

The Origins of EVM

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The Challenge



"Those who don't study history are doomed to repeat it.
Yet those who *do* study history are doomed to stand by
helplessly while everyone else repeats it."

For my work on project management history see:
<https://mosaicprojects.com.au/PMKI-ZSY.php>

This presentation is based on a paper in development

The Challenge



Prediction is very difficult, especially if it's about the future!

Niels Bohr, Nobel laureate in Physics

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- **BUT.....**
- A consistent theme running through this Symposium is the requirement to provide accurate forecasts of future outcomes:
 - Risk and uncertainty make forecasting difficult
 - Senior management want accurate forecasts to inform decisions
 - Not knowing the outcome = poor governance (but today we have the tools)
- **The value of project controls is providing management with early warning of potential undesirable outcomes so action can be taken to prevent the predictions coming true!**
- This paper shows systematic processes to predict outcomes only emerged in the 1960s and are still not widely used

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The Challenge

- Contracts with deadlines and fixed prices have been around for at least 2000 years
- Forecasting costs to complete on major projects has a long history
- Crystal Palace / Great Exhibition
 - Forecast profit 1853 'Not less than £173,000'
 - Actual December 1855: £186,436 18s 6d

(Battle of Waterloo 1815)



https://mosaicprojects.com.au/PDF_Papers/P180-Project_Governance-Building_the_Crystal_Palace.pdf

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- Planning work also has a long history
- Henry Gantt 1910 - 1920

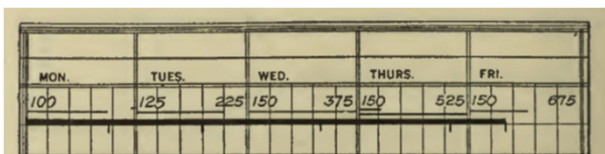
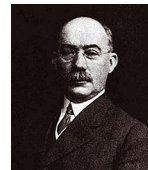


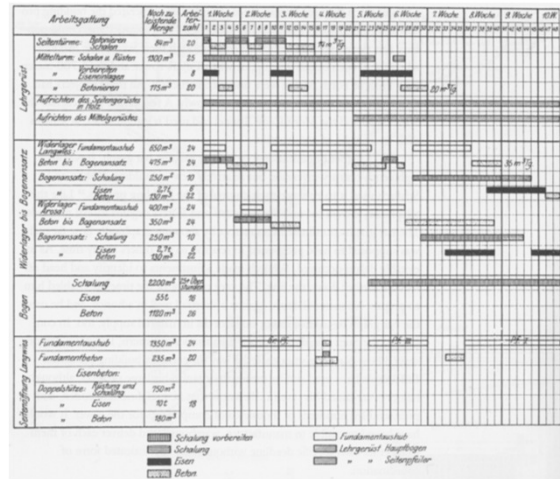
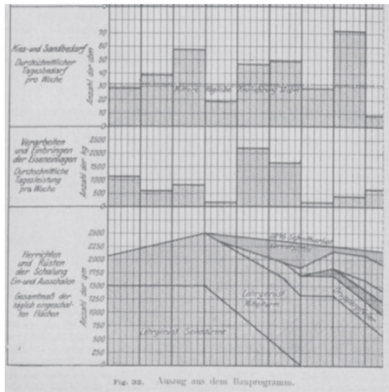
FIGURE 3. GANTT CHART SHOWING THE CUMULATIVE SCHEDULE AND THE CUMULATIVE WORK DONE

https://mosaicprojects.com.au/PDF_Papers/P158_Henry_L_Gantt.pdf

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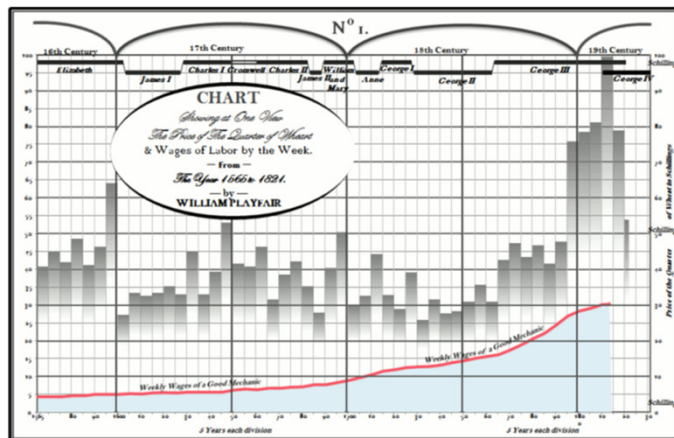
The Challenge

- Planning work has a long history
- 1912 Schürch barchart



The Challenge

- The use of charts to display data is even older
- William Playfair 1810 through to 1825



https://mosaicprojects.com.au/PDF_Papers/P042_History_of_Scheduling.pdf

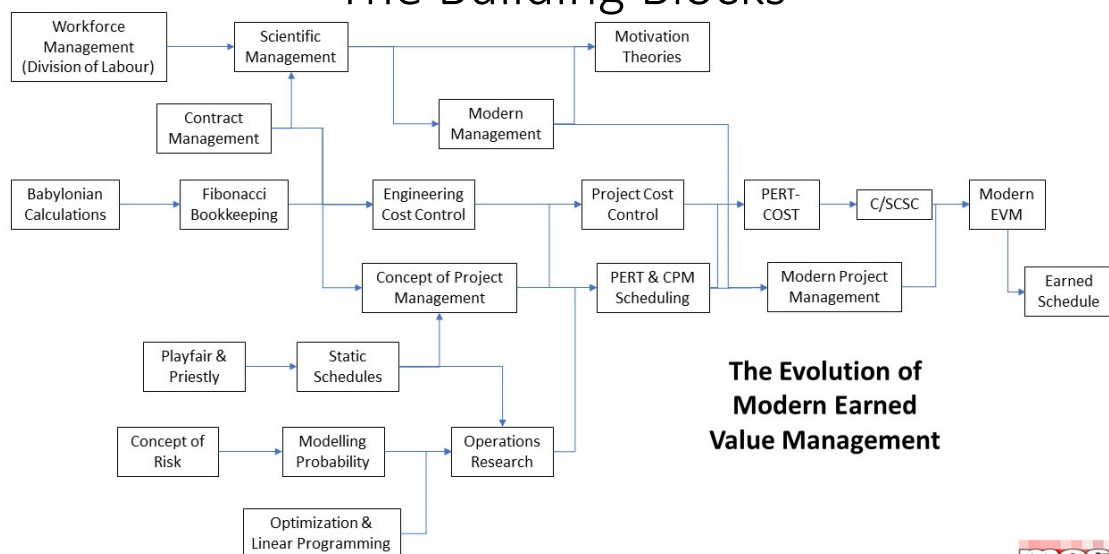


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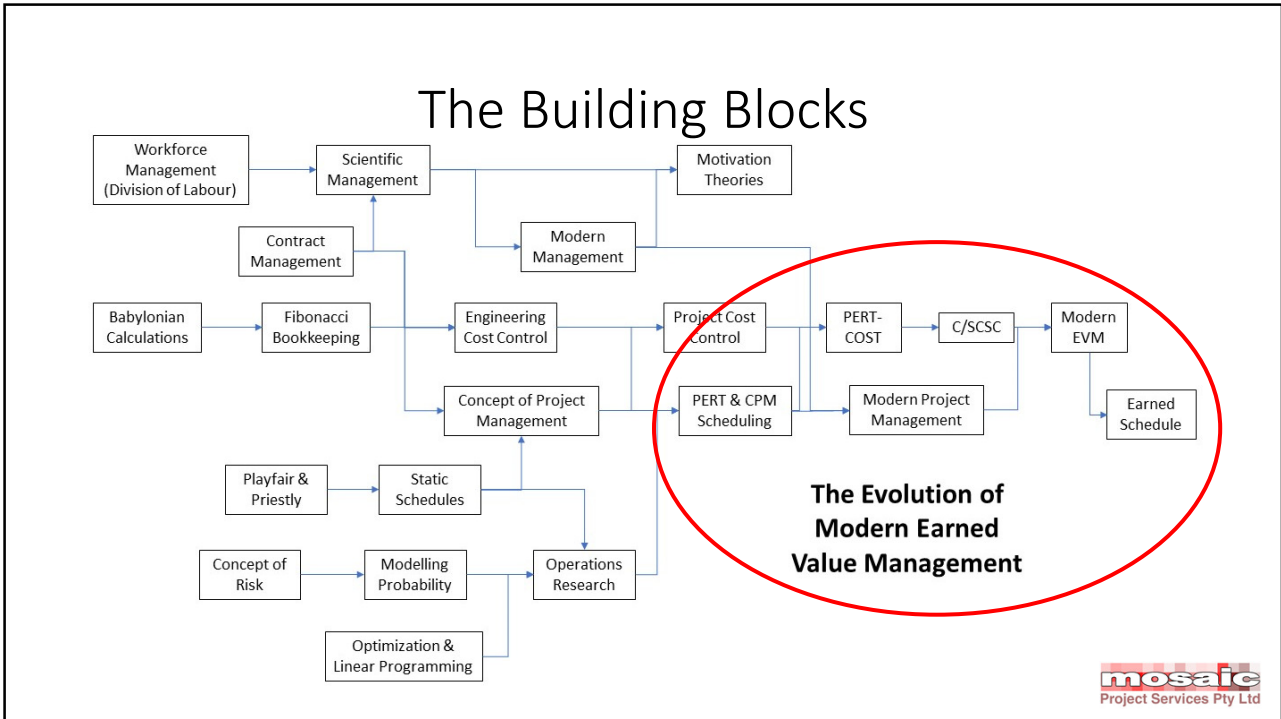
Prior to the 20th Century

1. All of the diagrams were static (Karol Adamiecki was an exception)
2. Tools did show current situation -v- the plan
3. This information was undoubtedly used to assess outcomes
4. But no standard process was developed to predict outcomes

The Building Blocks



**The Evolution of
Modern Earned
Value Management**



PERT & CPM Schedules

- Dynamic modelling of time
- Updates predicted outcomes
- CPM = deterministic
- PERT = probabilistic
- Weakness - both assume all future work will be performed as planned
- Developed 1956 / 1958

SAMPLE PERT OUTLOOK FOR MAJOR FBM PROGRAM SUBSYSTEMS

SAMPLE PERT OUTLOOK FOR MISSILE SUBSYSTEM COMPONENTS

Fig 14 Integrated outlook

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PERT Cost & WBS

- June 1962, DoD and NASA published the PERT/COST system
- Included description of WBS

PERT COST

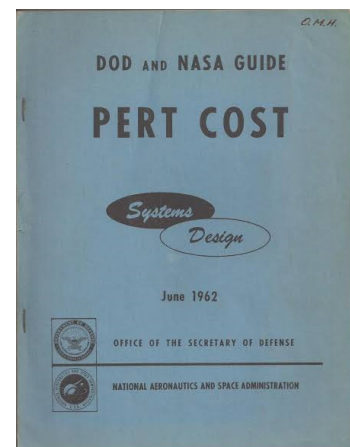
MANAGEMENT SUMMARY REPORT

The PERT COST Management Summary Report shows current and projected schedule and cost status of the total program and of each of the major component items or elements within the program. The report is prepared at several levels of the work breakdown structure and for all contracts or a specified combination of contracts, depending upon the needs of management. The report may be machine produced, but when it is manually prepared, the necessary information is derived from the Program/Project Status Report.

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PERT Cost & WBS

- Cost estimates were based on a 3 point estimate (normal 'PERT')
- Value of work accomplished was assessed based on progress (not amount spent)
- Actual costs were collected from contractors, etc.
- The cost to complete was assessed based on the resources expected to be used to complete each activity (in effect a re-estimate)
- Unlike schedule, cost reporting was initially a manual process



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PERT Cost & WBS

Estimate-to-Complete

The estimated manhours, costs, and time required to complete a work package or summary item, (includes applicable overhead except where only direct costs are specified)

Note: The forward estimate should not be based on estimated cost – actual cost!

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<https://babel.hathitrust.org/cgi/pt?id=mdp.39015006057866&view=1up&seq=36&skin=2021>

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PERT Cost & WBS

- The foundation of modern EVM is undoubtedly PERT/Cost
- Concepts include:
 - The WBS and work packages
 - Planned Value
 - Earned Value (approximated for WIP)
 - Estimate to Complete, but based on a re-estimating process typically only applied to open work packages
- The system was labour intensive and strongly opposed by most Govt. contractors forced to use the system

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Cost Schedule Planning and Control Specification (CSPCS)

- CSPCS is where the term 'C-Spec' originated
- Published as Annex 4 of Air Force Systems Command Manual (AFSCM) 70-5 in 1966 and revised in June 1967
- Defined 26 "specifications" that a contractor's system had to meet

- Limited application

C/SCSC

- Cost/Schedule Control Systems Criteria" (C/SCSC or CS2)
- DoDI 7000.1 1966 started the application of EVM based on 'C-Spec'
- DoDI 7000.10, 1974 defined the standard reports and calculations
- DoDI 7000.2, 10 June 1977 – definitive version
 - 35 Criteria
 - Required the use of standard formula
 - Required the use of standard reports

EIA-748-1998

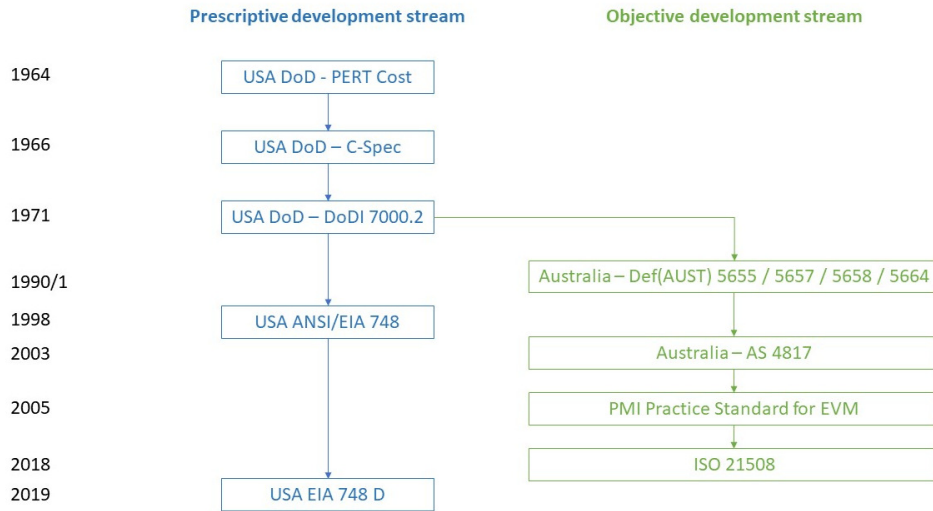
- Published 1998
- Adopted by US DoD on 17 Aug 1999
- Updated version of DoD Instructions, still
 - 35 Criteria
 - Required the use of standard formula
 - Required the use of standard reports
- EIA-748-A, 2002
- EIA-748-D, 2019 reduced 'criteria' to 32

Australia

- Adopted EVM for Defence contracts 1990/91
 - Def(AUST) 5655, 5657, 5658, 5664
 - Same basis as DoDI 7000.2
- AS 4817 2003 introduced 'objectives' rather than 'criteria'
- AS 4817 2006 updated the standard
- ISO 21508 2018 based on AS 4817 2006, and
- AS4817-2019 based on ISO 21508:2018

- The concept of EVM is spreading (slowly)

EVM – Concept Spreading



Limited Adoption of EVM



- Source: *Earned Value -A Leading Indicator of Clean Governance*
Paul D Giammalvo
PM World Journal. Jan. 2019
- Blue callout = Adopted
- Red callout = Recognised



Work Still To Do

- For me:
 - Find some of the key early documents
 - Complete the written paper
 - Publish with on-line versions of the core documents to provide a proper historical resource
- For you:
 - EVM supported by ES is the only standard method of predicting project outcomes based on actual performance to date
 - Keep focused on delivering the quality of control information needed by your senior executives



Thank You

- **Questions ??**
- Other project management history resources:
<https://mosaicprojects.com.au/PMKI-ZSY.php>
- Patrick Weaver: patw@mosaicprojects.com.au

