Focus on scalable fundamentals that lay the foundation for program controls and program management.

THIRD – MINIMUM VIABLE PRODUCT

Or “Just in Time” processes and tools. Build what you need as you need it. This is when the project tool kit starts to take form.

If you can't get ahead of it, build the plane while you are flying it. It is that simple. The advantage to that is it quickly separates the wheat from the chaff.

1. Project Controls –

- Continues making inroads on getting PO owners to effectively forecast and approve delivery receipts to support cashflow.

- Also, start to look at ways to leverage project data mapping to find tools and levels of access that can empower project teams to support project controls organically.
- 2. Standard Estimating Template.** The main purpose being to include all project stakeholders that generate project costs (like the often-forgotten IT infrastructure). Everything in project tracking follows from the estimate (which is just a scope with money per line item).
 - A large project will go through multiple estimates by multiple estimators, often from different companies. Have them do their thing, but also have them put it into your standard format so you can compare different estimates and understand where the 50% price increase came from.
- 3. Integrated Program Schedule.** Needs to be scalable from the start.
 - Schedule is the standard tool to estimate cashflows for multiple proposed large projects for multiple scenarios quickly.
 - Is also the standard tool to get your arms around what the program looks like.
 - And is the industry standard tool for resource planning.
 - Usually, the best solution is a Primavera program schedule.
 - A consultant could set you up with a program schedule in Primavera in a month or two.
- 4. PO Lifecycle – Procurement/Sourcing**
 - Get Procurement/Sourcing aligned with project needs.
 - A standard contract that is contractor friendly and meant for contractors and capital projects.
 - Anticipate any new supplier and get them on the approved vendors list as early as possible.
 - Work with indirect sourcing for way to expedite PO/SOW development & approval.
 - Work with procurement/sourcing to develop a standard program schedule for onboarding suppliers and awarding project POs so we can plan and forecast dozens of POs against multiple projects.
 - The goal - you want procurement/sourcing ready and waiting before the CAR is approved.
- 5. Project Document Control**
 - Requires an SME to come in evaluate existing Doc Control tools, pick one, and set up standards and processes for project document control.
 - Alternatively, if the project requires, Doc Control can set up a best of breed doc control system like Autodesk Construction Cloud or Aconex for capital project document control. Note those software

systems also provide project management tools you can scale into.

- Document control will likely need at least a few weeks (or longer) to get the basics in place to properly support new capital projects.
- Should be able to operate effectively in Box or SharePoint in the short term, and even long term if budget is limited.

6. Project Initiation Form

- Have it ready to kick off the next project quickly,
- Informs project stakeholders what the staffing requirements are and request resource commitments.
- Informs IT, and Project Document Control, Project Controls, Finance, and other stake holders that they need to set up whatever systems and tools that support the project.

7. Program Management - At a program level get a handle on scope, schedule, budget, cashflow, resource management and PO management.

- Figure out Stakeholder engagement.

8. Division of Responsibility – Once you get this far with new project practices, the division of responsibility should have naturally started breaking out, but it should be finished with some decisions and RACI forms to set healthy project boundaries.

You get these basics going, and you will have the foundation to build a program on. These tools, documents, processes, and structures become the intellectual property that future project execution will be built on.

And especially early on, the trick is getting enough early adopters of the minimum viable product to succeed, while accepting that many people will take time to understand, accept, and learn the new ways of approaching large projects.

FOURH – COMPLETE THE FUNDAMENTALS

As large projects get going, they will benefit from more organization and some standardized documents to set expectations and align efforts.

Project Execution Plan:

- The Idea here being able to supply the project team with all the project management documents to create a common understanding of what needs to be done to execute and deliver the project. The



Complete the Fundamentals.

- Flesh out a scalable project delivery and toolkit that can succeed with different systems and tools.

majority of these documents will likely start as MS office templates.

- And again, from a Minimum Viable Product perspective, you be building these when you need them, and the early versions will likely be basic until they have time to mature.
 - Project Charter.
 - Project Scope.
 - Scope – Deliverables list.
 - Estimate.
 - Budget.
 - Schedule.
 - Quality Plan.
 - Roles and Staffing Plan.
 - Procurement Plan.
 - Contracting Plan
 - Communications Plan and RACI.
 - Risk Management Plan.
 - Safety Plan.
 - Project Change Management Plan.
 - Action Item Log.
 - Decision Log.
 - Change Log.
 - Document Control Plan and Transmittal Log.
 - Change of custody, care and control. When do assets hand off from project responsibility and capital budget to site engineering, operations and expense budget?



Testing and continuous improvement

- As Projects happen and processes mature you can turn to optimizing and upgrading to sustainable and more automated solutions.

FIFTH - TESTING AND CONTINUOUS IMPROVEMENT

As Projects continue many processes and tools will naturally mature, while others will need deliberate attention and reinforcement to evolve into a form that gains acceptance from project teams.

- Push existing tools to their limits and see where they break, find limits of the value they bring.
- Review old gaps and look for new gaps and close them.
- Upgrade and improve documents and processes.
- Start looking for opportunities to automate tools and process, or upgrade to more powerful user-friendly tools that would benefit the project teams work smarter, not harder.
- Look for appropriate opportunities to phase out contractors and consultants in favor of sustainable solutions using the growing large projects tool kit.

- And all of the capabilities can scale down to smaller projects and backlogs.

At this point to some extent, you start looking at cost of quality and the value of competitive project execution while also finding opportunities for lean improvements that can subtly improve processes and tools.

Honestly in a matter of months after several large projects get kicked off and running there will likely be new requirements, gaps, and headaches that are not visible from the beginning. Every challenge is different.