

## On the Subject of the History of EVM

### LETTER TO THE EDITOR

In Response to Pat Weaver’s Letter to the Editor in the October edition of the PM World Journal, related to Ms. Bertille Hu’s paper on the History of EVM in the September PMWJ

19 September 2019

Ref: [Hu, B. \(2019\). The History of Earned Value Management through Incentive Plans, PM World Journal, Vol. VIII, Issue VIII, September.](#)

Ref: [Weaver, P. \(2019\) Letter to the Editor On the Subject of the History of EVM, PM World Journal, Vol. VIII, Issue IX, October.](#)

Dear Editor,

**Dr Paul Giammalvo [PDG] As the supervising professor of Ms. Bertille Hu’s paper, I would like to respond to the challenges raised by Pat Weaver.**

The article **‘The History of Earned Value Management Through Incentives Plans’** in the September edition of PM World Journal, is fundamentally flawed. The paper’s title has no relationship to the conclusions, and the material, as presented, fails to support the presumption implied in the title.

Earned value management has three fundamental components:

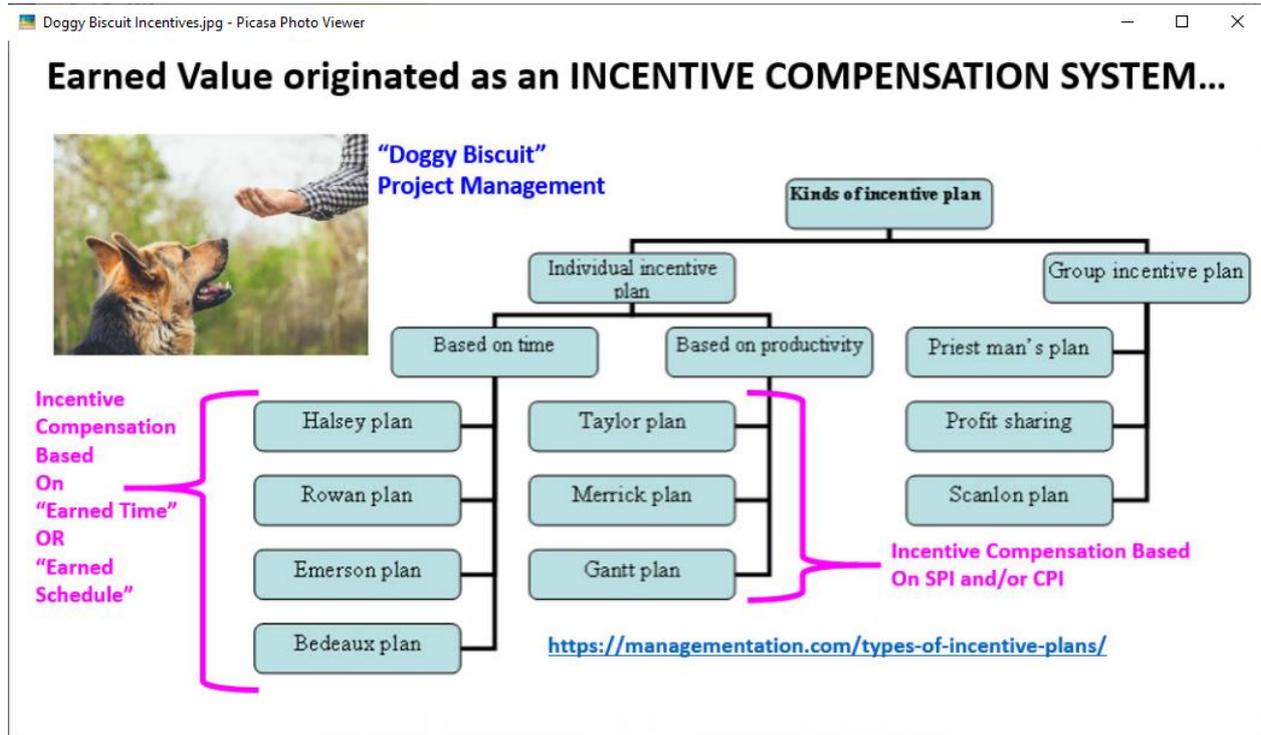
1. All of the resources and work planned and used in the course of a project is reduced to a single metric (usually money), this includes labor, materials, suppliers, subcontractors and overheads.
2. The work is planned, and progress measured based on the ‘metric’ to derive the planned, earned and actual ‘values’, for the entire scope of work required to complete the project.
3. As work progresses, the current difference between planned and actual performance (as measured by the metric) is used to forecast future outcomes.

The incentive schemes and piece rate payments described in the paper fail to achieve any of these fundamental objectives, and the issues discussed around ‘project failure’ while significant in themselves, have little relevance to either earned value or incentivization.

**[PDG] An investigation of the various incentive plans that the author has shown in Figure 9 when combined with the timeline shown in Figure 8, shows a clear evolutionary relationship between incentive payment or “payment for performance” and the formalized growth of earned value management. They evolved TOGETHER and for good and valid reasons.**

The fundamental problem ignored by the author is that incentive schemes focus on a very limited aspect of the work of a project (or manufacturing organization). The only aspect incentivized is that portion of the total scope of work undertaken by a team or an individual where predetermined performance targets can be set. There is always a lot of ‘other work’ for which incentive rates have not or cannot be set.

**[PDG] I disagree that the author ignored the fact that incentive schemes focus ONLY on specific elements (tasks) and not the “big picture”.**



**[PDG] In her paper, Ms. Hu was clear in explaining how these programs worked and how they were related to the evolution of EVM. She was also clear in explaining why these incentive programs are so important more so for contractors than they are for owners. (See Methodology, Step 1).**

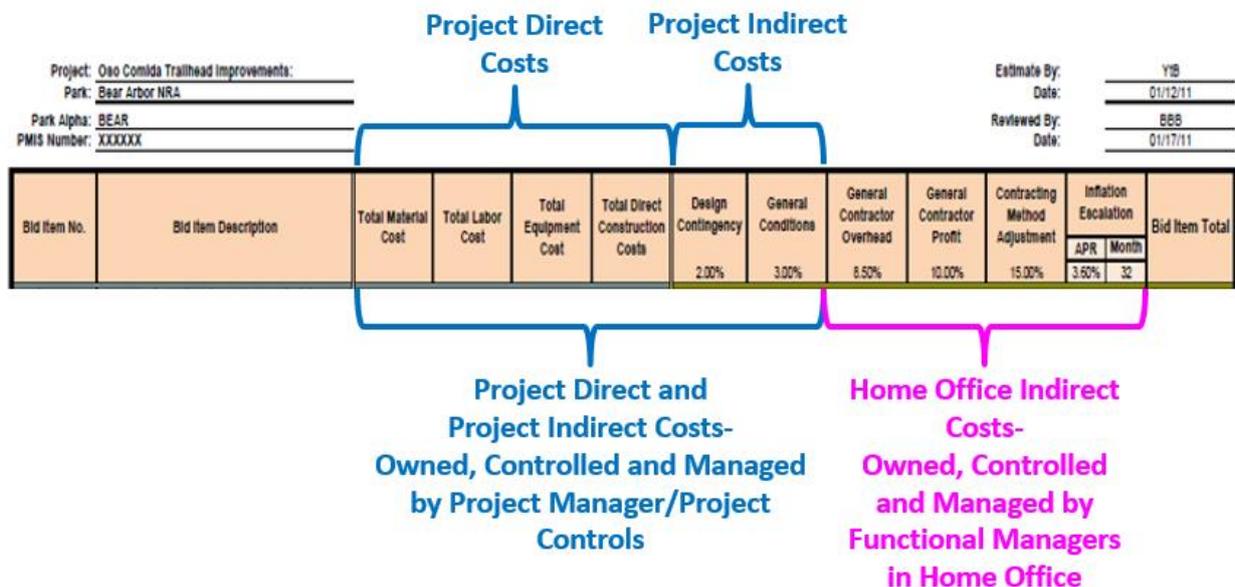
The concept of piece rate payments, which underpin most of the incentive schemes outlined in the paper, extend back into the ‘Dark Ages’. Stonemasons were paid by the number of ‘pieces’ of stone they cut and finished for use in the construction of castles, cathedrals, and other structures (which is why stones have ‘mason’s marks’ carved in the back). However, in this type of payment system the cost per item is pre-set and fixed, the employer always pays exactly the same amount, the variable is how much each individual earns in any given time period. Different workers working on the same task can earn very different amounts of money (but the cost to the ‘project’ per item and in total remains the same).

**[PDG] Speaking not only as an academic but as a “hard money” (firm fixed price) CONTRACTOR where my own money was and remains on the line if the project “succeeds” or “fails” I can tell you that IF I am able to finish the project early, the OVERHEADS associated with the time saved flows DIRECTLY to the “bottom line” in the form of PROFITS. So the formula you are missing is the Stone Mason’s Unit Price**

(which includes his direct costs (L,M,E) as well as his project overheads, contingency and profit margin) is FIXED to the OWNER, but VARIABLE to the CONTRACTOR and that when we account for the accelerated completion time the contractors ACWP is < the CONTRACTORS BCWS for that task yielding a +SV and + CV which, assuming there were no costs to crash or fast-track the project, translates into higher profits for the contractor.

This fundamental limitation is compounded by the fact that apart from ‘profit sharing’, which has nothing to do with the management of a project, the various schemes listed all fail to deal with the cost and usage of materials, suppliers, subcontractors, supervisors, and other elements incorporated into earned value calculations. None of the systems attempt any form of aggregation, they are designed to focus on motivating individuals, or small teams.

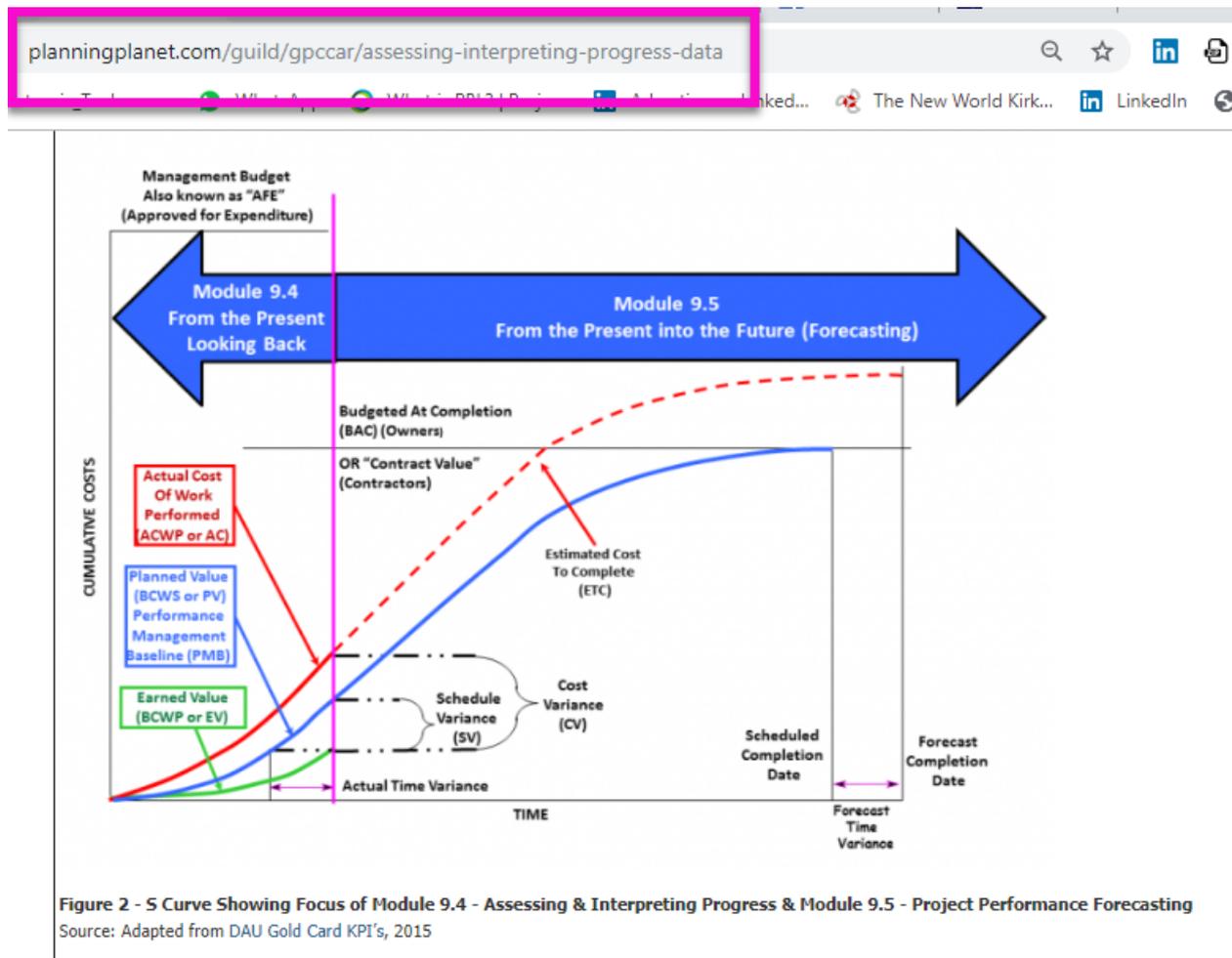
[PDG] Speaking as a “hard money” contractor, I would emphatically dispute your assertions that “profit sharing” is not a legitimate incentive method used to reward CONTRACTOR project teams. We use it all the time even today. Our PRIMARY incentives are based on the difference between our (contractors) BCWS and our (contractors) ACWP, with the DIRECT and PROJECT OVERHEAD savings being shared with the on-site project team and the savings in HOME OFFICE OVERHEADS being shared with the Home Office (support or PMO) team. This show how we and most other contractors, calculate the bonuses and incentives based on what DIRECT and/or OVERHEAD costs are owned and controlled by which entities and how much savings accrue.



From <https://is.qd/wBhR7x> Figure 13.

The second failing is far more significant: none of the systems listed make any attempt to forecast future outcomes. Given there is no change in the set cost, there is no cost variability to measure, and while there is data that would allow some prediction of time outcomes, there is no evidence of anyone ever attempting this calculation for a ‘project’. The fact data could have been derived from these incentive systems that may have been capable of forecasting overall time outcomes based on actual performance is not particularly useful in the absence of any evidence this concept was used.

[PDG] As this paper was focused on the HISTORY or EVOLUTION of EVM and not the FUTURE, forecasting was beyond the scope of her topic. The fact that she referenced Gillette and Dana's Figure 6 the "Efficiency Factors" (now SPI and CPI) is an indication that she has set the stage for follow on research on forecasting, which is the same approach taken by the Guild of Project Controls and which she cited in her Bibliography. In retrospect, I agree she could have made this point more clearly, but we also need to keep in mind that she is a 20 something graduate student and not an experienced practitioner and this was her first technical paper on this subject.



We know the ancient Babylonians were capable of calculating how long a gang of slaves would take to excavate a trapezoidal water canal based on the production rate for 'slaves digging sand'. The process of estimating the cost of doing work is a constant for at least the last 4000 years, and nothing much changed through to the early 20<sup>th</sup> century. Similar calculations are used in incentive schemes, and are used in project cost estimating, but I would suggest all this shows is that project cost management and incentive schemes have common roots rather than one lead to the development of the other.

[PDG] See my previous comment above regarding the scope of this paper along with the fact you have failed to look at EVM from BOTH the CONTRACTOR's and OWNER's perspective, while Ms. Hu did.

The closest I have been able to find of anyone deriving some form of overall measurement based on information in an incentive scheme is the work undertaken by Henry Gantt during WW1. He was able to assess the percent complete for the construction of a ship's hull based on the number of rivets fastened by workers compared to the total number in a ship's hull.

**[PDG] As noted in her paper and also above, there are others (Halsey, Rowan, Emerson and Bedeaux, as well as me as a general contractor) who base the incentives on “earned time”, the “incentive” being the difference in saved/reduced variable overhead costs by reducing the overall duration of the tasks or project. These savings are never seen by an OWNER, unless the project is “open book” or “cost plus”. Taylor and Merrick as well as Gantt were also focused on efficiency. (SPI and CPI)**

Gantt's approach combined two sets of data, the total number of rivets needed to complete the hull derived from the drawings developed for the ship and the number of rivets fastened by the crews derived from the piecework payment records. Unfortunately, apart from recognizing the work was ahead or behind schedule and instigating actions to 'catch up' when needed, this concept seems to be a 'dead end'. Extending on Gantt's work to predict the time needed to complete each hull was feasible, but it did not happen (or, more accurately, is not recorded as occurring in his books), and, as with all of the other systems, the cost of the riveting was fixed and did not change – the workers still received a fixed price per rivet, and the total cost of riveting was known and fixed.

**[PDG] See previous comments explaining the formula used to calculate the incentives.**

In summary, the objective of incentive plans is to motivate people to work harder, this is an important HR concept. But the concept of motivation has nothing to do with measuring the effect of this 'incentivization' on productivity, the overall cost of the work, and based on this predicting the consequences at project completion.

**[PDG] Ms. Hu was very clear in outlining her methodology (Step 1) where she explained the leading cause of CONTRACTOR failure was poor cash flow management which is why if you look at Earned Value not only from the perspective of an OWNER but from the perspective of a CONTRACTOR you can appreciate why EVM is so important. The fact that in how the USA government uses EVM, the direct connection between “work performed” (BCWP) and prompt payment has largely been lost helps explain why EVM has not been as widely adopted as it could or should have been. (See research by Bessner and Hobbs).**

**Especially today, owners want to delay payments as long as they possibly can while CONTRACTORS are fighting back with “prompt payment” legislation. This is a REAL ISSUE especially today that needs to be addressed and Earned Value is the answer, dating back to Biblical times.**

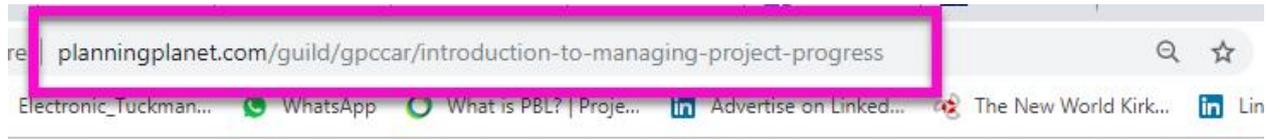


Figure 7 Showing the Underlying Concept of Earned Value Management  
 Source: Giammalvo, Paul D (2015) Contributed Under Creative Commons License BY SA v 4.0

The shift in thinking from comparing planned to actual and then making arbitrary decisions based on that information to manage the work, to a paradigm where information is used to dynamically model future outcomes seems to have its roots in concept of 'Operations Research' (OR) which originated in the 1930s.

**[PDG] Operations Research was based on and evolved from EXACTLY the same concepts developed on the factory floors of 17<sup>th</sup> and 18<sup>th</sup> Century Industrial Revolution then captured and codified by Taylor, the Gilbreath's, Gantt, Gillette, Dana, Fayol, et al back in the late 1800's- early 1900's. Same concepts given a new name. And for proof compare any decent Operations Management textbook to the PMBOK Guide, AACE's TCMF or the Guild's Compendium and you will see the tools and techniques are almost identical, except applied to on-going operations rather than just to projects.**

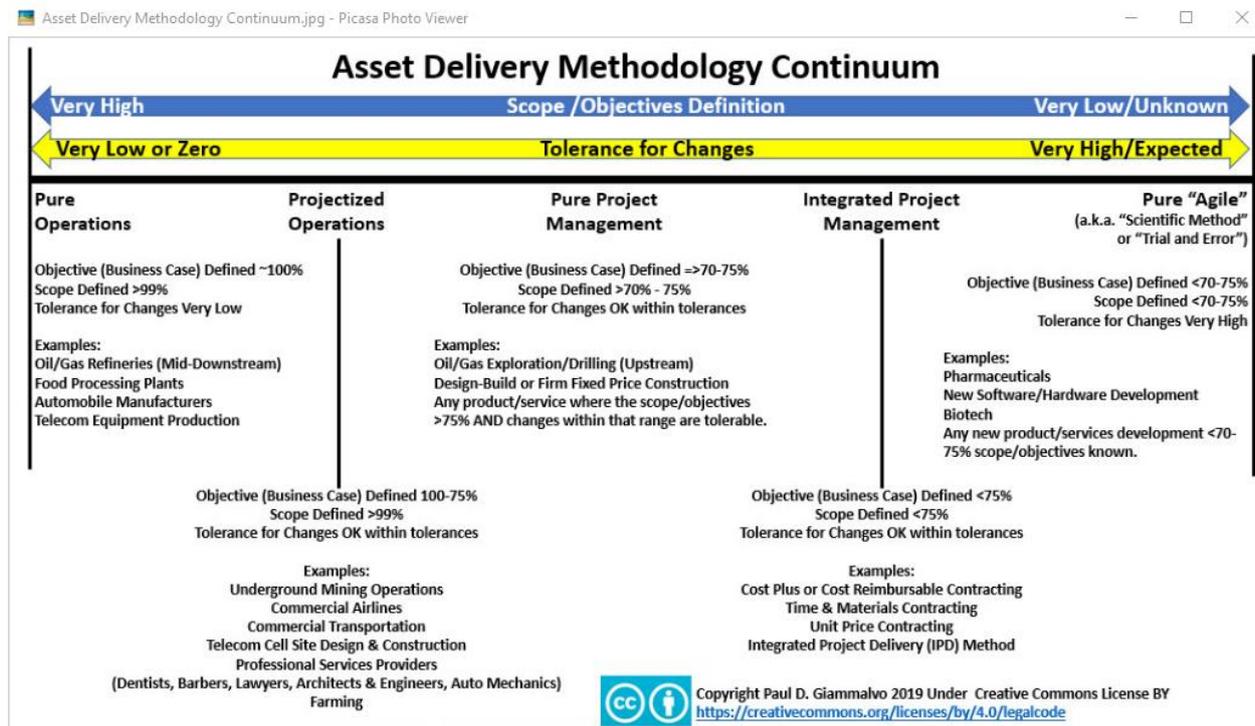
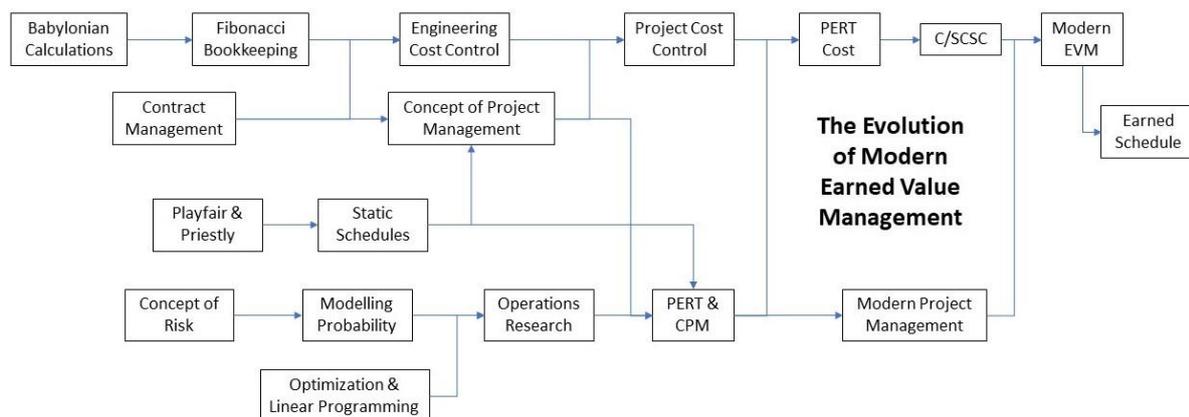


Figure 4 (See <https://is.gd/nzvs4> for a full explanation of Figure 4)

OR uses the mathematics of optimization and linear programming, applied to a scenario, to assess expected future outcomes. These concepts underpinned the systems used by the British Airforce in the 'Battle of Britain' and then went on to be applied on both sides of the Atlantic, in a wide range of situations where a range of outcomes was possible. OR was the foundation of critical path and PERT scheduling and the combination of PERT with project cost management (a concept that goes back to the 14<sup>th</sup> century at least) gave rise to PERT Cost, which in turn evolved in the C/SCSC and then into what we know today as 'Earned Value'. The overall flow of developments looking something like this:



**Note:** this diagram is being developed for a paper on the origins of EVM which I hope to publish early in 2020. While many of the links are well documented, others still need more substantiation.

[PDG] I think you are missing some key elements here. Check out the work done by Ms.

Hu's classmate, Ms. Yasmine Taybi, linking the use of EVM to Sharia Law. Ms. Taybi took the history back to the Old Testament. <https://is.gd/xcRG3F> as well as the soon to be published work by Ms. Sophie Geneste, who also took the history back to the Old Testament. <https://is.gd/PiIJAc>

I can only urge you to differentiate between the OWNERS use of EVM and the CONTRACTORS use of EVM, which are DIFFERENT, especially how the US Government uses EVM. <https://is.gd/4SCv99> and <https://is.gd/axFsXM> IMPO, by ignoring the different perspectives (which both PMI and AACE are guilty of that the Guild of Project Controls addressed) is one of the reasons why EVM has not gained widespread use outside of construction, which is where it originated, based on the work of Gillette and Dana et al. Taking your approach, you are telling a highly biased or "one-sided" story which is not your usual high standards. I can only urge you to show BOTH perspectives. For more on this, compare the cash flow analysis published for the Guild of Project Controls <http://www.planningplanet.com/guild/gpccar/capturing-progress-updating-schedule> Figures 15-18 to the absolute CRAP that PMI published in their latest PMBOK Guide Figure 7-9 on page 255. Then we wonder why so many people don't understand applied EVM much less use it?

While it is true that both project controls (including earned value) and incentive systems rely on the ability to calculate the expected time and effort required to accomplish a task, all this shows is they have this common root. However, a common heritage which dates back to the Babylonians does not mean one influenced the other. The two systems are fundamentally different!

**[PDG] Based on firsthand experience as a "hard money" general contractor as well as the documented work by Gillette and Dana, I respectfully disagree with you. At least from the perspective of the CONTRACTOR, the two are inextricably linked to one another.**

In summary, I would suggest the assertion contained in this paper that an incentive system that paid individuals a pre-set amount for work they have actually done (and pays different amounts to different people based on their individual efforts), somehow lead to a system that holistically looks at current performance and uses that information to predict future outcomes of a project, is, fundamentally flawed.

**[PDG] I can only conclude that you have not downloaded much less read and fully understood Gillette and Dana's "Cost Keeping and Management Engineering: A Treatise for Engineers, Contractors and Superintendents Engaged in the Management of Engineering Construction" as the basis for the evolution of applied earned value management as used by the private sector. <https://is.gd/BQDoVw>**

To conclude, I stick by the work of Ms. Hu (and her fellow students, Ms. Yasmine Taybi whose paper also appeared in the same PMWJ issue, and Ms. Sophie Geneste, whose paper was published in the October issue of the PMWJ- <https://is.gd/PiIJAc>) as being valid and accurate portrayals of the genesis of Earned Value Management as it evolved from the perspective of BOTH OWNERS and CONTRACTORS.

Yours sincerely,



Patrick Weaver.  
Melbourne, Australia

**Note:** Research and copies of original documents that support the assertions in this letter can be freely accessed at: <https://mosaicprojects.com.au/PMKI-ZSY.php>.

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