

The Futility of Integrated Master Plans Prepared by Planner/Schedulers with Little or No Hands-on Field Experience¹

By Dr. Paul D. Giammalvo

INTRODUCTION

This paper is being presented as a counterpoint and alternate perspective to the paper presented in the July PMWJ by Dr. Ken Smith, Col USAF (Ret), entitled “TAKE THE GUESS OUT OF GUESS-TIMATING: Use MILESTONES to Monitor Project Performance”² and as an expanded version of the moderated discussion on Pat Weaver’s Mosaic Blog “[DCMA 14 Point Schedule Assessment – Updated](#)” published on July 1, 2023 and “[Calculating Completion Dates is Subjective](#)” on July 11 2023.

The paper looks at “CPM Scheduling” as viewed through the eyes of a successful “hard money” (Firm Fixed Price) contractor, where our own money is on the line if our projects “succeed” or “fail,” noting that invariably, OWNERS have spread the milestones out so far as to starve us of the very “asset” we need to keep the project running, and that is maintaining “CASH FLOW NEUTRALITY.”

As in all this author’s writings and teaching, this paper embraces and conforms to the 5 attributes of the [Scientific Method](#), more specifically:

Attribute #1 - *Empirical Evidence*- “The scientific method is empirical. That is, it relies on direct observation of the world and disdains hypotheses that run counter to observable fact.”³

Attribute #2 - “Scientific experiments are replicable. That is, if another person duplicates the experiment, he or she will get the same results. Scientists are supposed to publish enough of their method so that another person, with appropriate training, could replicate the results.”⁴

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² Smith, K. F. (2023). Take the Guess out of Guess-timating: Use Milestones to Monitor Project Performance, advisory article, *PM World Journal*, Vol. XII, Issue VII, July. <https://pmworldlibrary.net/article/take-the-guess-out-of-guess-timating-use-milestones-to-monitor-project-performance/>

³ Flom, Peter, (2018) “Five Characteristics of the Scientific Method” <https://sciencing.com/five-characteristics-scientific-method-10010518.html>

⁴ Flom, Peter, (2018) “Five Characteristics of the Scientific Method” <https://sciencing.com/five-characteristics-scientific-method-10010518.html>

Speaking as SUCCESSFUL Property Developers & Managers, where we act as OWNERS, investing in and managing rental real estate, but most often we function as CONTRACTORS where we quote a firm fixed bid to buy, rehabilitate, and sell (“flip”) properties as well as providing project management competency development and capacity building professional services on a “Unit in Place” or “Lump Sum” basis.

The reality is that there is no shortage of credible, peer-reviewed research telling us that despite 50+ years of “formalized” project management, represented by global professional societies (i.e., PMI, IPMA, AACE, AIPM, et al.) along with hundreds of local or regional organizations that projects continue to “fail” with alarming regularity. Two of the more credible researchers and practitioners who have been “sounding the alarm” for over 10 years now are Prof Bent Flyvbjerg⁵ and NASA’s Glenn Butts,⁶ yet they continue to be ignored.

But the most compelling research was researched and published in 2019, 2020, 2021, and most recently, 2022 by KPMG, IPMA, and AIPM, showed us that despite Australia being a developed, well-educated, and sophisticated country with strong representation from PMI, AACE, IPMA, and even their own home-grown Australian Institute of Project Managers (AIPM) that after 50+ years this is the best that Australia has achieved. Note that since the 2021 report, Customer Satisfaction, Business Success, On-Time, and Within Budget have actually gotten WORSE, going back close to the results from the 2020 Survey.



Figure 1- AIPM, KPMG, IPMA Research Findings 2022⁷

⁵ Flyvbjerg, Bent (multiple dates) https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=1935014

⁶ Butts, Glenn (2010) “Mega Project Estimates- A History of Denial”
<https://www.slideshare.net/NASAPMC/glennbutts-mega-projects-estimates>

⁷ “The State of Project Management in Australia, 2022”
<https://info.aipm.com.au/hubfs/Reports%20and%20major%20content%20assets/The%20State%20of%20PM%202022%20Report%20FINAL.pdf>

Given the fact that we are getting WORSE, not BETTER, how much longer will it be before we heed the advice of Henry Ford that “if you do the same thing you’ve always done, you will always get the same results you always got” or the wisdom of Einstein who told us “doing the same things over and over again but expecting different results is the definition of INSANITY.

To further reinforce the reality that what we are doing is NOT WORKING, keep in mind that PMI has even finally admitted that their PMBOK and PMBOK Guide, after being published for 35+ years, has not resulted in any measurable improvement and have thus RETIRED their [PMBOK Guide 6th Edition](#)⁸ with no apparent plan to research and adopt “best tested and PROVEN” practices.

SO, WHAT RULES OF THUMB DO SUCCESSFUL CONTRACTORS FOLLOW?

As contractors, where our own money is on the line if our projects “succeed” or “fail,” there are 5 “Rules of Thumb” that we have adopted that we credit with having kept us in business for 30+ years despite working in low-margin, highly competitive marketplaces.

- RULE #1- “No battle plan survives first contact with the enemy.”⁹
- RULE #2- “Plans are USELESS, but planning is ESSENTIAL.”¹⁰
- RULE #3- “Amateurs study STRATEGY while Professionals study LOGISTICS.”¹¹
- RULE #4- “Reality eats strategy for breakfast.”¹² (paraphrased)
- RULE #5- “God (or the devil?) lies in the details.”¹³

In our 6-month-long, graduate-level competency development/capacity-building courses, we start by asking all participants, “What are you going to be doing a year from today?” and logically enough, most rational people respond honestly and candidly, “I have no idea. I will be happy just to be alive”. So based on that starting point, how is it possible that today’s “Planner/Scheduler,” most of whom have zero field experience and whose only claim to fame is they took a 3- or 4-day course on running P6 or MSP and maybe have a PMI, AACE or APM/APMG certificate, possibly going to create a CPM schedule that looks out 1, 2 or even 3 years in advance? That is the height of arrogance standing as evidence of the Dunning-Krueger Effect in action and is one of the leading “root causes” underlying why so many projects finish “late” and/or “over budget.”

⁸ PMBOK Guide 6th Edition Sunset Plan FAQs <https://www.pmi.org/-/media/pmi/documents/public/pdf/pmbok-standards/faq-pmbok-guide-sixth-edition-retirement.pdf?v=03823aaf-cb53-403b-9571-c61460a176aa>

⁹ Field Marshall Helmuth von Moltke (1880) <https://www.oxfordreference.com/display/10.1093/acref/9780191826719.001.0001/q-oro-ed4-00007547;jsessionid=1B2F912F0CEDA2AD73C47D6CEE5A833>

¹⁰ General Dwight D Eisenhower (1950) <https://quoteinvestigator.com/2017/11/18/planning/>

¹¹ General Omar Bradley (n.d.) <https://www.goodreads.com/quotes/8785615-amateurs-study-strategy-professionals-study-logistics>

¹² Drucker, Peter (n.d.) <https://www.thecorporategovernanceinstitute.com/insights/lexicon/what-does-culture-eats-strategy-for-breakfast-mean/>

¹³ Ludwig Mies Van Der Rohe (n.d.) <https://www.phrases.org.uk/meanings/the-devil-is-in-the-details.html>

To illustrate the naivete of what we are currently expecting our “Planners/Schedulers” to accomplish, the US National Oceanic and Atmospheric Administration’s¹⁴ (NOAA) “National Weather Service” (NWS) publishes real-time Hurricane and Tropical Storm Watches, Warnings, Advisories, and Outlooks. To accomplish this, NOAA is running the largest and most powerful super-computers, using sophisticated Systems Dynamics software based on hundreds of years of weather data, and the BEST they can do is forecast the path of the storm 5 days into the future and even then, the “Cone of Uncertainty” is so broad as to be almost useless for most people to use as the basis for “long-range” planning. So, if this is the best that NOAA can do, what makes today’s “Planner/Scheduler” believe they can use an overly simplistic “forwards pass-backward pass” algorithm that doesn’t even allow for any FEEDBACK loops to predict what will happen 3, 6, 12 or more months into the future? Surely, the absurdity of that should be readily apparent to anyone and everyone? Yet despite the lack of measurable improvement in project success rates, we insist on “doing the same things over again but expecting different results?” Are we INSANE, as Einstein posited?

Project Controls/PMO Handbook of “Best Tested and PROVEN Practices”

Researched and Compiled by PTMC and Dr. Paul D. Giammalvo



Figure 2- NOAA Hurricane Forecast example.¹⁵

¹⁴ NOAA Hurricane Tracker (n.d.) <https://www.weather.gov/safety/hurricane-ww>

¹⁵ PMO Handbook of Best Tested and Proven Practices, Unit 6- Managing Risk and Opportunity Figure 7- <https://build-project-management-competency.com/1-4-1-6-unit-6/>

Figure 2 helps us understand just how quickly and how broadly the “Cone of Uncertainty” expands as we move into the future and why both NASA¹⁶ and Prof Bent Flyvbjerg¹⁷ are such strong advocates for the use of RANGE ESTIMATES, not only for costs but also for time.

To gain a more complete understanding of the failure of the most popular “planning and scheduling” software packages to come close to modeling what really can or should happen in a CPM Schedule, take a look at a common Systems Dynamics Model. Notice that while the SD models feature many FEEDBACK LOOPS, the most popular “forward-pass/backward-pass” software does not ALLOW for those pesky feedback loops. And then we wonder why so many projects finish late and/or over budget when the software cannot possibly model what could or should happen as work progresses.

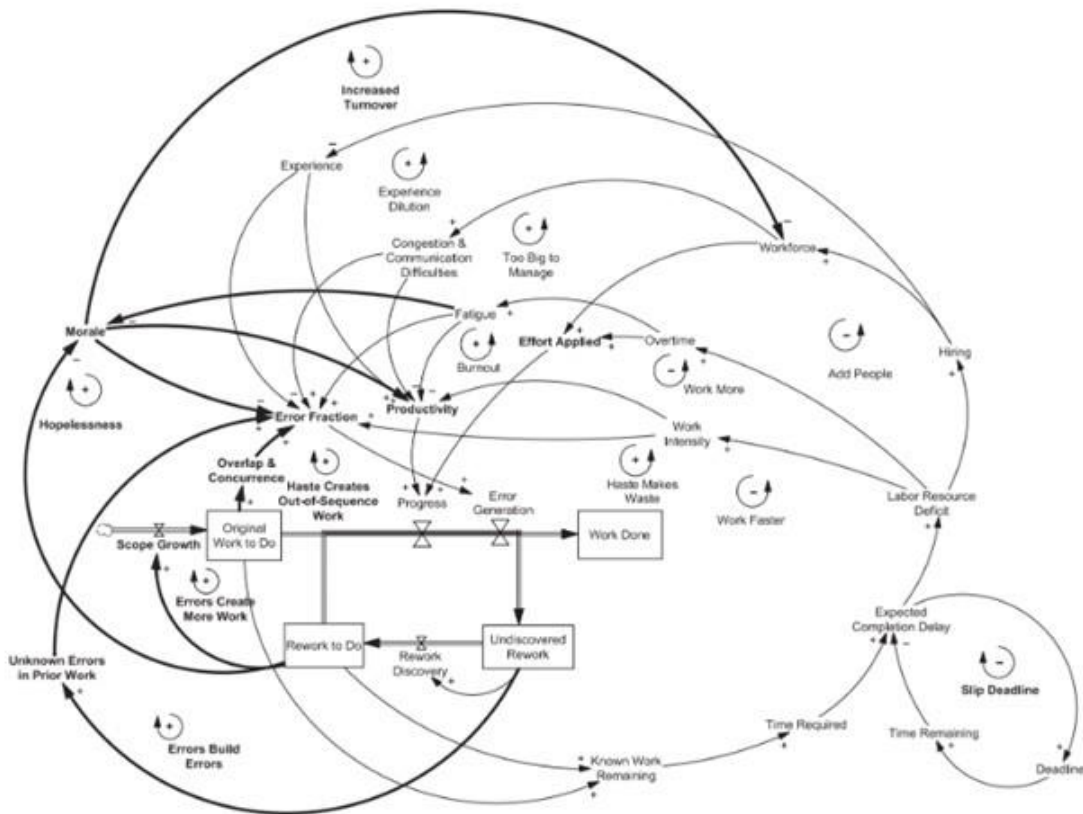


Figure 3- An actual Systems Dynamics Model showing the impacts of rework.¹⁸

¹⁶ NASA Cost Estimating Handbook- Version 4.0 (n.d.) Para 2.3.2 and Appendix J.4.1.3.

<https://www.nasa.gov/content/cost-estimating-handbook>

¹⁷ Flyvbjerg, Bent (n.d.) Oxford University https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=1935014

¹⁸ Warhoe, Stephen (n.d.) “Applying Earned Value Management to Design-Bid-Build Projects to Assess

Productivity Disruption- A System Dynamics Approach” <https://www.dissertation.com/m/books/1612334164>

Now, being honest and candid, which model comes closer to what REALLY happens on a project, what we see above or what the planner/schedulers are attempting to convince us to use as the basis to manage our projects that is based on a linear forward pass/backward pass algorithm with NO feedback loops?

HOW DO CONTRACTORS APPLY OUR “RULES OF THUMB”?

Rather than fight a losing battle, we, as the contractor’s field project and construction managers, accept the CPM schedules, whether from our own internal planner/schedulers or, worse yet, from the owner’s planner/schedulers. We dutifully hang them on the wall and then, based on Rule #1 and Rule #2, promptly ignore them. What do we do instead? Consistent with General Eisenhower’s wisdom, we recognize that planning is essential, but referring back to the NOAA approach shown in Figure 2, we use what is known in construction as “rolling wave planning” but is known to our IT colleagues as “Scrums” or “Sprints.” The very fact that this has long been a “best tested and PROVEN practice” for the better part of the 50 years this author has been in the contracting business, combined with the fact that our IT colleagues have discovered the same “truth” should stand as “prima facie” evidence that it should be recognized as such and taught in place of those advocating for “Integrated Master Plans” as the basis to physically manage the execution of the projects.

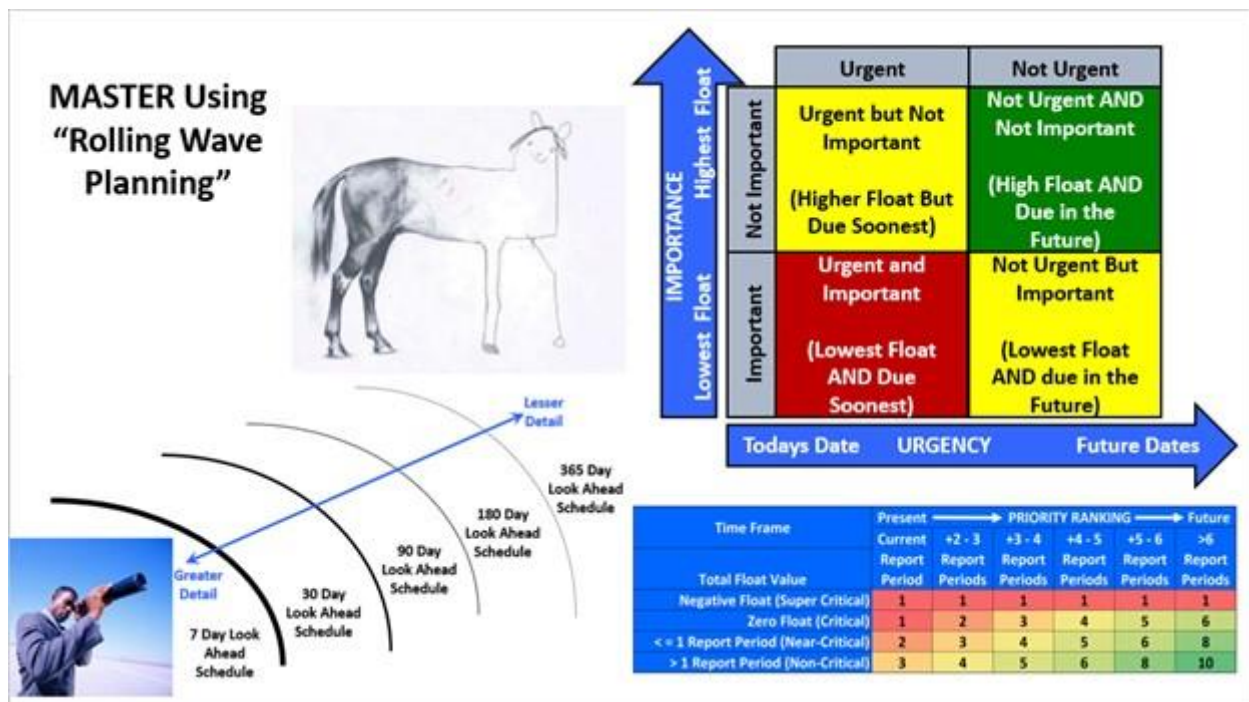


Figure 4- How Contractors Use Rolling Wave Planning¹⁹

¹⁹ Giammalvo, Paul D. Course Materials (n.d.) Unit 9- Managing Planning & Scheduling <https://build-project-management-competency.com/1-4-1-9-unit-9/>

Consistent with what we learned from NOAA’s “Cone of Uncertainty,” contractors preferred working date ranges are 1 Week Back-3 Week Look Ahead Schedules for resource planning and 90-day look ahead for procurement and subcontracting. Then, knowing that as contractors, we are ALWAYS working with RESOURCE CONSTRAINED SCHEDULES, we have no option but to deploy our scarce and limited ORGANIZATIONAL ASSETS (= RESOURCES) to where they will yield the most “bang for the buck.” At the same time, understanding that “contractors live or die by our cash flows,” the prudent contractor will not only be looking at those activities with low float values that are coming due to start soonest, but we are also looking to deploy our ASSETS (= RESOURCES) to where they will generate the most BILLINGS (BCWP or Earned Value) as we strive for “cash flow neutrality,” where our last month’s billing cover our current operating costs.

But in the end, we know that ALL activities must be done so to the greatest extent possible, we strive to avoid negative float UNLESS it was caused by errors/omissions on the part of the OWNER, which will open the door for us to EXPLOIT those opportunities to generate change orders or compensated extensions of time. For a CONTRACTOR’S planner/scheduler, the most important professional service we expect from them is to DOCUMENT change orders and delays by practicing what we call “Defensive Scheduling.” (For more on this, reference Jim Zacks’s “Games Contractors Play.”²⁰



Figure 5- Primary Role of Contractor’s Schedulers

Expanding on the fact that “contractors live or die by our cash flows” and understanding now that starving a contractor for cash flows only serves to hurt the OWNER as much as it hurts the CONTRACTOR, and consistent with our belief that “God or the devil lies in the details,” we need to stop paying off of MILESTONES and start paying by the ACTIVITIES.

²⁰ Hedmon, Shane and Zack, James (2015) <https://www.constructionjunkie.com/blog/2015/5/31/19-scheduling-games-contractors-play-and-how-to-stop-them>

APPLICATION AND CERTIFICATE FOR PAYMENT AIA DOCUMENT G702 PAGE 1 OF 2

TO OWNER: _____ PROJECT: _____ APPLICATION NO: _____
 _____ Job No: _____ PERIOD TO: _____

FROM CONTRACTOR: **Erland Construction, Inc.** VIA ARCHITECT: _____ ARCHITECT'S PROJECT NO: _____
 83 Second Avenue CONTRACT DATE: _____
 Burlington MA 01803

CONTRACTOR'S APPLICATION FOR PAYMENT

Change Orders Approved in Previous months by Owner	ADDITIONS	DEDUCTIONS
TOTAL		
Approved this month		
Number Date Approved		
TOTAL		
Net Change by Change Orders		

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by the Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR: **ERLAND CONSTRUCTION, INC.**
 By: _____ Date: _____
 _____ Project Manager

ARCHITECT'S CERTIFICATE FOR PAYMENT
 In accordance with the Contract Documents, based on on-site observations and the data comprising the above application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

Application is made for payment, as shown below, in connection with the Contract. Continuation sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM _____
2. NET CHANGE BY CHANGE ORDERS _____
3. CONTRACT SUM TO DATE (LINE 1 & 2) _____
4. TOTAL COMPLETED & STORED TO DATE _____
5. RETAINAGE
 - a. % of completed work _____
 - b. % of stored material _____
 - Total retainage _____
6. TOTAL EARNED LESS RETAINAGE
 (Line 4 less Line 5 Total) _____
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT
 (Line 6 from prior Certificates) _____
8. CURRENT PAYMENT DUE _____
9. BALANCE TO FINISH, PLUS RETAINAGE
 (Line 3 less Line 6) _____

State of: _____ County of: _____
 Subscribed and sworn to before me the day of _____
 Notary Public: _____
 My Commission Expires: _____
 AMOUNT CERTIFIED _____

(Attach explanation if amount certified differs from the amount applied for.)
 ARCHITECT
 By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

AIA DOCUMENT G702 APPLICATION AND CERTIFICATE FOR PAYMENT MAY 1992 EDITION AIA ©1993 THE AMERICAN INSTITUTE OF ARCHITECTS, 1735 NEW YORK AVENUE, NEW YORK, N.Y. 10014

Figure 6- Page 1 of 2 from [AIA Document G702 "Application for Payment"](#)

As the AIA G702 document has been around for 40+ years (1992), it has come to form the basis for most contractors' billing templates. While owners create their cost estimates "top-down" and ideally, "best tested and PROVEN" practices indicate owners should define scope down to Level 4 of the WBS/CBS in the Bid Documents, while contractors produce our cost estimates "bottom-up" usually to Levels 5 or 6 of the WBS/CBS, the ideal level of interface between the owner and contractor normally occurs at Level 4 of the WBS/CBS coding structure. Consistent with the "Rule" that "God (or the devil) lies in the details," successful contractors have adopted what is known as "[Activity Based Costing/Activity Based Management](#)" (ABC/ABM)²¹ as our core business practices.

²¹ Cokins, Gary and Institute of Management Accounts (IMA) (2018) "Implementing Activity Based Costing" <https://vdocuments.net/implementing-activity-based-costing-on-management-accounting-table-of-contents.html?page=1>

APPLICATION AND CERTIFICATE FOR PAYMENT CONT. SHEET FOR AIA DOCUMENT G702 PAGE 2 OF 2

PROJECT NAME: _____ APPLICATION NUMBER: _____
 CONTRACTOR'S PROJECT NO.: _____ APPLICATION DATE: _____
 PERIOD FROM: _____
 TO: _____

ITEM NO.	DESCRIPTION OF WORK	ORIGINAL VALUE	REVISED VALUE	PREVIOUS APPLICATIONS	WORK IN PLACE THIS MONTH	STORED MATERIALS	TOTAL TO DATE	PERCENT COMPLETE	BALANCE TO FINISH	RETAINAGE
1								#DIV/0!		
2								#DIV/0!		
3								#DIV/0!		
4										
5										
6										
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30										
31										
Totals										

2 of 2

Figure 7- Page 2 of 2 from [AIA Document G702 “Application for Payment”](#)

IF and WHEN we get serious about fixing the problems resulting in projects finishing late and/or over budget, one of the core tenets has to be to maintain cash flow neutrality for contractors in a way that protects the owners from fraudulent billings- (i.e., work not physically completed or substandard work that fails to meet the technical specifications.) It is unconscionable for owners to expect contractors to be providing them with “interim financing.” This is the very essence of “Earned Value Management,” not as defined by the US DAU under ANSI 748 C or D, but as Earned Value Management originated during the 16th Century Guilds as a “Cash on Delivery” (CoD) payment method that was refined and documented during the 18th Century Industrial Revolution as an “INCENTIVE PAYMENT” or “PAY FOR PERFORMANCE SYSTEM” proven to be so successful it remains in use today in most production facilities and any “contractor” who provides his/her professional or trade services on a “Unit in Place” basis.²²

²² Giammalvo, P. D. (2022). The Origins and History of Earned Value Management – “A Contractor’s Perspective”; featured paper, PM World Journal, Vol. XI, Issue IX, September. <https://pmworldlibrary.net/wp->

Another important “Rule” we contractors subscribe to comes from General Omar Bradley, who demonstrated that LOGISTICS (Asset/Resource Allocation) matters more than STRATEGY.

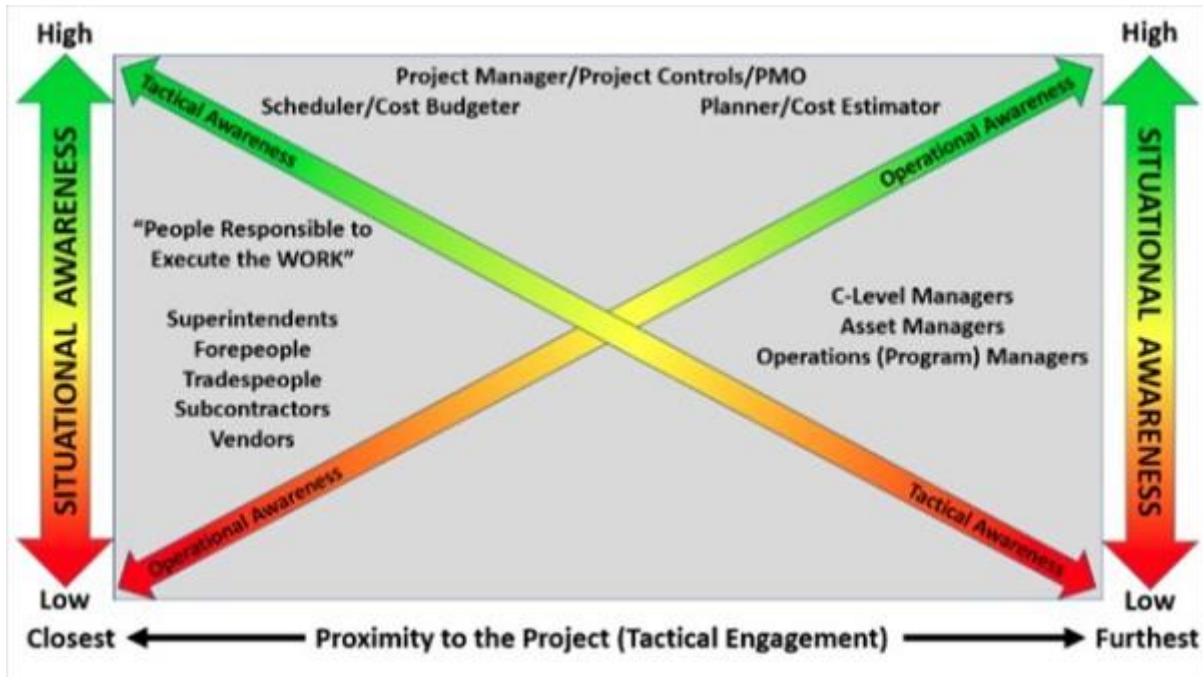


Figure 8- “Situational Awareness” Applied to Project Management.²³

This concept of “Centralized Control and Decentralized Execution” is a direct derivative of General Bradley’s teachings. In this model, the most important people are those on the front lines, executing the work, and it is in the best interests of BOTH the contractor (for outsourced projects or the owner’s project manager for INSOURCED projects) and the owner that whatever it is that the field needs to execute their work, it is the responsibility of the Project Manager, Project Controls and PMO Manager as well as Planner/Schedulers and Cost Estimator/Budgeters to IDENTIFY and COMMUNICATE this information to the ASSET MANAGERS in the home office and FACILITATE getting what the field needs as promptly as possible. For the OWNERS PM/PMO Team, this normally takes the form of getting the most current design changes to the field when needed and ensuring your contractors, subs, and vendors are paid PROMPTLY based on Earned Value Management.

For the CONTRACTOR, making sure the people on the front lines responsible for executing the work have the tools, training, knowledge, and necessary staffing in terms of both numbers and expertise is essential, as these are the people who are responsible for producing the DELIVERABLES that your contracting company can bill for at the end of each month. Explained

content/uploads/2022/09/pmwj121-Sep2022-Giammalvo-origins-and-history-of-evm-a-contractors-perspective.pdf

²³ Docauer, Alan Lt Col USAF (2014) Peeling the Onion Why Centralized Control / Decentralized Execution Works https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-28_Issue-2/F-Docauer.pdf

another way, as the people physically working on the project are the ONLY people who can generate revenue or produce contractual deliverables, everyone else is OVERHEAD and should be playing a supporting role to get those on the frontlines to be as productive and efficient as possible. For a more detailed discussion of how to keep your teams working efficiently and generating the maximum possible BCWP or Earned Value, see this paper, [“The Origins and History of Earned Value Management: “A Contractor’s Perspective.”](#)

Also worth noting at this juncture is that the DAU has finally admitted that “Earned Value Management” as advocated under ANSI 748 C & D has not worked, and they are in the process of revising the US Government’s approach to Earned Value consistent with much of what is being shared in this paper. Two important papers, [“It’s Time to “Reboot” Earned Value Management”](#)²⁴ and [“Planning for the Future of Earned Value Management”](#),²⁵ were recently published in the March issue of the Defense Acquisition University’s (DAU) blog and as Earned Value Management is where Costs and Schedule become INTEGRATED these changes are essential to realize the full potential value.

THREE CASE STUDIES ILLUSTRATING THE ABOVE CONCEPTS AND “RULES OF THUMB”

Consistent with Attribute #2 of the Scientific Method- *“Scientific experiments are replicable. That is, if another person duplicates the experiment, he or she will get the same results. Scientists are supposed to publish enough of their method so that another person, with appropriate training, could replicate the results.”*²⁶ Your Author is providing you with 3 case studies that will reinforce the concepts explained above in a way that you can adapt for use in your day-to-day projects.

Case Study #1- Illustrating how “God (or the Devil) Lies in the Details.”

Background information - Our company plans on taking 4 of our staff to the USA in September 2023 to attend a professional conference. As they are all from Indonesia, we must obtain tourist visas. Because they cannot attend without a visa, we built appropriate “risk buffers” by starting the visa application process in March 2023.

Constraints/Assumptions - The US Embassy in Indonesia is only open for VISA applications between the hours of 08:00 and 12:00. That means applicants have to stand in the queue between those hours, or they will not be able to apply that day.

²⁴ Abba, Wayne (2023) “It’s Time to “Reboot” Earned Value Management” Defense Acquisition University Blog <https://www.dau.edu/library/defense-atl/blog/Reboot-Earned-Value-Management>

²⁵ Reynolds, Chad (2023)

<https://www.dau.edu/library/defenseatl/blog/PlanningfortheFutureofEarnedValueManagement>

²⁶ Flom, Peter, (2018) “Five Characteristics of the Scientific Method” <https://sciencing.com/five-characteristics-scientific-method-10010518.html>

Thus, the decisions as to what is the best transportation method to use and how much time to allow from leaving the office to arriving at the Embassy so as not to miss the window of opportunity while minimizing the amount of time spent queuing are the risk management decisions that have to be made. While we have done this same trip hundreds of times, the actual decision cannot be made until the day of the appointment as many variables go into the decision as to which transportation method to use and departure time, including weather, political realities, and flooding not to mention “unknown” or “ad hoc” risk events.

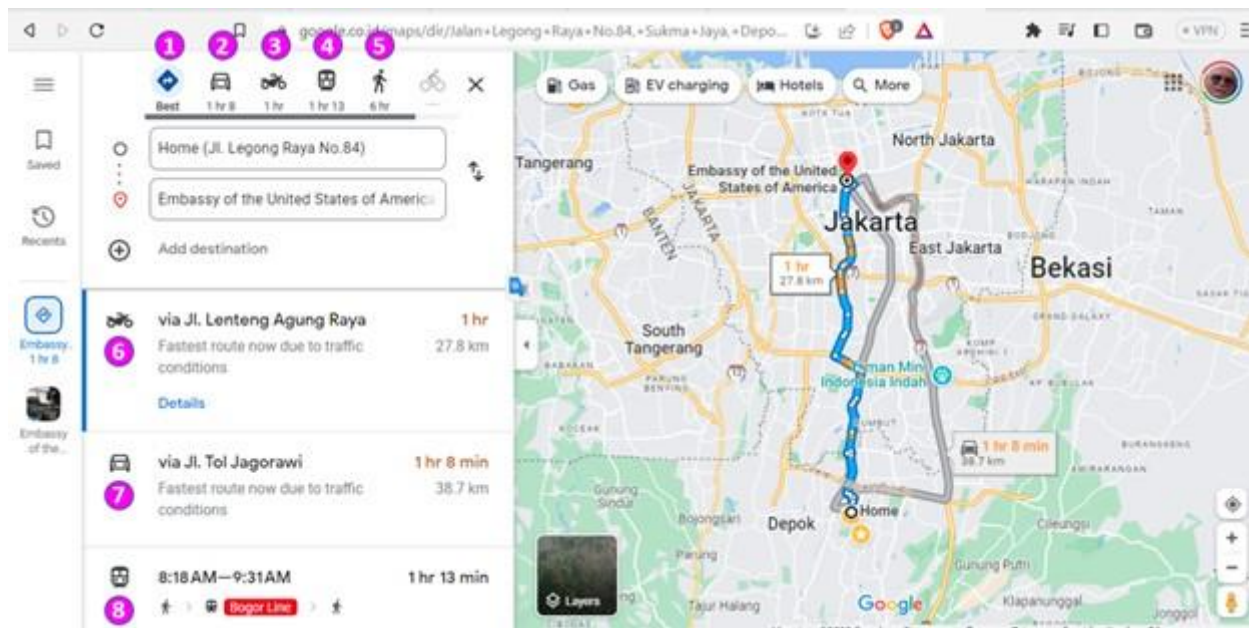


Figure 9- Decision-Making Using Artificial Intelligence Tools

To illustrate the complexity that contractor’s project managers face even for the most basic tasks, we have 4 different transportation modes (“Feasible Alternatives”) we can choose from, and each of these consists of a TIME component and a COST component:

- 2) Automobile- Time = 1 h 8 m, Cost = \$10.00/4 people
- 3) Motorcycle- Time = 1 h 0 m, Cost = \$5.00/person X 4 = \$20.00
- 4) Train- Time = 1 h 13 m, Cost = \$2.00/person X 4 = \$8.00
- 5) Walking- Time = 6 h 0 m, Cost = \$00.00

So if TIME is the most important consideration, taking a motorcycle would be the fastest, but with 4 people, we would have to pay 4 X \$5.00 = \$20.00, meaning that the fastest option would also be the most expensive. Likewise, the cheapest option (walking) would be prohibitively long. As the train option would not only take longer but we would have to take a motorcycle to the train station, adding another 15 minutes but would cost 4 people x \$2.00/person or \$8.00, plus 4 people X \$1.00 for the motorcycle taxi = \$12.00 and 1 h 28 m. That leaves taking Uber or Grab

taking 1 h 8 m and costing \$10.00 for all 4 people being the most cost-effective option. Using Uber means leaving the office at 08:00 – 1 h 8 m or no later than (NLT) 06:52.

Automobile						Motorcycle						Train					
Option 1		Option 2		Option 3		Option 1		Option 2		Option 3		Option 1		Option 2		Option 3	
Time (M)	Cost (\$\$)	Time (M)	Cost (\$\$)	Time (M)	Cost (\$\$)	Time (M)	Cost (\$\$)	Time (M)	Cost (\$\$)	Time (M)	Cost (\$\$)	Time (M)	Cost (\$\$)	Time (M)	Cost (\$\$)	Time (M)	Cost (\$\$)
70	\$10.00	72	\$8.58	76	\$8.71	57	\$20.43	61	\$20.43	64	\$19.28	71	\$8.00	89	\$10.03		\$11.49

Figure 10- Table showing ALL the possible TIME and COST Combinations to Choose from.

BUT it gets even more complicated. What if there is an UNFORESEEN (or unforeseeable) risk event after we leave, like an accident, emergency road work, or flash flood, then we need to develop a WORKAROUND,²⁷ or we may decide to mitigate any risks by building in a risk buffer by leaving at 06:30 or 06:45?

Conclusions and “Lessons Learned”- While this seemingly simple task that we’ve done hundreds of times still requires the prudent project, project controls, or PMO manager who is on-site and experienced enough to make informed and rational decisions in real-time. This is NOT the kinds of decisions made by “Planners/Schedulers” with little or no actual field experience being made months, weeks, or even days in advance or by anyone unfamiliar with the work areas. Now multiply these concepts times what, 10, 20, 30, or more activities being done by different trades daily, and you can begin to appreciate why “planners/schedulers” do such an abysmal job of creating plans weeks, months or even years in advance, and why despite first-hand knowledge, those people on site, despite their best professional judgment, end up making what appear in retrospect, to have been “bad” decisions.

This example also shows that OPPORTUNITY Planners/Schedulers have to embrace the tools and techniques associated with Artificial Intelligence, much along the same lines as Google Maps has done to provide real-time traffic and road condition information. To accomplish this, we need to STANDARDIZE WBS/CBS coding structures, and the focus of both Planner/Schedulers and “Cost Estimators/Quantity Surveyors needs to be on developing and maintaining cost and productivity databases for different locations and under varying conditions.

²⁷ “WORK-AROUND” is defined by Merriam-Webster Dictionary as “a plan or method to circumvent a problem (as in computer software) without eliminating it. <https://www.merriam-webster.com/dictionary/work-around>
 Giammalvo, Paul D (n.d.) “An unplanned or “ad hoc” response to an unexpected or unanticipated risk event. Sometimes referred to in construction as a “field fix”.

Case Study #2- Illustrating Why Using SPI and CPI are the “BEST” or “BETTER” EVM Metrics

Background information - For 30+ years, our company has been designing and delivering graduate-level, Competency, and Capacity Building programs built around the [7 Essential Project Design Elements](#) and [7 Project Based Teaching Practices](#).

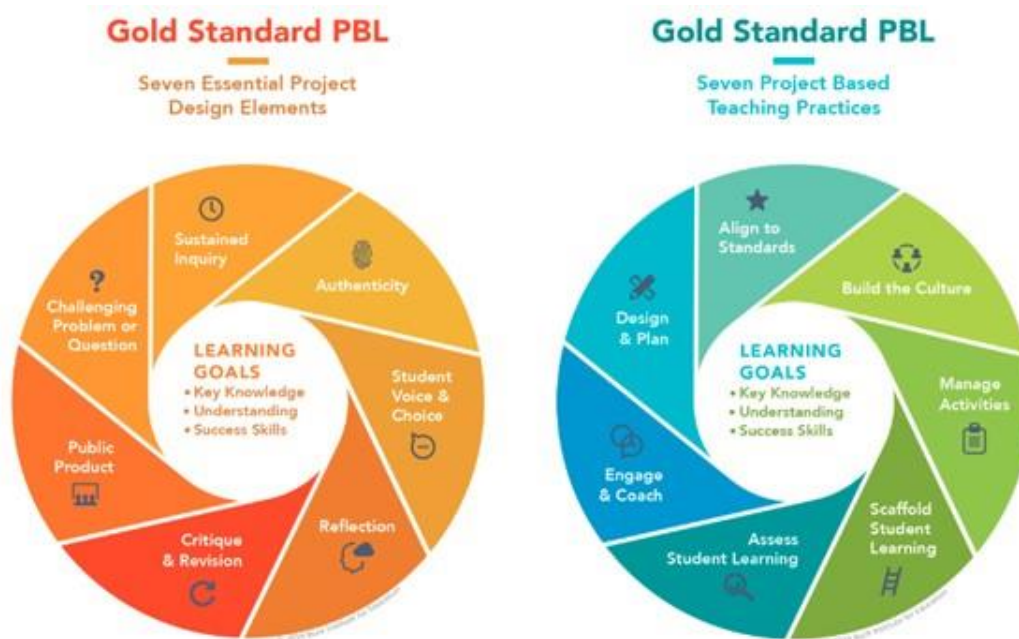


Figure 11- Buck Institute’s Gold Standards for Project-Based Learning and Teaching.

We design and deliver all our courses based on the following 6 SPECIFICATIONS or STANDARDS:

- 1) DESIGN our course content using the ILO’s “Regional Model Competency Standards” <https://tinyurl.com/yzqromj2>
- 2) DESIGN our courses using the IOWA STATE Revised Blooms Taxonomy- <https://goo.gl/HNcuv8>
- 3) DESIGN our courses to develop the SKILLS that employers are SEEKING and VALUE- <https://goo.gl/U61YxY>
- 4) DELIVER our courses in a way that FULFILLS all 7 of the Project Based Learning attributes- <https://tinyurl.com/yys2dyg>
- 5) DELIVER our courses in a way that FULFILLS all 7 of the Project Based Teaching attributes- <https://tinyurl.com/y4mr6hnd>
- 6) MEASURE the EFFECTIVENESS of our training using all 4 Levels of Kirkpatrick- <https://goo.gl/8YpZEA>

Below the list are icons for: Regional Model Competency Standards: Construction; a stack of colorful cards; Gold Standard PBL (Design Elements); Gold Standard PBL (Teaching Practices); NACE National Association of Colleges and Employers; and a Kirkpatrick model diagram with levels: Level 4: Results, Level 3: Behavior, Level 2: Learning, Level 1: Reaction.

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Figure 12- Full Set of Course Standards and Specifications

Constraints/Assumptions - For 30 years, we have been using the same STANDARDIZED PROJECTS and, consistent with “student voice and choice,” enable each class to determine on their own how they will “plan, execute, control, and close” these 6 projects, requiring them to produce a weekly report for 26 weeks at the PROGRAM, PROJECT, and INDIVIDUAL level using all the Earned Value Management tools & techniques, but consistent with how we learned earned value not based on ANSI 748 C or D but as developed by Frederick Taylor, the Gilbreths, Henri Fayol, Henry Gantt but especially by Gillette and Dana in their 1909 book “Cost Keeping and Management Engineering: A Treatise for Engineers, Contractors, and Superintendents Engaged in the Management of Engineering Construction.”

Also consistent with “student voice and choice,” we allow them to select the scheduling software of their choice, with most of them choosing MSP or P6.

Our students tend to be engineers (90%) from oil, gas, mining, telecommunications, and infrastructure construction, with 5 - 20 years of experience. Approximately 75% hold master’s degrees in business or a technical specialty (i.e., Petroleum Engineer or Telecommunications Engineer), and these are the 8 job titles who most commonly sign up for our program:²⁸

- 1) Business Analyst
- 2) Cost Engineer
- 3) Cost Estimator/Quantity Surveyor
- 4) Forensic Claims Analyst
- 5) Planner Scheduler
- 6) Project Controller
- 7) Project Manager
- 8) Systems Engineer

Most of them hold management positions or are being groomed for management positions, which is why they are approved to attend our 6 months (26-week) program, which was roughly designed around a 2 semester-long “capstone” course, providing students to experiment with some 200+ “tools & techniques” with the objective to generate a favorable “return on training investment” equal to or greater than the cost of the program including the value of the students time. Worth mentioning at this point is our top class from Freeport Indonesia after implementing what we taught them about applied earned value management, documented savings of \$65 million over a 4-year period.^{29, 30}

²⁸ Giammalvo, Paul D (2017) PMWJ <https://pmworldlibrary.net/wp-content/uploads/2017/01/pmwj54-Jan2017-Giammalvo-analysis-of-current-job-descriptions-featured-paper.pdf>

²⁹ <https://build-project-management-competency.com/ptmc-training-standards-and-specifications-individual/>

³⁰ Wibiksana, Ridwan (2012) “Earned Value Management: Adapted for use in Underground Mining Operations” PMWJ <https://pmworldlibrary.net/wp-content/uploads/2013/01/PMWJ2-Sep2012-WIBIKSANA-EVM-Adapted-for-UndergroundMining-StudentPaper.pdf>

What are the PROJECT DELIVERABLES expected from you?
 (Projects within the CCP/CEP/EVP/PSP/DRMP/GPC Prep Program)

	W0	W1 - W26	Total	Responsibility
1) Project Plan (1a- Create the Plan/ 1b Track Progress)	100	/ 150	250	Team
2) "Cheat Sheet" (SWOT Analysis)	0	/ 100	100	Individual
3) Solve Assigned Problems- Eng. Economy	0	/ 250	250	Team
4) Solve Assigned Problems- Humphrey	0	/ 500	500	Team
5) 2,500 Word Papers (To Guild/AACE Specifications)	0	/ 500	500	Individual
6) Weekly Blog Reports (25)	0	/ 150	150	Individual
Total Possible Deliverable Based Points	100	1650	1750	

TEAMWORK EVALUATION

7) Team Leadership/Participation (Competency Assessment)		250	250	Individual
Grand Total Possible Earned Points		1900	2000	

Total 2000 possible points- 1000/2000 = 50% Individual Effort; 1000/2000 = 50% Team Effort;
 Total 2000 possible points- 100/2000 = 5% Week 0; 1650/2000 = 95% Weeks 1-26;

Figure 13- Six STANDARDIZED Projects, their WEIGHTINGS and RESPONSIBILITIES

These are the same 6 projects we have been using for 30+ years, giving us a very rich and robust data set upon which to analyze what works and what doesn't.



Figure 14 - Consistent with "Student Voice and Choice," How and When they Execute the 6 Projects is entirely up to them. This requirement shows us just how poor supposedly professional project planners, schedulers, controllers, and PMO practitioners are at planning and executing their own work, even work they have at least some, if not full, knowledge of.

It also gives us first-hand information indicating that even amongst experienced people, even those with formal training in project management and holding PMI, APM/APMG or AACE certifications, and holding the job titles of “Planner/Scheduler,” “Project Controller” and “Cost Engineer,” how few of them can effectively “initiate, plan, execute, control and close” these 6 projects within a target SPI and CPI of 0.95 to 1.05 or even within 3 Sigma Statistical Process Control limits of +/- 3 Sigma.

Here are the ACTUAL results from a recent student that drives home my point that despite being well trained in the use of scheduling software, even people who hold the title of “Planner/Scheduler” are not even close to being COMPETENT at being able to USE the software to actually “initiate, plan, execute, control and close” what amounts to be fairly simple projects and programs.

As a quick introduction, we do NOT use Cost Variance or Schedule Variance because we use the EVM data as inputs into our cost and productivity databases. Why not? Because if we use money, we have to continuously update the cost information to account for year on years inflation or to use the data from our databases in other locations. To get around that problem, we track the Schedule Performance Index (SPI) and Cost Performance Index (CPI), expressed as EFFICIENCY factors. Doing this makes it much faster and easier to keep the cost and productivity databases current, and we can easily use them in different locations.

What is also crystal clear is that we CANNOT parse COST from SCHEDULING. The two are inextricably linked in a symbiotic and correlated relationship where changes (+/-) in TIME have a corresponding (+/-) impact on COSTS, and conversely, changes (+/-) in COST have a corresponding (+/-) impact on TIME. This is how we can support our claims that “contractors live or die by our cash flows” and why “prompt payment” is now and has been for 600+ years as the basis for Earned Value Management. We also have been told by “people in high places who know” that to get ANSI 748 adopted, the US Government had to DIVORCE “payment” from “performance.”

✓ **Schedule Performance Index (SPI)**

The formula to calculate the Schedule Performance Index (SPI) is BCWP/BCWS or EV/PV for the PMI folks in the audience. The SPI measures how EFFICIENTLY the project manager/project team uses the physical assets (human and equipment resources) assigned to their projects. An SPI of >1 is good (within reason), while an SPI of <1 is almost always bad.

✓ **Cost Performance Index (CPI)**

The formula to calculate the Cost Performance Index (CPI) is BCWP/ACWP or EV/AC for the PMI folks in the audience. The CPI measures how EFFICIENTLY the project manager/project team uses the monetary assets (financial resources) assigned to their projects. A CPI of >1 is good (within

reason), while a CPI of <1 is almost always a bad sign unless offset by an increase in the SPI.

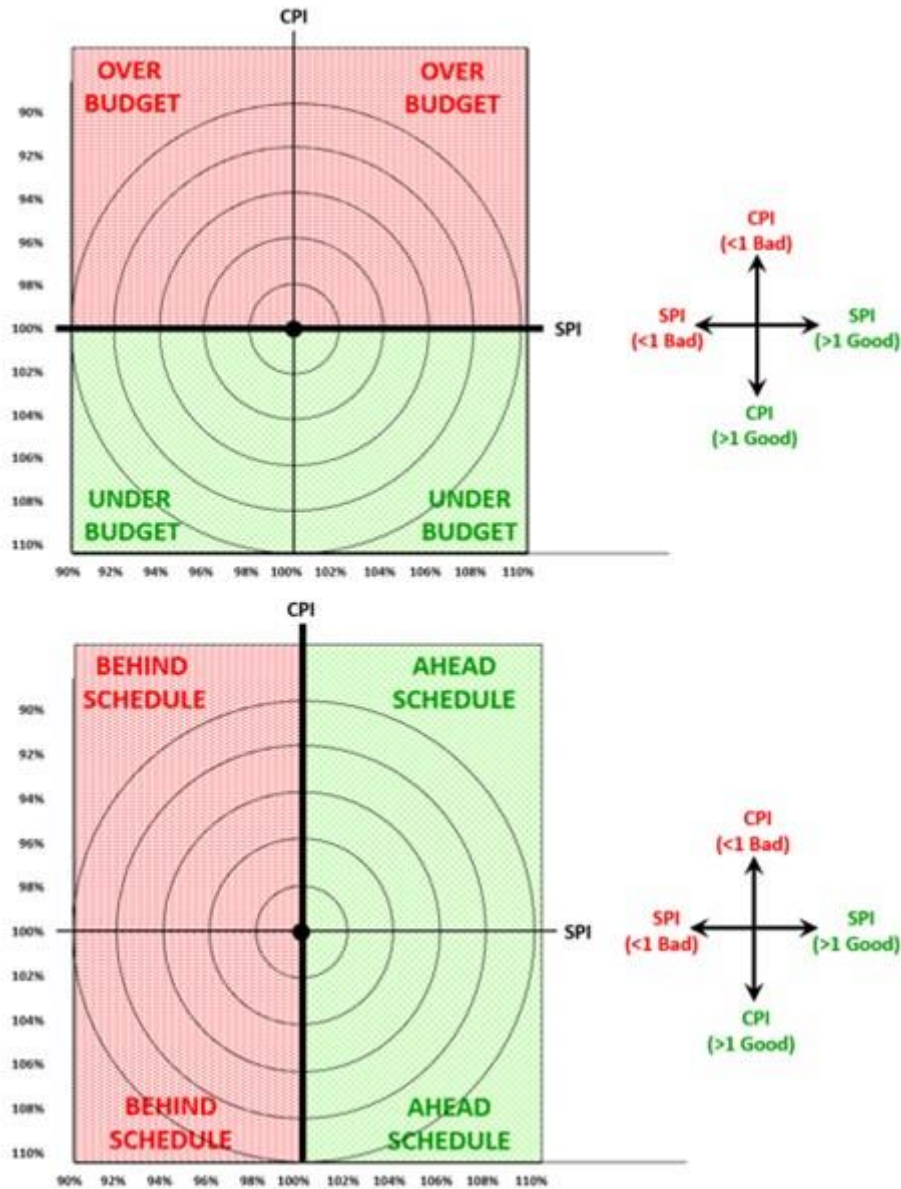


Figure 15- CPI vs. SPI “Bullseye Chart” Explained

As hunters or target shooters will know, the “target” we are aiming for is the “Bullseye,” which has an SPI of 1.00 and a CPI of 1.00, and by adjusting our aim, we can get our “bullets” to land closer to the Bullseye.

Figure 16 (below) shows the actual SPI (1) and CPI (2) data for the full 25-week program. This individual is a Civil Engineer who has 7 years of office experience as a “Project Controller,” with < 1-year “ad hoc” (intermittent) field experience. He is in the middle of earning his master’s

degree in project management, where the local university uses the PMBOK Guide as the primary reference. He was the “Program Manager” for his team of 8 people, of which only 5 passed the program. In short, he represents a “typical” Gen X or Millennial we see join our programs but is also typical of what we observed in the “Boomer” generation 30+ years ago when we first started developing and delivering this program.

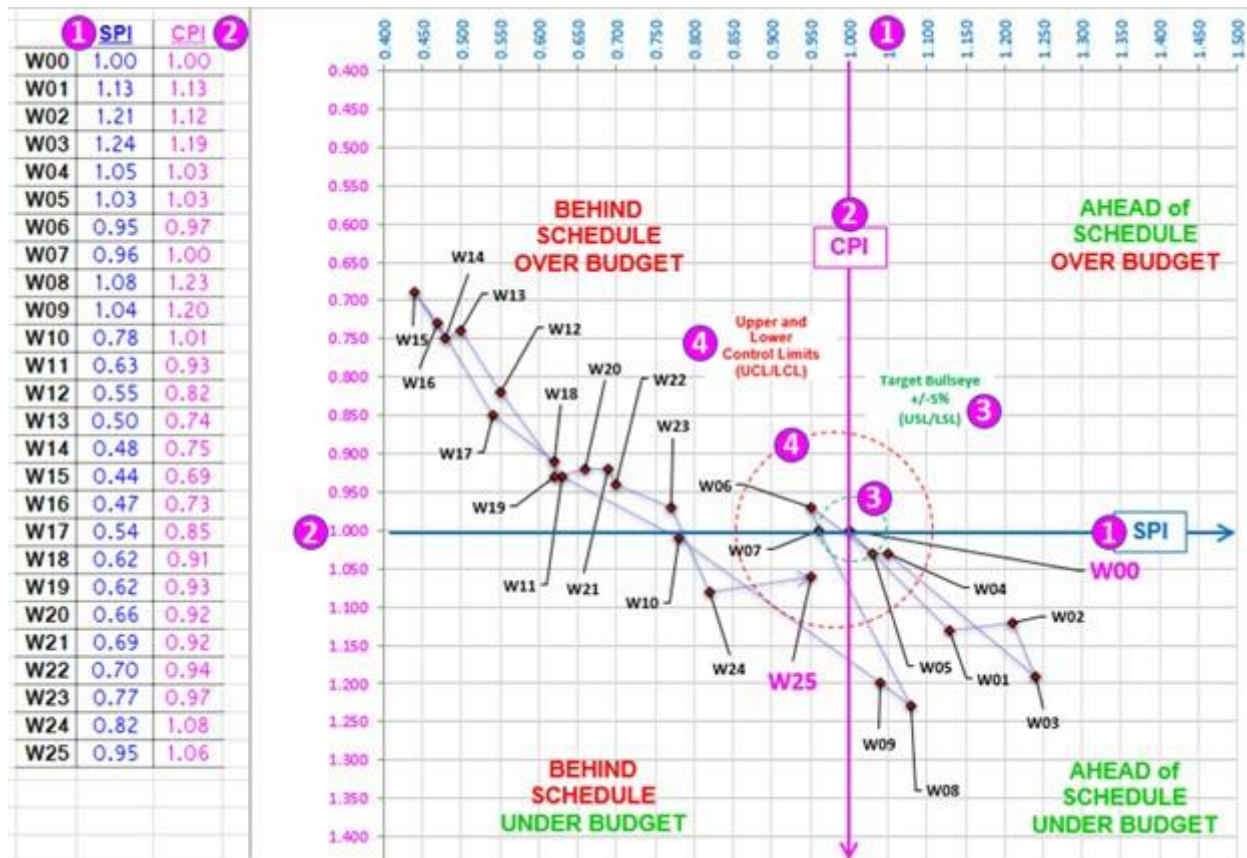


Figure 16- Actual Readings from an EXPERIENCED “PROJECT CONTROLS” PRACTITIONER

As you can see, despite this individual being a well-educated, experienced professional-level practitioner whom anyone would be happy to have working for them, he was INCAPABLE of creating a CPM schedule and Cost Estimate that he could follow. Not only was he unable to keep most of his readings within the target Upper and Lower SPECIFICATION limit between 0.95 and 1.05 (W5 & W7), but he was only able to keep 5 of his readings within the Upper and Lower CONTROL limits of +/-3 Sigma. (W4, W5, W6, W7 and W25) The rest of his readings were “Out of Control” due to external problems either being way ahead of schedule and under budget (W1, W2, W3, W8, and W9) or, at the other extreme, Behind Schedule and Over Budget. (W10, W11, W12, W13, W14 and W15)

In W15, this student finally woke up and realized that for the past 6 weeks (W9 – W15), his program (consisting of 6 projects identified in Figure 12) was headed for DISASTER. Recognizing the reality, he was the only one out of this team of 8 who was able to grasp what needed to be done to bring the remaining work on his 6 projects back to the targets of CPI and SPI back between the target upper and lower SPECIFICATIONS limits of between 0.95 and 1.05.

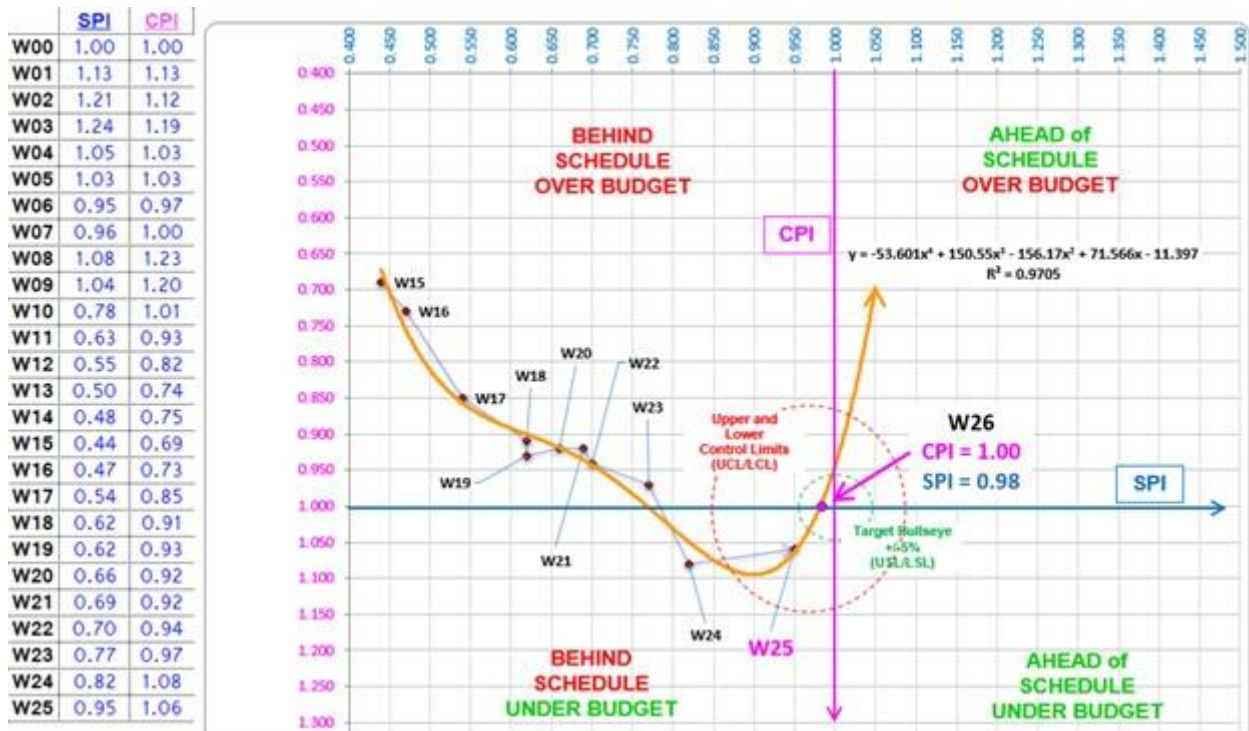


Figure 17- Case Study from Figure 16 showing ONLY W15 to W25 FORECAST to W26.

In Figure 17, we are looking only at the period from W15 to W25, and then using the “Add Trendline” feature in Excel, we can experiment with the various options that will yield the highest R² value, which in this case was 4th Order Polynomial giving us an R² value of 0.9705. In actuality, he finished the program at the end of W26 with a CPI of 1.00 and SPI of 0.98, well within the SPC Upper and Lower CONTROL limits, but also well within the Upper and Lower SPECIFICATIONS LIMITS of +/-05%.

Conclusions and “Lessons Learned”- As this case study was typical of the findings over the past 30+ years, we have to ask what is wrong with the education and training systems that have produced 3 generations of supposedly well-educated and qualified practitioners who are not able to create and follow their own schedule and cost budgets, much less be expected to create cost and time estimates for others to follow?



Figure 18- AIPM/KPMG Findings 2022

Then we wonder why the most recent [AIPM/KPMG research from 2022](#) shows that despite 50+ years of degrees, professional societies with their “standards” and professional certifications, not only are we doing poorly, but that as practitioners, we are getting WORSE, not better? Following Henry Ford’s or Albert Einstein’s advice, how long will we do the same things repeatedly but expect different results?

As part of this conclusion and “lessons learned,” here are the 4 “quality metrics” we apply to the SPI and CPI data.



Figure 19- Quality Metrics for Cost and Productivity Data

- ✓ **ACCURACY - (19.1/19.3)** Accuracy: The degree to which a measurement represents the true value of something. Explained: How close a measurement is to the true or target value. Accuracy and Validity can be used synonymously.
- ✓ **VALIDITY - (19.1/19.3)** The extent to which the data measures what it is intended to measure. Put: Are the values describing what was supposed to be measured? The lack of Validity is called “Bias” or “Systematic error.” Validity and Accuracy are used synonymously.
 - **Internal Validity-** Are the results valid for the study subjects? Is the process in control due to SPECIAL or IDENTIFIABLE causes? Are there any outliers beyond +/-3 sigma? Is the process being measured in control due to problems within the process itself?
 - **External Validity (Generalizability)-** Are the results valid for the population from which the sample was drawn? Is the PROCESS (workflow) CAPABLE of meeting the specifications?
- ✓ **PRECISION - (19.1) and (19.2)** Precision: The degree of resemblance among study results were the study to be repeated under similar circumstances. Explained simply: How close the measurements are to each other. Lack of Precision is referred to as ‘random error. ‘Precision (reliability): Precision and reliability are used synonymously. What was the SPREAD? In this case, the Upper and Lower SPECIFICATIONS limits were 5%. (19.5) In Figure (19.1), all were within the USL and LSL circle. (19.5) In Figure (19.3), the actual data points not only fell outside the USL and LSL of 5% (19.5) but ALSO even exceeded the Upper and Lower Control Limits of +/-3 δ . (19.6)
- ✓ **RELIABILITY - (19.1) and (19.2)** Reliability: A measure of how dependably an observation is exactly the same when repeated. It refers to the measuring procedure rather than to the attribute being measured. Put: Will one get the same values if the measurements are repeated? Reliability and Precision are used synonymously. This is a way to measure how USEABLE the data set is. In the example shown in (19.2), while the data totally missed the target because it was closely clustered, given the high PRECISION and high RELIABILITY, we can still use this data provided we make the appropriate adjustments. The classic example of this is when we apply city indices to cost data to account for differences in costs between two or more locations. Another example that we can see in (19.4) is that while most of the data points were within the USL and LSL of +/-5%, some outliers fell outside the UCL and LCL of +/-3 δ . As shown in (19.4), we have outliers beyond the UCL and LCL, and we delete those readings. If any shooters are reading this, you can appreciate how you can apply your shooting (target acquisition and adjustment)

knowledge to help you decide what adjustments to make to bring your SPI and CPI values back to the Bullseye.

Case Study #3 - Calculating the “Optimum Gestation Period” for Projects.

Background information - Going back 10 million years ago, research indicates that humans (40,000 to 60,000 years), chimpanzees (5 million years), and gorillas (10 million years ago) all experience gestation periods ranging between 230 to 260 days.³¹ This research also indicates that the duration of the gestation period is most closely related to the physical size of the animal. (i.e., Elephants are 640-645 days, cats and dogs are ~60 days, rabbits are 30 days, and mice have a gestation period of ~20 days.

And we know that there is an “OPTIMUM gestation period of 39 weeks with a Median duration of 272 days plus or minus 2 weeks (1 standard deviation). We also know that as we deviate from that OPTIMUM that both the monetary healthcare cost INCREASE, as do the risks to both the fetus and the mother. At around 23-24 weeks, the fetus cannot survive outside the mother’s womb and after 42 weeks, the doctors will either induce labor or perform a cesarean section; otherwise, both the life of the mother and fetus are at risk.”³²

So why is this important to us as project or program managers, project planners/schedulers, cost estimators/quantity surveyors, or PMO practitioners? If, for 10 million+ years, gestation periods have been an integral part of evolution, what makes us think that the same concepts and principles don’t apply to projects and programs? Is there not some formula we can or should apply to develop the optimum time and cost trade-offs for our projects based on their size?

³¹ San Jose State University, (n.d.) “Gestation Periods for Different Size Animals”
<https://www.sjsu.edu/faculty/watkins/gestation.htm>

³² “Over-due Baby- What Happens if My Baby is Late” (n.d) <https://www.nct.org.uk/labour-birth/getting-ready-for-birth/overdue-baby-what-happens-if-my-baby-late>



Figure 20 - Human Gestation Period Illustrated

As shown in Figure 20, when we plot the RISKS and COSTS to both the baby and the mother, we end up with a classic “Bathtub” or “U” shaped curve.

Constraints/Assumptions - While anyone who is a contractor whose own money is on the line if the project finishes on time is intuitively aware of this concept, the only formal recognition of the “optimization” of projects has been published by the [US Dept of Transportation’s Federal Highway Administration in their Work Zone Road User Costs - Concepts and Applications](#), Figure 15.

This concept of being expected to pay a premium to accelerate product or service delivery should be familiar to us. Back in the days of film, we could have our pictures developed in 1 hour, “same day” or “next day” service with a premium for faster delivery. We see this in dry cleaners today, but the most common example are the delivery times and shipping fees from Amazon- Standard (9-12 days/\$9.69 + \$2.89/lb.); Expedited (5-10 days/\$18.49 + \$6.99/lb.) Priority (2-4 days/\$29.48 + \$2.23/item)

Figure 15 . Relationship between project cost and duration.

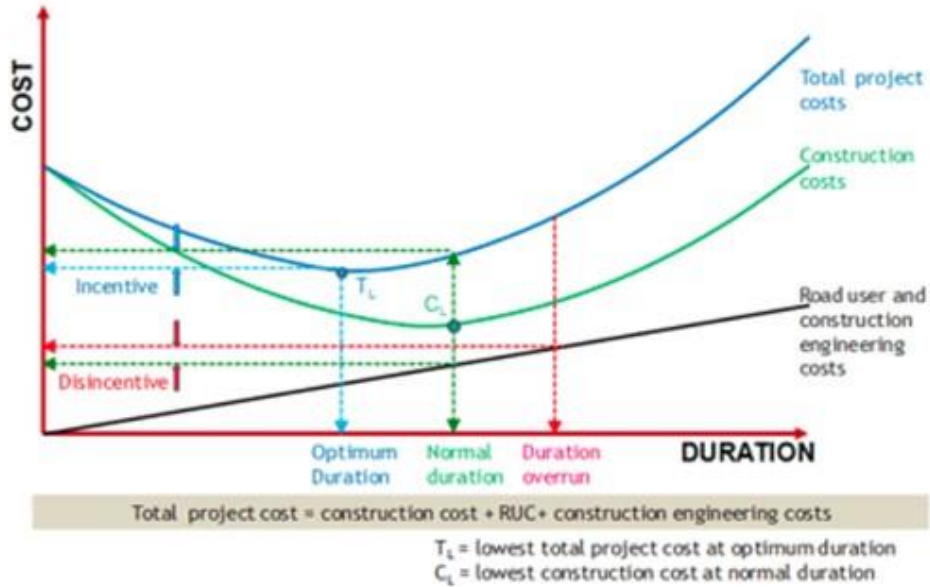


Figure 21 - [USDOT FHWA Cost v Time Optimization Formula](#) Showing Incentives/Penalties

Because we have long believed that the formula developed by the US DOT FHWA is incorrect, one of our top students, [Stephen Paterson, Project Controls Manager with Exxon-Mobil Singapore](#), created this case study for an oil or gas project with an estimated cost of 3-3.5 billion USD and a duration of 30 to 50 months.³³



Figure 22 - Development of the OWNER'S CASH FLOWS OVER TIME

³³ Paterson, Stephen S.J. (2017) "Incentivizing Early Completion of Major Oil and Gas Projects"
<https://pmworldlibrary.net/wp-content/uploads/2017/11/pmwj64-Nov2017-Paterson-incentivizing-early-completion-of-oil-and-gas-projects.pdf>

The first step is to develop the OWNER’S CASH FLOWS. This includes the cumulative costs inherent in following the Phase Gate (Asset life span) process.

Cost vs Time Optimization- “Learning Curves” ...

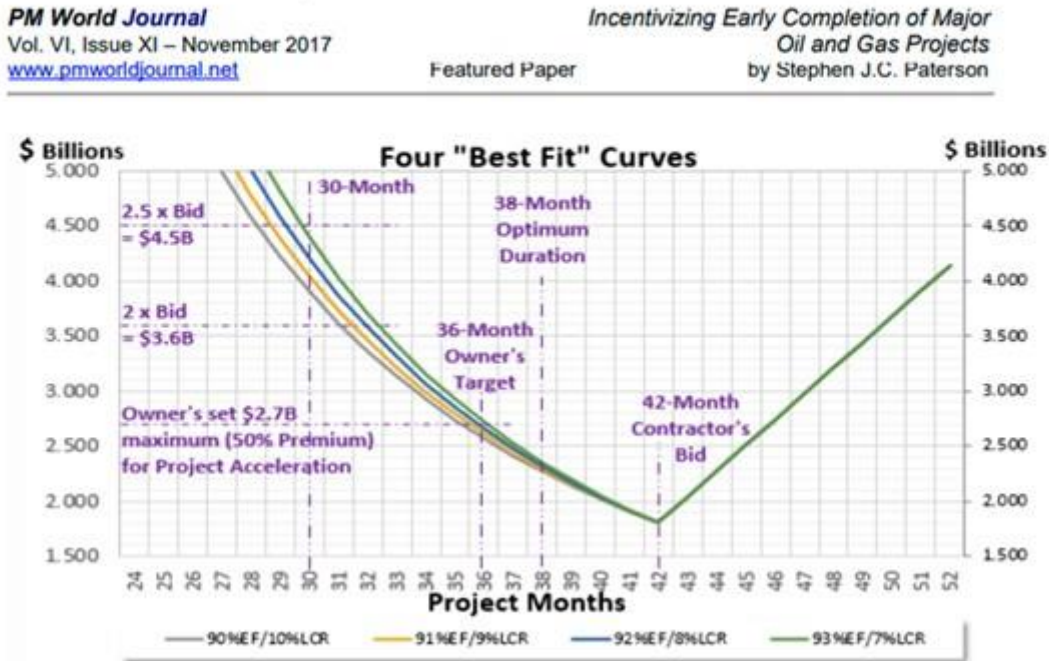


Figure 23 Using the “Learning Curve” to Develop the Cost Increase Formula

The next step is the tricky one, and that is to develop the appropriate formula that best describes the cost increase that happens when we try to shorten (“crash”) any project. We know intuitively that we cannot Engineer, Procure, and Construct (EPC) a 3-billion-dollar project in one month, no matter how much money or resources we throw at it. And we also know there is a “point of diminishing returns” where adding more money or resources does not produce a corresponding decrease in time. So by applying the “Learning Curve Formula” in reverse, we can calculate the MARGINAL COSTS required to reduce or “CRASH” the DURATION by 1 work period, which in this case is months.

Figure 24 illustrates the application of the Learning Curve Formula that demonstrates the “marginal costs” required to crash the project by one month. Applying “common sense,” we can appreciate that it is physically impossible to construct a multi-billion-dollar project in 1 month or even 12 months. The analysis, which was based on HISTORICAL DATA, indicates that the RANGE ESTIMATE is somewhere between 30 and 50 months.

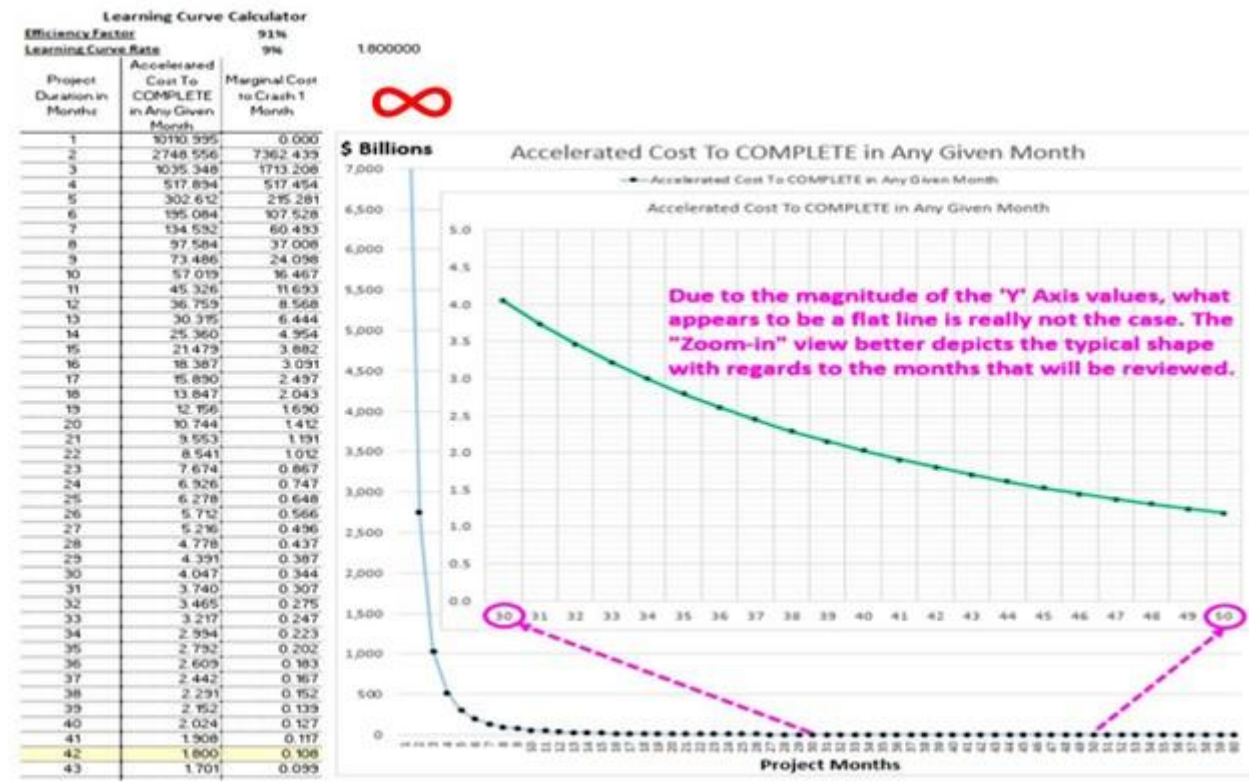


Figure 24- Illustrating the Marginal Costs to “Crash” the project by 1 Month.

Again, applying “common sense,” we know intuitively that a 3.5-billion-dollar project cannot be physically completed in less than 30 months, regardless of how much money or resources we dedicate. Explained another way, impregnating 9 women simultaneously will not produce a healthy baby in 9 months. There is always a “point of diminishing returns” where adding more resources does not produce a corresponding reduction in time.

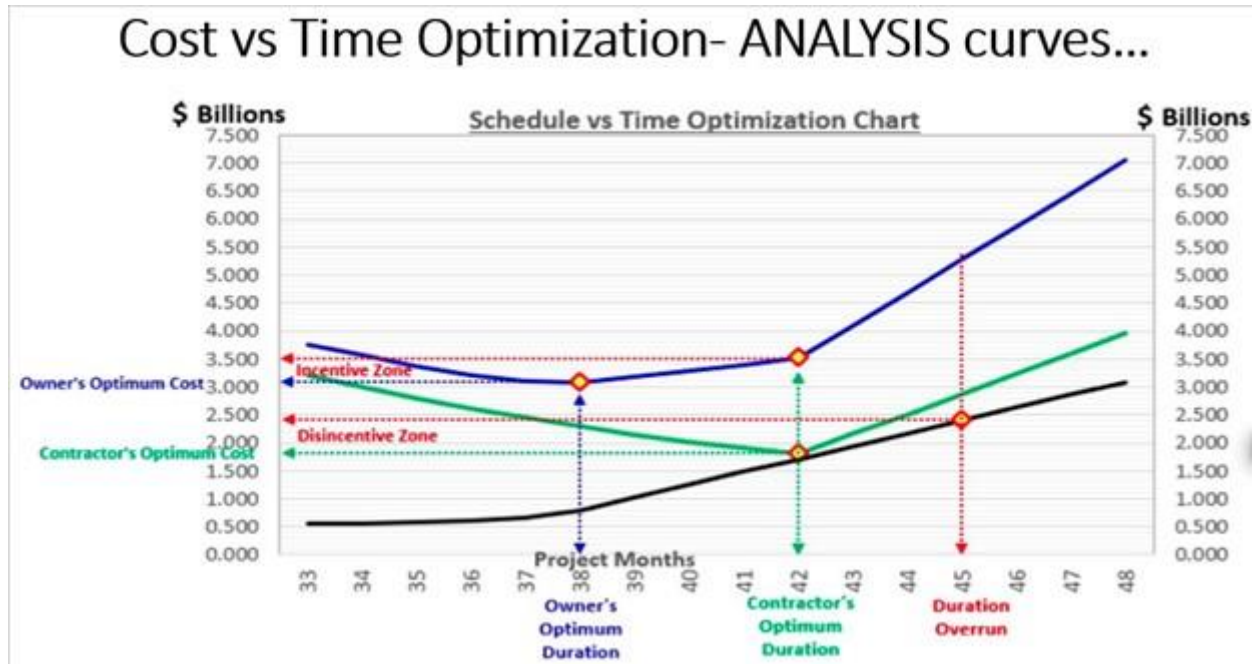


Figure 25- Integrated Owner + Contractor Curves

“The determination of the ‘Incentive Zone’ is found by trending the data points from the Contractor’s optimum duration and the Owner’s optimum duration on the Total Cumulative Cost curve across to the ‘Y-axis.’ The upper value is \$3.5B, and the lower is \$3.1B. Therefore, the incentive is \$0.4B, which needs to be broken down into a \$/day basis. To be clear, the incentive would be 100% to the contractor to cover the expenses/inefficiencies associated with acceleration to complete the project quicker; the benefit to the contractor is the shortening of the project duration, which would reduce their overheads. [Equation 6: Daily Incentive Cost = Total Incentive value / Number of days] In this case, there are 4 months at 30.4375 days per month (the number of days in a month – refer to equation 4), which equals 121.75 days. Using the \$0.4B or \$400,000,000, divide the figure by the total number of days to give a daily figure of \$3.285M/day. This is the incentive figure that would be included in the Contract.”

“Likewise, the ‘Disincentive Zone’ is determined by using the difference in the other two points on Figure 25, the higher data point of the Duration overrun, which in this case is on month-45 intersection with the ‘Owner’s overhead and opportunity’ line equal to \$2.4B, and the Contractors optimum cost which is the bid value of \$1.8B. The disincentive zone value is equal to \$0.6B, which also needs to be converted into a daily rate; this time, the number of days is 3 months multiplied by 30.4375days/month, which equals 91.3125days, giving a daily disincentive rate of \$6.571M/day for any delivery after the end of the 42nd month.”

CONCLUSIONS AND RECOMMENDATIONS

Given the “preponderance of the evidence” clearly indicating that project management, as being advocated by professional societies, governments, and even many private sector companies, is not working, how much longer are we willing to continue “Business as Usual” (BaU) while, according to Einstein, “insanely expecting different results?”

Planners & Schedulers, wake up to reality. As CONTRACTORS, we CANNOT and DO NOT run our projects using your schedules. What we as contractors want to see “planners/schedulers” providing for what we perceive as being legitimate “value-added services” are:

- ✓ Updating the Baseline to reflect an “As-Built” rather than “As Planned” dates, durations, and logic for inclusion in our libraries of “frag-nets” as the basis for FUTURE work.
- ✓ Updating and maintaining the COST and PRODUCTIVITY databases using both Cost Variances (CV) and Schedule Variances (SV) as well as EFFICIENCIES (Cost Performance Indices (CPI) and Schedule Performance Indices. (SPI) as the basis for using TODAY’S
- ✓ Tracking and documenting change orders and delays (documenting, supporting, and perfecting/defending against claims/counterclaims)
- ✓ About two weeks before the billing date, tell the field what activities have STARTED but not yet finished (Physical % Complete >1% but <100%), allowing the field operations to close out as many activities as possible so we can bill for them. (“Contractors live or die by our cash flows.”)
- ✓ A couple of days before the billing date, provide a report showing what activities have been completed, which Field Management uses as the basis to ensure we bill for everything we are entitled to and that we have confirmed concurrence with the Owners Project Manager that he/she will approve those billings. (“Contractors live or die by our cash flows.”)
- ✓ One Week Back-Three Week Look Ahead Schedules. (Rolling Wave Planning, “Sprints,” or “Scrums.”) as the basis to plan our RESOURCE DEPLOYMENT and ALLOCATION. (General Abram’s “Centralized Planning/Decentralized Execution)
- ✓ 90-day look ahead procurement status for long Lead items and subcontractor/vendor contracts.
- ✓ Develop AI or Machine Learning Programs showing ALL the possible “time & space & assets/resource” options for Project Managers to consider. (i.e., Google Maps, GPS Guidance Systems.)

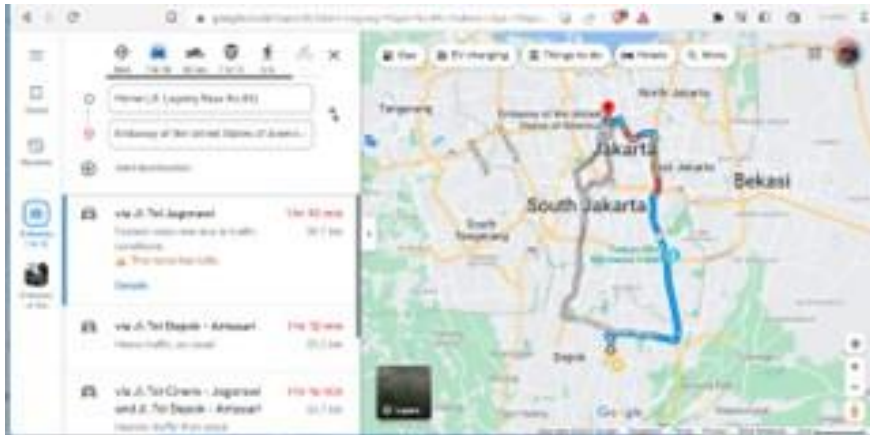


Figure 26- Future of “Planning & Scheduling” using AI

- ✓ Do NOT divorce “performance” from “payment.” Embrace Earned Value Management not as advocated under ANSI 748 C & D (which even the DAU admits is not producing the desired results), but as it originated with the Trade and Commerce Guilds of 16th Century UK and France as a “Cash on Delivery” (CoD) method which was formalized in the late 18th and early 19th centuries by such well known and highly respected practitioners like Frederick Taylor, Henri Fayol, Henry Gantt, Frank and Lilian Gilbreth but especially the published research of [Halbert Powers Gillette](#) and [Richard Turner Dana](#) in their 1909 seminal work [“Cost Keeping and Management Engineering: A Treatise for Engineers, Contractors and Superintendents Engaged in the Management of Engineering Construction.”](#)



Figure 27- Fundamental Earned Management Policy and Procedures

This model results in fairness to SELLERS (Owners or Greengrocer) and BUYERS (Customers, Contractors or Vendors). The SELLER was paid fair market value for the quantity the BUYER needed or wanted, while the BUYER paid fair market value for what she needed or wanted. No more, no less. NO ONE is cheated under this system.

Moreover, for Muslims, this concept of “prompt payment” is consistent with Islamic Shariya Law^{34, 35}

- ✓ Embrace the well-established principles of Frederick Taylor, Henri Fayol, Henry Gantt, Frank and Lilian Gilbreth, but especially Gillette and Dana in applying Earned Value Management as an Incentive Payment policy that REWARDS those who can innovate and deliver quality results FASTER and/or at LOWER COSTS.

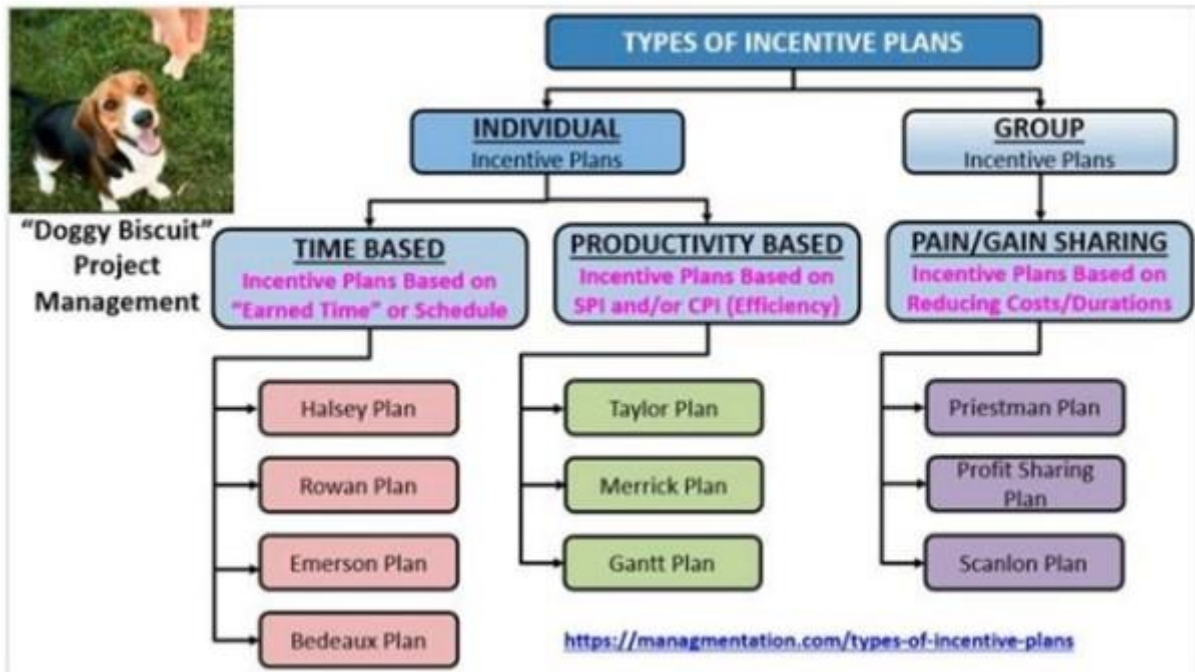


Figure 28- Incentive Plans Derived from Earned Value Management

³⁴ Taybi, Y. (2019). Is Earned Value Management (EVM) consistent with Sharia Law: Will it help in fighting corruption? PM World Journal, Vol. VIII, Issue VIII, September. [https://peworldlibrary.net/article-is-earned-value-management-evm-consistent-with-sharia-law-will-it-help-in-fighting-corruption/](https://peworldlibrary.net/article/is-earned-value-management-evm-consistent-with-sharia-law-will-it-help-in-fighting-corruption/)

³⁵ There is one hadith that teaches us about prompt payment of the worker. An utterance from the prophet Muhammad, “Promptly pay your labor/employee worker salary before his sweat is dry and tell them how much they will be paid while they are working” (Hadist from Baihaqi & Ibnu Majah). Achmad Farid Malone, CCP, PMP

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He is also active in the Global Project Management Community by playing a “thought leadership” role for the Association for the Advancement of Cost Engineering International (AACEI) <http://www.aacei.org/> since 1991. He has also been active in two IPMA member organizations: The Green Project Management Association (GPM) <http://www.greenprojectmanagement.org/> where he served on the Certification Board of Directors for two years, and the American Society for the Advancement of Project Management <http://www.asapm.org/> for which he served for four years on the BoD as Director of Marketing. He also sat on the Board of Directors of the Global Alliance for Project Performance Standards (GAPPS), www.globalpmstandards.org, Sydney, Australia, and is active as a regional leader. Previously, he has also been a compensated consultant to the International Guild of Project Controls. <http://www.planningplanet.com/guild> as the primary author of their “Compendium and Reference” as well as the chief architect of their competency-based credentialing program. <http://www.planningplanet.com/guild/certification>

He has spent 35 of the last 50 years working on large, highly technical international projects, including such prestigious projects as the Alyeska Pipeline and the Distant Early Warning Site (DEW Line), upgrades in Alaska and the Negev Airbase Constructors, Ovda, Israel and the Minas Oil Field in Rumbai, Sumatra. His client list includes Fortune 500 major telecommunications, oil, gas, and mining companies, the UN Projects Office, and many other multi-national companies, NGO organizations, and Indonesian Government Agencies.

In addition to 45+ years of hands-on field experience, Dr. Giammalvo holds an undergraduate degree in Construction Management, his Master of Science in Project Management through the George Washington University and was awarded his Ph.D. in Project and Program Management through the Institute Supérieur De Gestion Industrielle (ISGI) and Ecole Supérieure De Commerce De Lille (ESC-Lille) under the supervision of Professor Christophe Bredillet. “Dr. PDG” can be contacted at pauldgphd@gmail.com.