What Do We Do AFTER Calculating Our Average Costs or Durations? [1]

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This is a FOLLOW-ON Advisory article to the December posting by Dr. Ken Smith, "Given Extant Averages, Which is Best for Your Business?[2] to help us APPLY our average data in a practical and useful way, especially for those who continue to believe in and support the origins of Earned Value Management as captured and documented 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.***"

BACKGROUND INFORMATION- INTRODUCING SIMPSON'S PARADOX

As noted, we have long advocated the "5 Immutable Laws of Planning and Scheduling" to help us understand why so many projects run late and/or over budget.

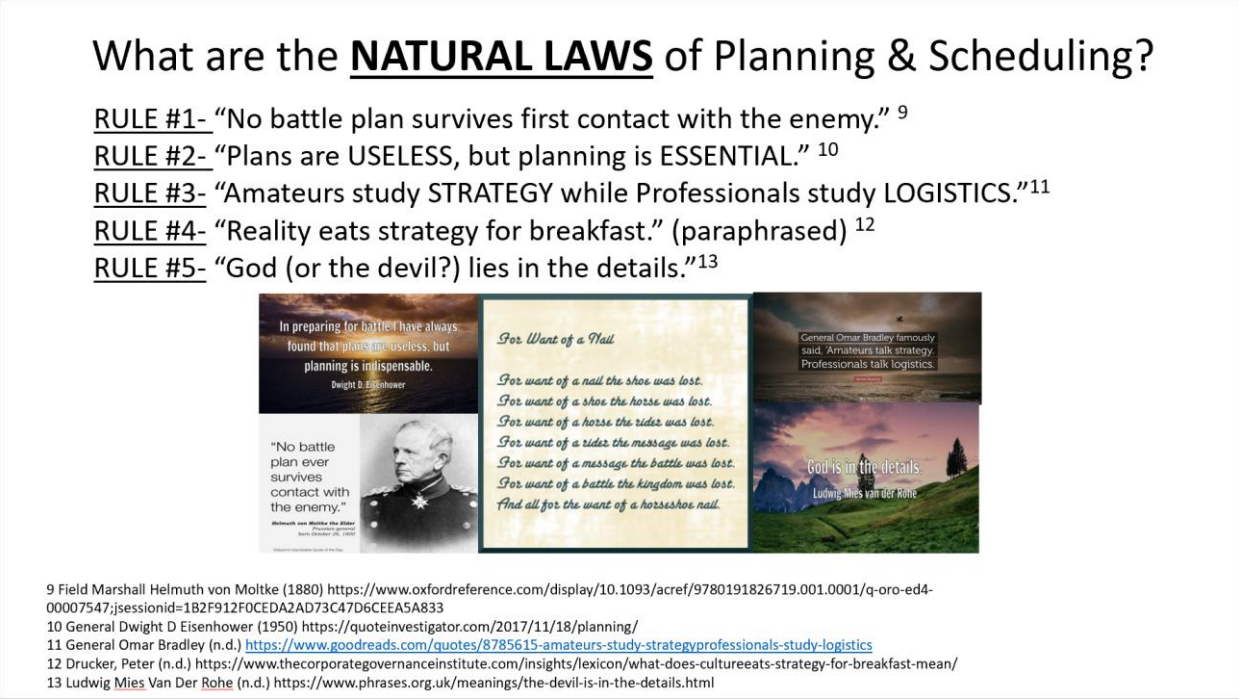

Figure 1- The 5 IMMUTABLE laws of Planning and Scheduling.

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[2] Smith, K. F. (2025). Given Several Extant Averages; Which is Best for Your Business? *PM World Journal*, Vol. XIV, Issue XII, December Available online at https://pmworldlibrary.net/wp-content/uploads/2025/12/pmwj159-Dec2025-Smith-which-is-best-average-to-use-advisory-2.pdf

In this paper, we are going to focus on Architect Ludwig Mies Van der Rohe with his observation that "God (or the devil?) Lies in the Details", which is why we are opening with the introduction of the Simpson Paradox.[3]

> *Simpson's Paradox is a statistical phenomenon in which an association between two variables in a population appears, disappears, or reverses when the population is divided into subpopulations. For instance, two variables may be positively associated in a population, but be independent or even negatively associated in all subpopulations.*

To explain Simpson's Paradox, we rely on another highly trusted and respected Cost Engineer colleague from NASA, Glenn Butts.[4]

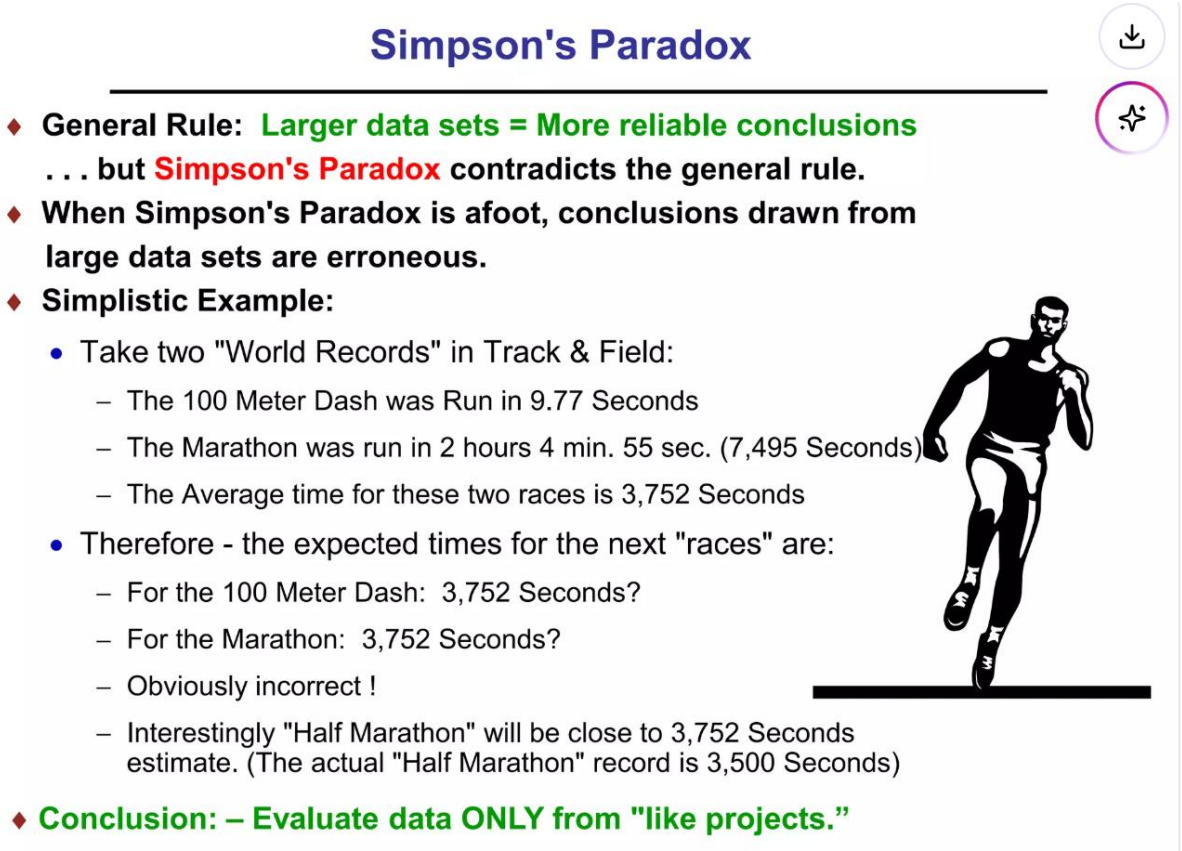


Figure 2- Simpson's Paradox Illustrated[5]

So how does Simpson apply to us, especially when collecting and analyzing EVM data? Well, another trusted and respected academic is Prof. Bent Flyvbjerg, Oxford University, who has

[3] Simpson's Paradox Defined https://plato.stanford.edu/entries/paradox-simpson/#:~:text=Table%201:%20Simpson's%20Paradox:%20the,but%20at%20the%20same%20time%2C
[4] Butts, Glenn- https://www.slideshare.net/slideshow/glennbutts-mega-projects-estimates/9907986 Slide #25/48
[5] IBID

identified that the two most common causes of cost overruns and/or schedule slippages are due to:[6]

1) Optimism Bias
2) Strategic Misrepresentation (a.k.a. FRAUD)

For the purposes of this paper, we will ignore Fraud/Misrepresentations and rely on our legal processes to address those issues. Our focus here will be on what we DO and SHOULD be managing control- the rampant and gross optimism bias in both time and costs.

Worth noting BEFORE we move forward, anyone can claim that what they advocate is a "best practice." Until or unless a tool, technique, or methodology has met the 5 attributes of the Scientific Method, it is nothing more than an unsubstantiated marketing claim. To be BOTH TESTED and PROVEN, it must meet all 5 of the Scientific Method.

CASE STUDY #1- NASA SOLUTION

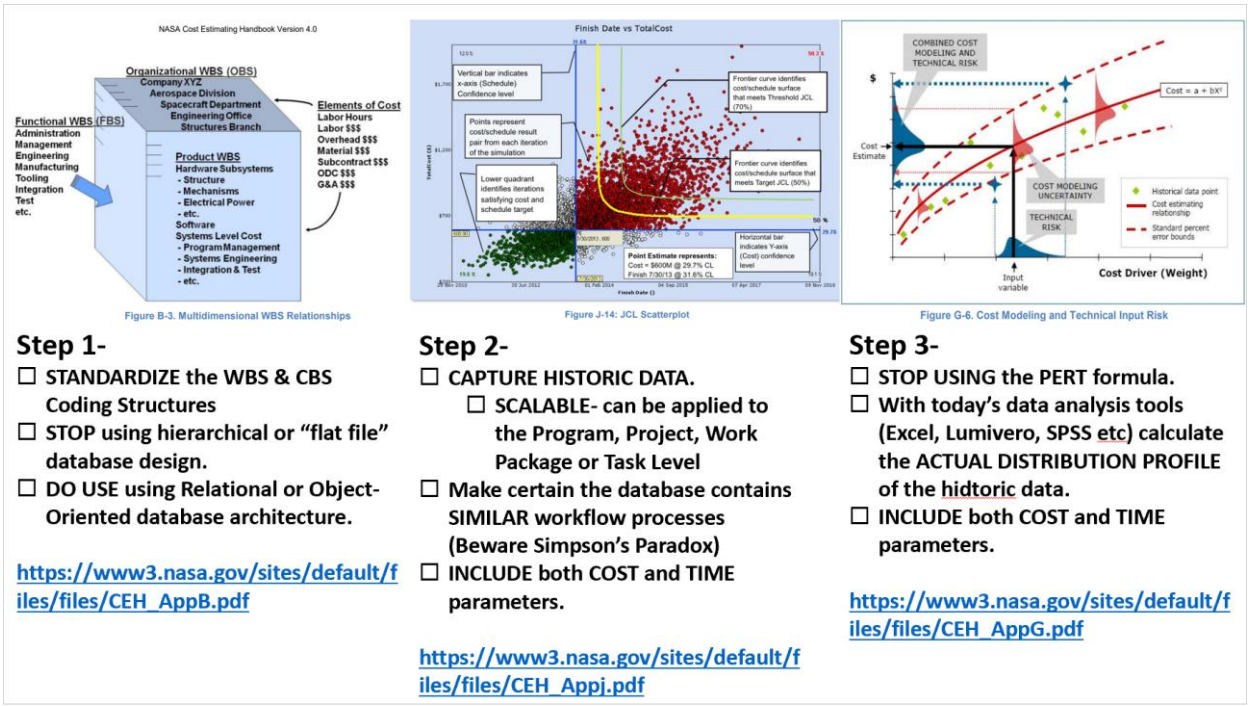


Figure 3- NASA's Data Analysis Process Mapping from Cost Estimating Handbook v 4.0

This provides a handy CHECKLIST to help you IMPLEMENT a **"best TESTED and PROVEN"** systemic approach that anyone can apply to your existing historic data. Just be cautious to ensure that, ideally, your data has been coded using a STANDARDIZED WBS/OBS coding structure. (Since the 1960s, construction in the USA has been using CSI's Masterformat and Uniformat, but other

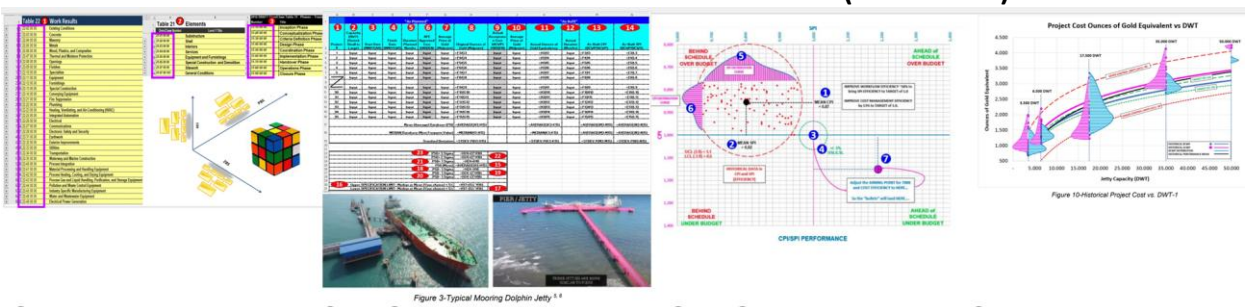
[6] Flyvbjerg, Bent (2011)
https://www.academia.edu/3365343/Over_Budget_Over_Time_Over_and_Over_Again_Managing_Major_Projects

sectors probably have not yet done so.) We also need to be aware of Simpson's Paradox to ensure the data being analyzed shares the same or similar workflows. The solution is to increase the granularity of the data being analyzed. Explained another way, as CONTRACTORS, we break our concrete placement activities down into more specific types of concrete placement- Slab vs Wall concrete, and even more granular, slab on grade vs elevated slab concrete. Never forget Van der Rohe's rule #5: "God (or the devil) lies in the DETAILS." That is why, when we hire project managers, we specifically do NOT hire "big picture" thinkers. For our PMs, Project Controllers, and PMO leaders, we hire detail-oriented candidates. People who "sweat the details." This proverb, often attributed to Benjamin Franklin's Poor Richard's Almanack, illustrates how a small neglect leads to big problems and why we value those people who demonstrate that they are detail-oriented:

> *"For want of a nail, the shoe was lost;*
> *for want of a shoe, the horse was lost;*
> *for want of a horse, the rider was lost;*
> *for want of a rider, the message was lost.*
> *for want of a message, the battle was lost;*
> *for want of a battle, the kingdom was lost—*
> *and all for the want of a horseshoe nail".*

Unfortunately, this reality is often overlooked by organizations such as PMI, AACE, PRINCE2, APM/APMG, and IPMA when they profile the attributes of successful professional practitioners.

CASE STUDY #2- PRIVATE SECTOR SOLUTION USING EVM DATA (SPI and CPI)



Step 1-
- ☐ STANDARDIZE the WBS & CBS Coding Structures
  - ☐ For CONSTRUCTION, we recommend using CSI's Omniclass Format
- ☐ STOP using hierarchical or "flat file" database design.
- ☐ DO USE using Relational or Object-Oriented database architecture.

Step 2-
- ☐ CAPTURE HISTORIC DATA.
  - ☐ NORMALIZE the data to TODAYS COSTS
  - ☐ Use Gold Equivalency as Purchasing Power Parity
- ☐ Make certain the database contains SIMILAR workflow processes (Beware Simpson's Paradox)
- ☐ INCLUDE both COST and TIME parameters.

Step 3-
- ☐ STOP USING the PERT formula.
- ☐ With today's data analysis tools (Excel, Lumivero, SPSS etc) calculate the ACTUAL DISTRIBUTION PROFILE of the historic data.
- ☐ INCLUDE both COST and TIME parameters using SPI and CPI from the EVM data.

Step 4-
- ☐ STOP USING the PERT formula.
- ☐ START applying Motion & Time Studies
- ☐ With today's data analysis tools (Excel, Lumivero, SPSS etc) calculate the ACTUAL DISTRIBUTION PROFILE of the historic data.
- ☐ INCLUDE both COST and TIME parameters.

Figure 4- Private Sector Process Map Using SPI and CPI Data from EVM

This summarizes the 4 Step process we have been applying based on the **"BEST TESTED AND PROVEN"** approach taken by NASA, and ADAPTING it using the SPI and CPI data generated by Earned Value Management, not per ANSI/SEA 748, but as the origins of Earned Value Management, based on the research of Taylor, Gantt, Fayol, the Gilbreth's et al., as captured and documented 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*"

The Figure 4 graphic originated from a paper published in 2024 by Pak Rizkia Arifani Zain, showing us the results of 95 typical mooring dolphin jetty projects for Pertamina's Mitra Kerja, entitled "Developing Parametric Modelling for Class 4 Estimate of Pier and Jetty Construction by Analyzing Historical Databases using AI Tools & EVM Techniques"-"-

In his paper, he began by using the CSI's OmniClass™ Construction Classification System (OCCS), a system for organizing and retrieving information specifically designed for the construction industry. He chose Table 22, Work Results, but since these are designed as RELATIONAL DATABASES, he could have used any of the 15 tables as the basis for organizing his cost and productivity data.

The key challenge when using historical data is normalizing our cost data to account for inflation and currency changes. To accomplish this, we advocate using the purchasing power parity of Gold as the **"best tested and proven"** approach for forecasting future costs.

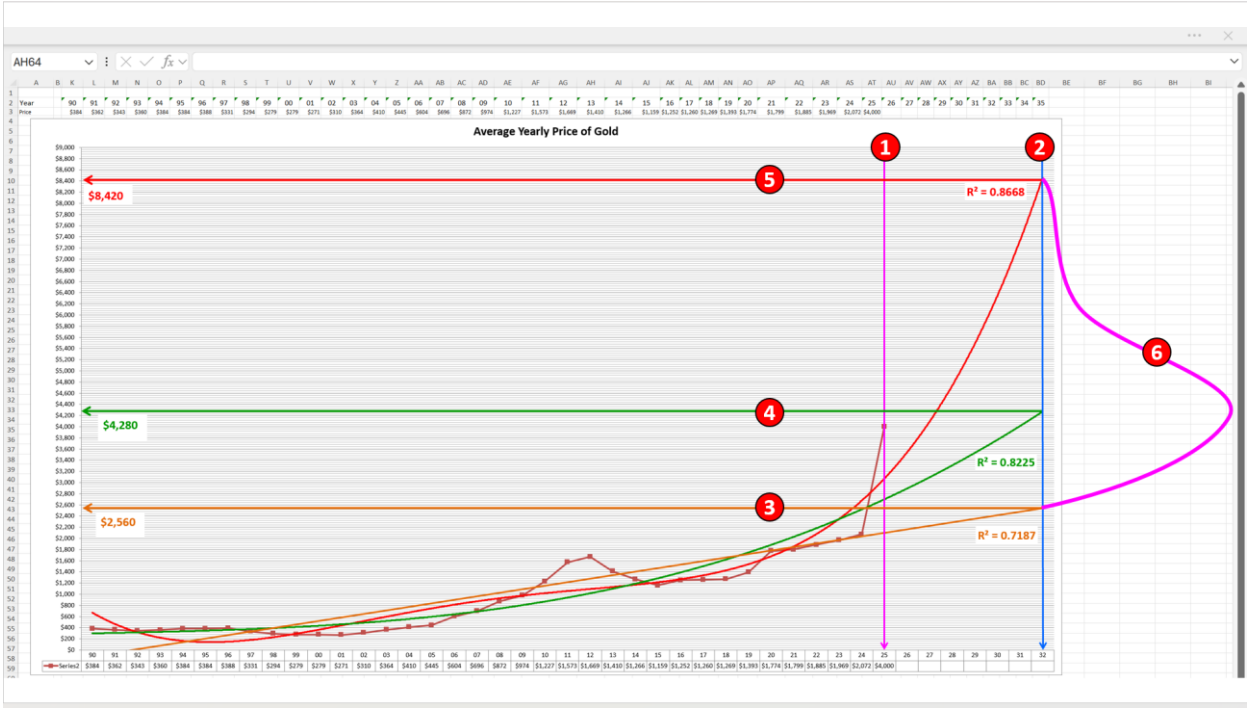


Figure 6- Gold as Purchasing Power Parity to Forecast Future Costs

Figure 6 illustrates how we can use the historical market value of gold as a basis for predicting future costs for our programs, projects, or individual activities or pieces of equipment. If we used a PERT formula, the distribution would be normal or Binomial. Using Monte Carlo simulation software, we can generate more realistic Lognormal or Poisson-distributed profiles that incorporate the skewness of cost and productivity data. **(6)**

To begin using the gold equivalency PPP method, we need to identify a specific project (or program, work package, or series of activities). We need to select a COMPARATIVE BASELINE that is as closely matched in size, capacity, and workflows/processes as possible to the proposed project. Then we divide the ACTUAL COST (ACWP) of the BASELINE Project by the fair market value (FMV) of gold at the end of the BASELINE project. This will yield the equivalent ounces of gold when the project's asset is put into service. (ACWP/FMV of 1 ounce of Gold=Equivalent Ounces of Gold)

The fair market cost of gold at the end of Nov 2025 is $4,000 (1), and the midpoint of our project is planned for 2032. **(2)** Applying the "best fit" data curves from Excel, we can see that the "best case" would be gold @$2,560/ounce in 2032 **(3)**, the "most likely" of $4,280/oz **(4),** and a "worst case" of $8.420/oz. **(5)** But notice that when we plot the data distribution, instead of having to apply the PERT formula, we can generate the probabilities at any desired comfort level by knowing the distribution. **(6)** Using this method, we can generate a more risk-adjusted SKEWED curve, which NASA proves is what Cost and Schedule data actually looks like, rather than the Normal distribution assumed when we apply PERT?

WHY IS PERT SO MUCH YESTERDAY'S "BEST PRACTICE" BUT NO LONGER REMAINS?

The simple answer is that the data indicate it no longer works.

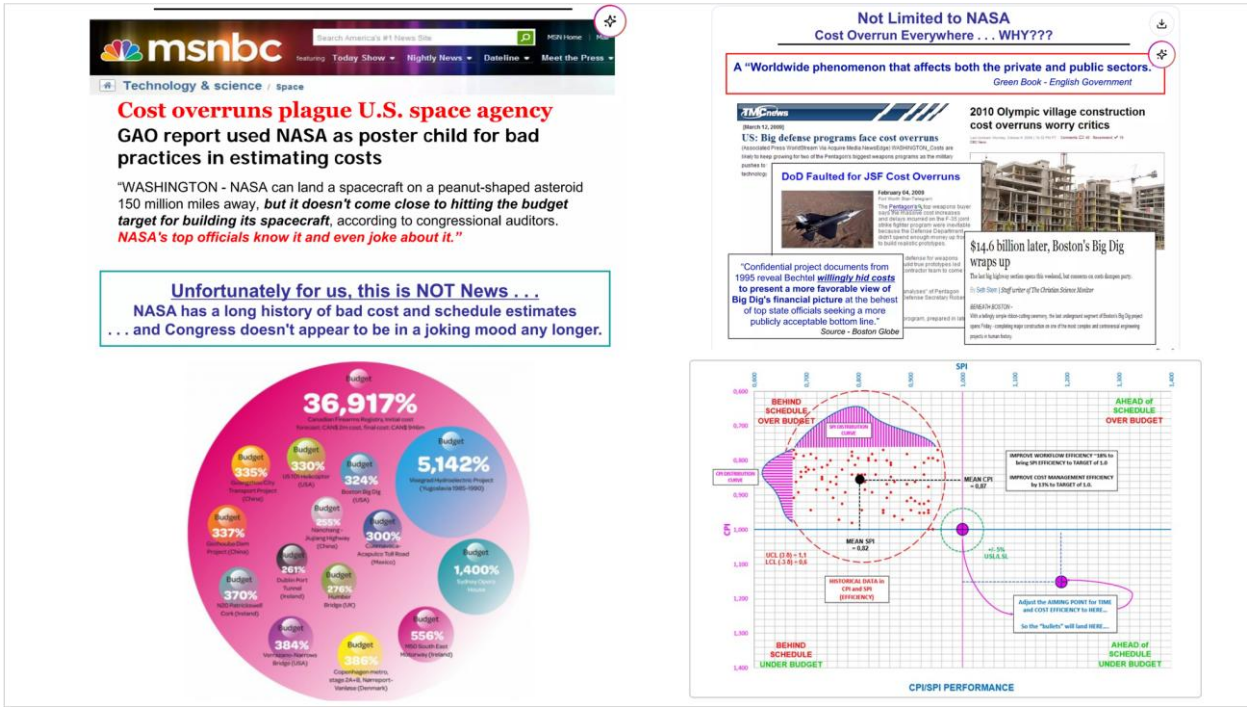


Figure 7- Examples of Cost/Schedule Overruns

IF PERT worked, then WHY are we still getting the same dismal results? Wasn't it Einstein who supposedly told us that "doing the same thing over and over again, but expecting different results, is the definition of INSANITY?" Or how about these supposed words of wisdom from Henry Ford? "If you always do what you've always done, you will always get what you always got." We have AI and sophisticated statistical software today. Isn't it about time that we RETIRE the use of PERT and REPLACE it with Excel or more modern, sophisticated tools?

BOTTOM LINE- WHAT ARE TODAY'S "LESSONS LEARNED to SHARE?"

Lesson #1-

As practitioners, we talk a lot about the importance of "Lessons Learned," but, as Douglas Adams noted, "Human beings, who are almost unique in having the ability to learn from the experience of others, are also remarkable for their apparent disinclination to do so."

Or how about these quotes? "The only source of knowledge is experience" ~ Albert Einstein? Or this one? "Experience is a tough teacher. She gives the test first and the lesson after." ~ William H. Ottley.

We need to CHANGE from advocating the use of Shewhart's "Plan-Do-Check-Act" Cycle PDCA and Deming's "Plan-Do-Study-Act" PDSA Cycle, which haven't proven to result in any measurable improvements, and try something NEW and DIFFERENT. We have successfully implemented Argyris and Schön's 1974 Double-Loop Learning System.

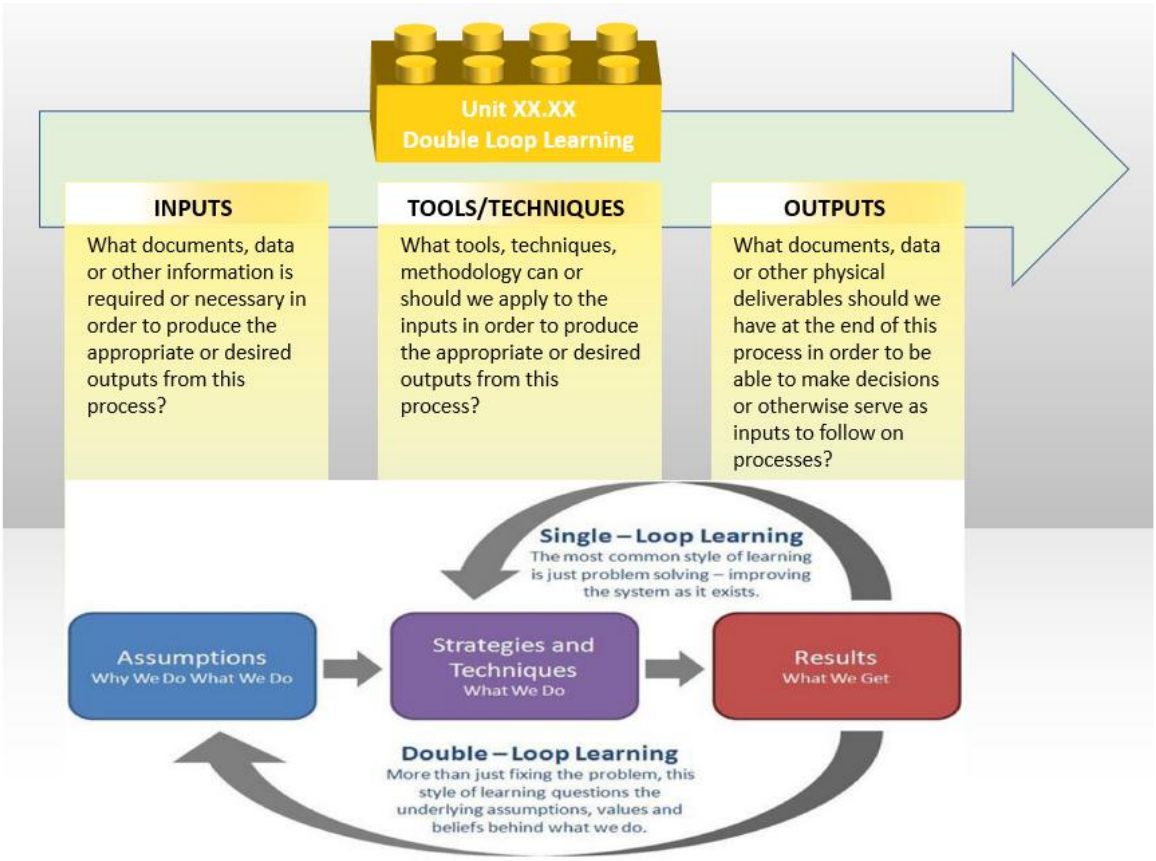


Figure 8- Argyris and Schon's Double Loop Learning System

This is the learning system our company adopted 30 years ago, and it is the system that we have been teaching to our clients. Should the fact that we have been in business for 30+ years stand as *prima facie* evidence that what we advocate and use has withstood the test of time?

Lesson #2-
For better or worse, we are quickly moving to various combinations and permutations of Artificial Intelligence.

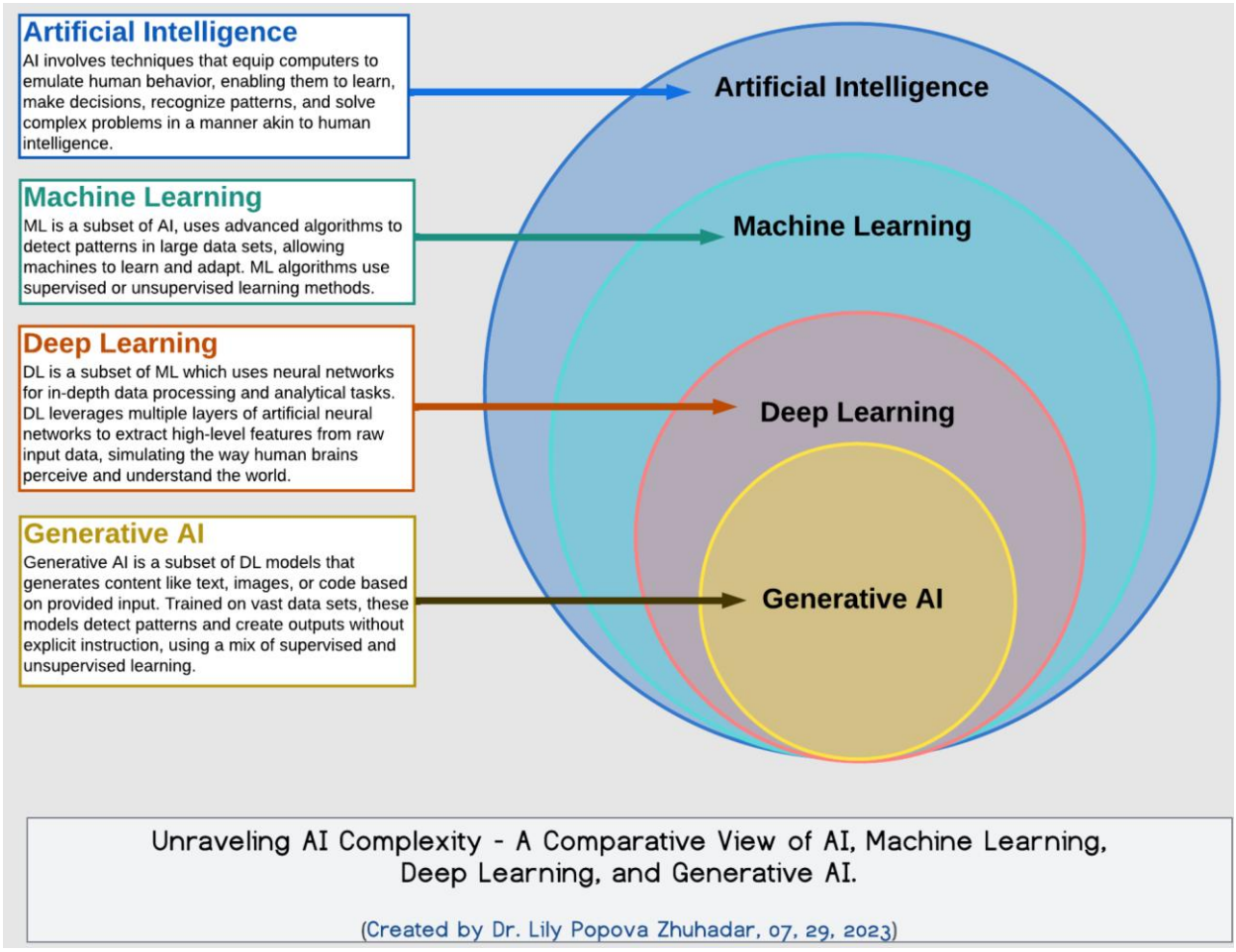


Figure 9- Unraveling AI Complexity: A Comparative View of AI, Machine Learning, Deep Learning, and Generative AI

Given that we are already using AI for EVM and SPC Analysis and are beginning to develop machine learning for integrated Asset, Portfolio, Program, and Project Management, we need to establish RULES to govern any AI system. Wouldn't it make sense first to identify what the **BEST TESTED AND PROVEN** systems are and use those rules as the basis to develop and test our machine learning?

We have already shared 5 IMMUTABLE LAWS of Planning and Scheduling, so why waste any more time creating another PMBOK Guide 8th Edition? Why not invest that time, money, and effort in identifying additional rules to guide us in creating Machine Learning models that can be **TESTED and PROVEN** to work?

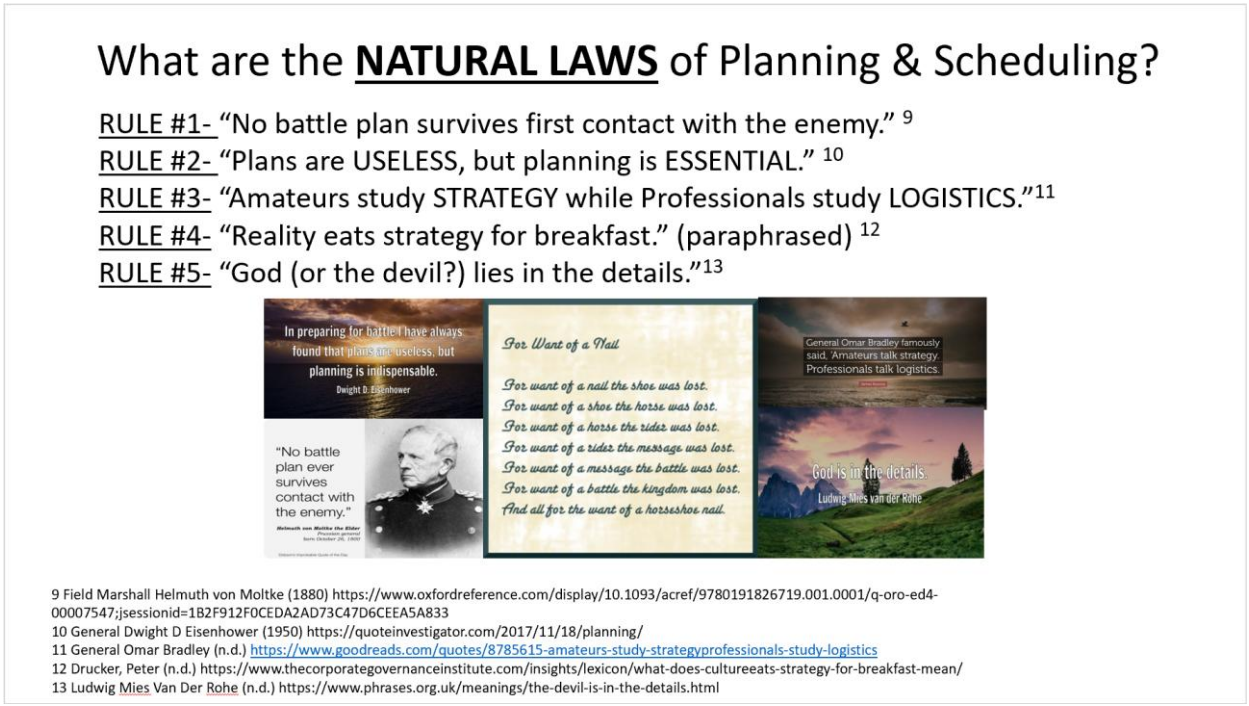


Figure 10-The 5 IMMUTABLE Laws of Planning and Scheduling.

Lesson #3-
For 20 years, NASA's Glenn Butts has been researching, developing, and publishing fundamental truths that we continue to ignore. Isn't it about time to start to LISTEN to people with the first-hand experience to have the PROOF to SUPPORT WHAT THEY ARE TELLING US?

Yet to quote from one of the well-known, influential, and exceedingly popular "thought leaders" from NASA, who is also a highly supportive disciple of PMI, stated to this author when he advocated what Butt was telling us, is that "Butts is an a**hole." This is a major problem whenever "speaking the truth to power" is EXACTLY why we need more Glenn Butts in charge of our professional organizations and fewer "B-School Graduates" and academics who have never gotten their boots dirty by actually working on projects where their own money is predicated on the success or failure of the project.

There is a HUGE difference between THEORY and FACT, especially when you have serious "skin in the game."

Below are the recommendations from Glenn Butts, and to encourage you to read his work, "Mega Projects- A History of Denial", scroll down to Slide #32 of 48 and see his proposed "solution." Definitely doesn't fall under the category of ESG/DEI/Woke think!!!

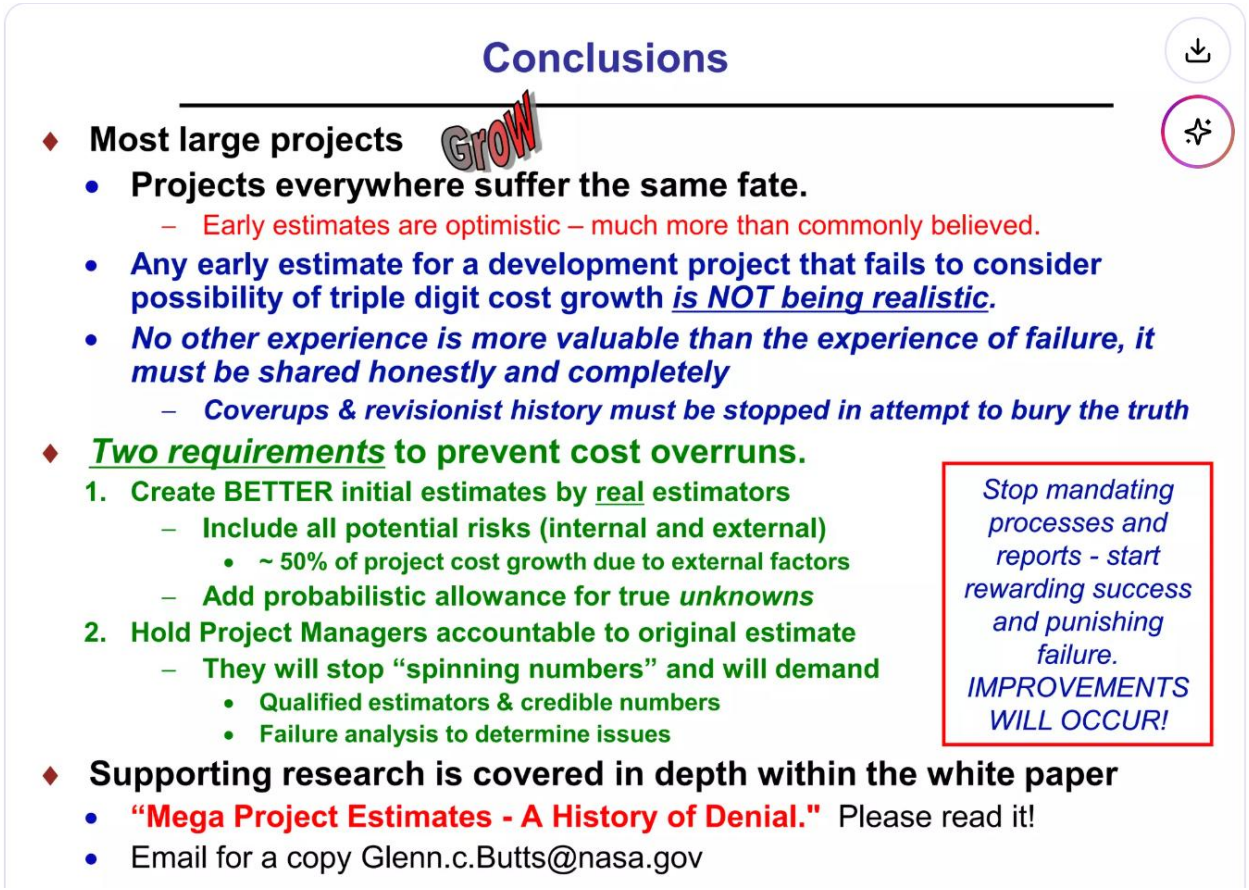


Figure 11- NASA's Glenn BUTTS Recommendations[7]

Lesson Learned #4-
Another recommendation we often reference but that is not always easy to find is Prof. Bent Flyvbjerg's Capability Maturity Model. While most of the CMMs (mercifully!!!) died around 2008 or so (PMI's OPM3 ("Opium3") died when Dr. Ginger Levin passed away, as she was the last person I knew who continued to support it), we adopted and still follow Flyvbjerg's CMM to this day, and recommend our clients do so as well.

Prof. Flyvbjerg has granted this author permission to share his "Stairway to Success" graphic from his course presentation slides.

In fact, our highly successful 6-month graduate-level competency development and capacity-

[7] Butts, Glenn- Mega Projects Estimates- A History of Denial (2010)
https://www.slideshare.net/slideshow/glennbutts-mega-projects-estimates/9907986

building program is grounded in the fundamental tenets of Flyvbjerg's CMM.

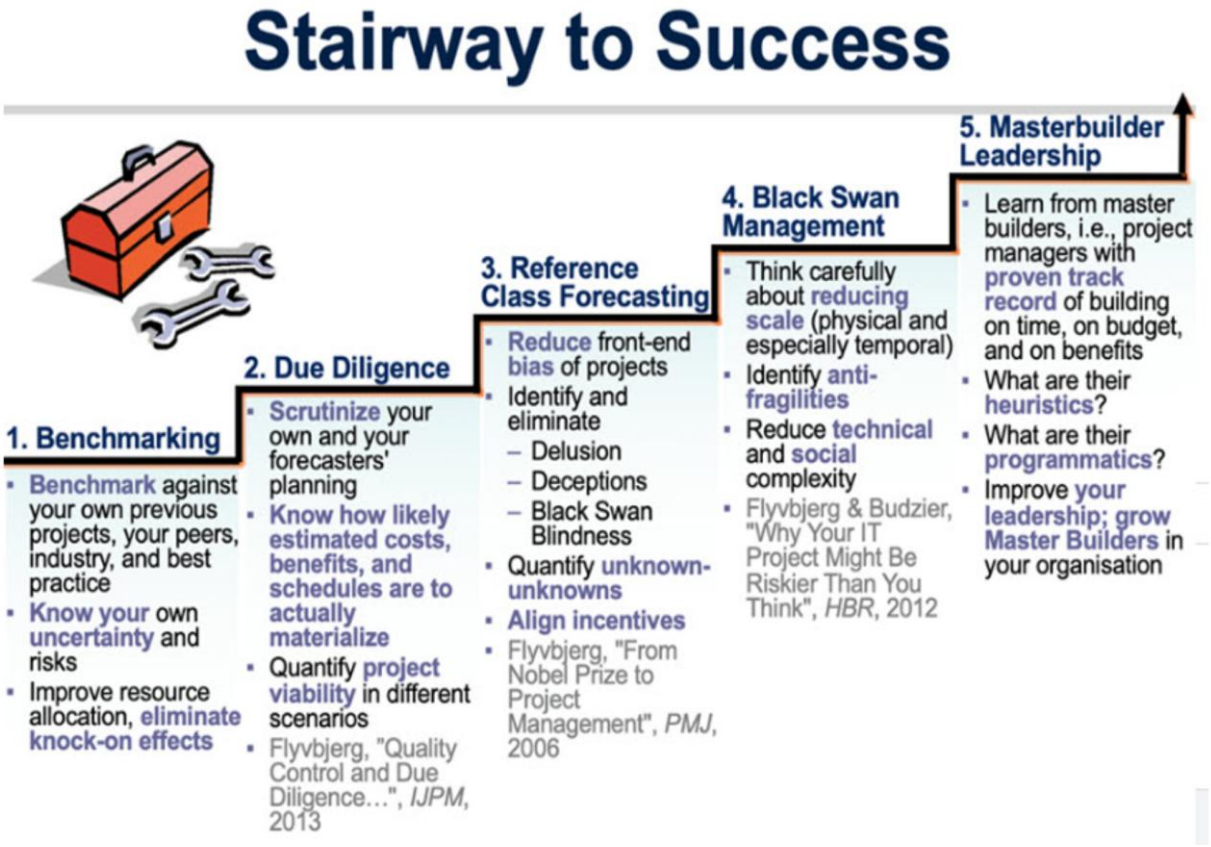


Figure 12- Prof Bent Flyvbjerg's Capability Maturity Model.

Lesson Learned #5-
Throughout this paper, we urge ourselves to stop relying on the PERT Formula. In place of using a method that may have worked back in the 1970s, but is no longer suitable to meet today's needs and expectations, we need to go back to the past and REDISCOVER what Taylor, Gantt, Fayol, the Gilbreth's et al., as captured and documented 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*" and that is the importance of the use of Motion and Time Studies (remember Van der Rohes Rule #5?) and the importance of rewarding EFFICIENCY and penalizing INEFFICIENCY.

For PROOF to support Gillette and Dana's "10 Laws of Management" in particular Laws #7, #8, and #9, we need to look at this recent paper from Ms. Sita Pangestu, in her 2024 paper "Enhancing Productivity in Greenfield Mining Projects through Earned Value Management and Timely Contractor Payments." Her research provides recent examples from the Discovery Channel's "Gold Rush," illustrating that what Gillette and Dana recommend is as valid today as it was in 1900, and with so much more at stake, perhaps even more important today than 120+ years ago.

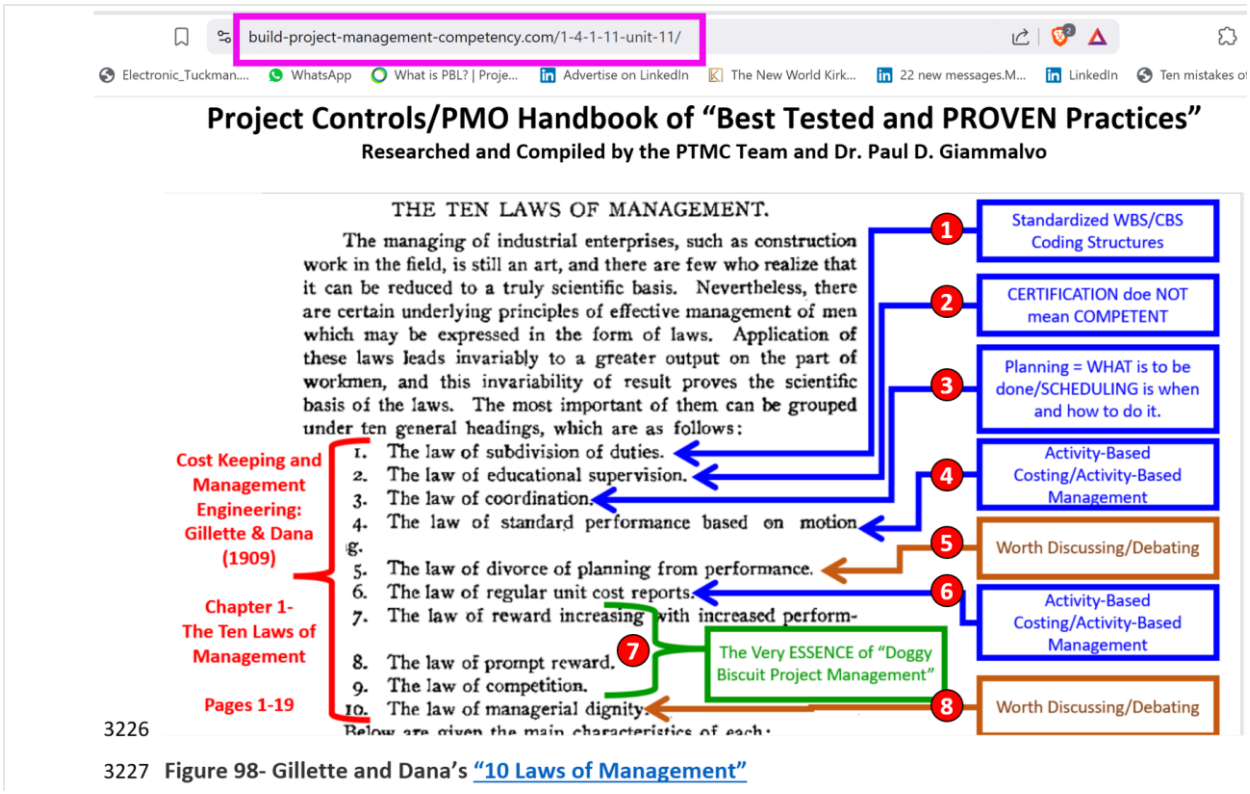


Figure 13- Gillette & Dana's "10 Laws of Management"

BEFORE we go publishing a PMBOK Guide, 8th Edition, or ANY standard, including from the DAU/FAR or GAO, to fulfillmeeting Trump's Executive Order number 14303, "Restoring Gold Standard Science", wouldn't it make sense to UPDATE these 10 Laws to reflect 120+ years of experience, incorporating today's **BEST TESTED AND PROVEN** tools, tecchniques and systems?

About the Author

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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 , and served on the Board of Directors of the Global Alliance for Project Performance Standards (GAPPS; www.globalpmstandards.org), Sydney, Australia, and remains active as a regional leader. Currently, he is 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 current client list includes Fortune 500 telecommunications, oil, gas, and mining companies; the UN Projects Office; and many other multinational companies, NGOs, 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 PhD in Project and Program Management through the Institute Superieur De Gestion Industrielle (ISGI) and Ecole Superieure De Commerce De Lille (ESC-Lille) under the supervision of Professor Christophe Bredillet. "Dr. PDG" can be contacted at pauldgphd@gmail.com.

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