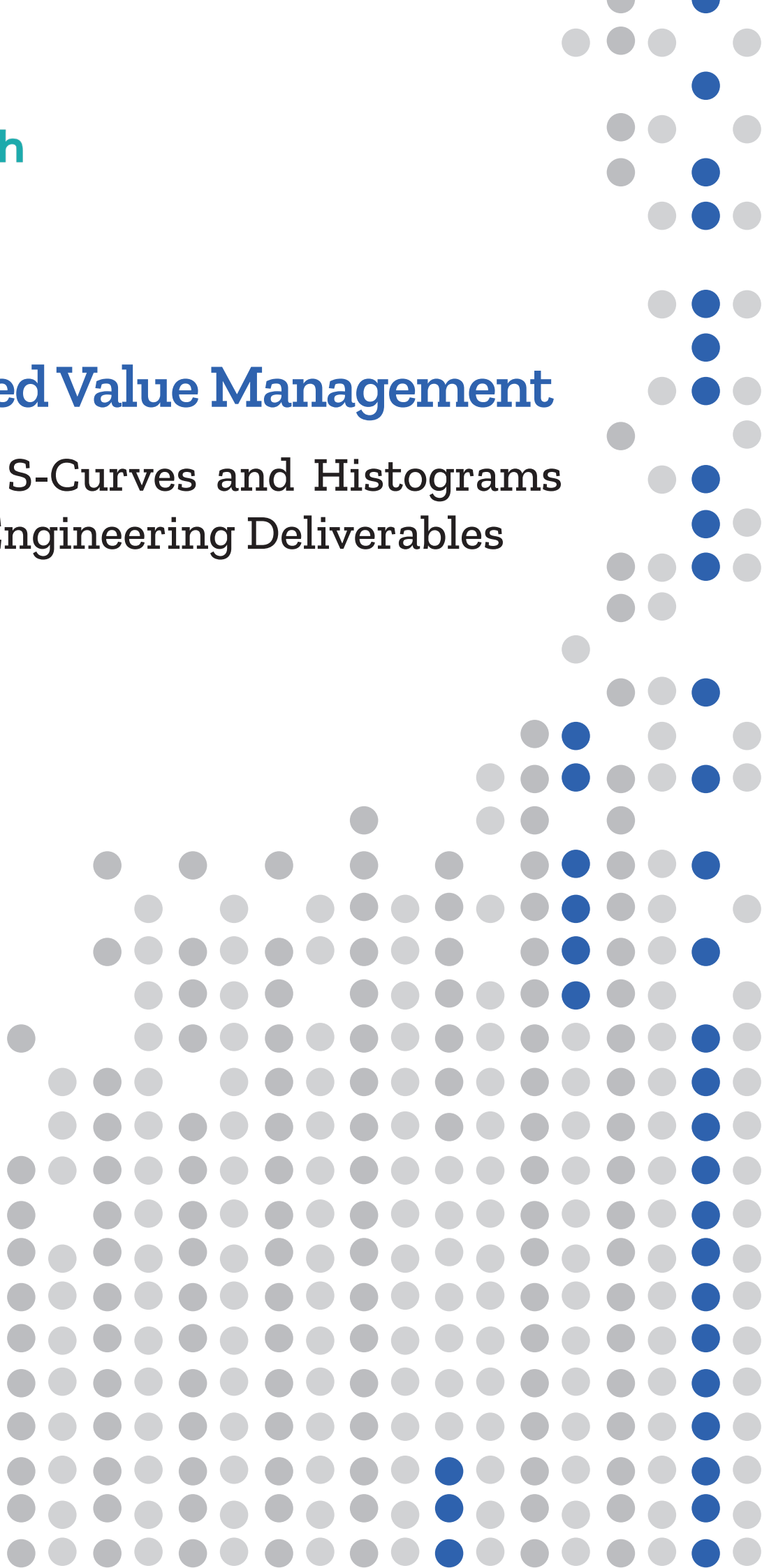


wrench

Earned Value Management

Using S-Curves and Histograms
of Engineering Deliverables



All you need to know about applying EVM

In 2021, Earned Value Management (EVM) is both overhyped buzzword and overused jargon, which might explain why it's rather unpopular with EPC companies despite the clear benefits. In this ebook, we'll avoid both hype and jargon.

What is EVM in practical terms?

EVM is a method of measuring project progress. Specifically, it measures the discrepancy between what was planned and what actually happened so that you can resolve the discrepancy and get back on track.

EVM is better than traditional methods of progress measurement because it is more accurate, more timely, and more reliable. In the long run, EVM reduces project risk and keeps stakeholders happy by increasing visibility about project status and progress, and also enables better forecasting behind the scenes.

Understanding S-Curves

S-Curves are graphs that show a project's planned progress versus actual progress over time. In Figure 1 the graph shows that according to the project plan, 10% (blue line) was supposed to have been completed by Jan 22 but only 8% (red) was actually completed. The line also shows the overall trend of the project's progress. This is useful information for a project manager and project stakeholders.

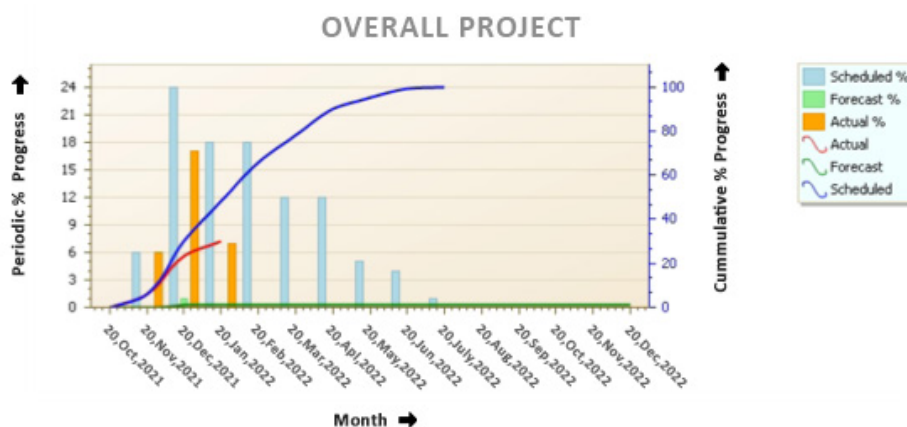


Figure 1: S-curve

S-Curves are so called because they show graphically the slow-fast-slow rhythm of most projects i.e. how at the start and the end of projects there is a lull or slowdown while in the middle, progress accelerates the most. What happens is this: initiating a project requires a lot

of resources and time, so at this stage the progress percentage remains fairly stagnant (shown as the bottom curve of the S shape). Once initial planning and mobilisation is complete the progress picks up and a flurry of activity begins (shown as the steep vertical rise in the curve). At later stages there are again lots of activities which need time and effort and so progress slows down again (and the line flattens out again in the top flatter line

of the S). So the middle period represented by the steep vertical of the S-Curve is the most productive period in a project's lifecycle.

Now any project manager knows all the above already. The point we are making is that without EVM, measuring and verifying the data required to plot S-Curve is a herculean task.

Geek Alert: *The term Earned Value refers to the fact that 'value' is 'earned' based on completed work. To give a crude example, if you've completed 50% of your project and your project budget is \$100, then you have 'earned value' (or the value you have earned so far) is \$ 50. Since projects are extremely complex, calculating Earned Value is challenging for most companies. To properly use earned value, a few additional calculations must be considered, and so the largest benefits of earned value result from completing both cost and schedule variance analyses - as with everything the devil is in the details. But that's for another E-book.*

How to use EVM

To monitor any kind of progress correctly, you need to first define exactly the components of that progress.

Each deliverable should be given a certain number of estimated manhours so that the weightage of each deliverable with respect to the project timeline can be easily calculated. This means that each deliverable should be broken down into its component milestones, with defined rules of credit, so that you know exactly what % of overall progress has been gained on achieving a particular milestone - for example, when you achieve milestone 1,2 & 3 you know that you're 12% closer to project completion.

Finally, each milestone should be given clearly specified planned dates for completion. Once this is done, you have the foundation for accurate progress measurement.

Metrics done, the next step is recording the actual progress and solving the inevitable discrepancies as per the metrics laid out during planning. As anyone from EPC knows, easier said than done - because things rarely go according to plan. EVM acknowledges this, and is in fact a direct solution for expected failure or deviation. The purpose of EVM's seemingly pessimistic approach of planning-for-failure is actually a very positive one; it lets you work proactively rather than reactively, it lets you work realistically, and it helps you ultimately deliver the project successfully despite deviations along the way.

How to measure the actual progress of a deliverable:

First the % progress and the corresponding dates need to be recorded and the weightages of the deliverables (the budgeted man hours) should be known.

Actual percentages are based on milestones, and milestones need to be achieved for the actual percentage to be 'earned'; if not, then for each deliverable the actual percentage progress should be updated.

Let's say a deliverable has been given 3 milestones (ref Figure 2), each with its own assigned (ie planned) progress percentage. When the specified percent progress is complete, the milestone is said to have been achieved.

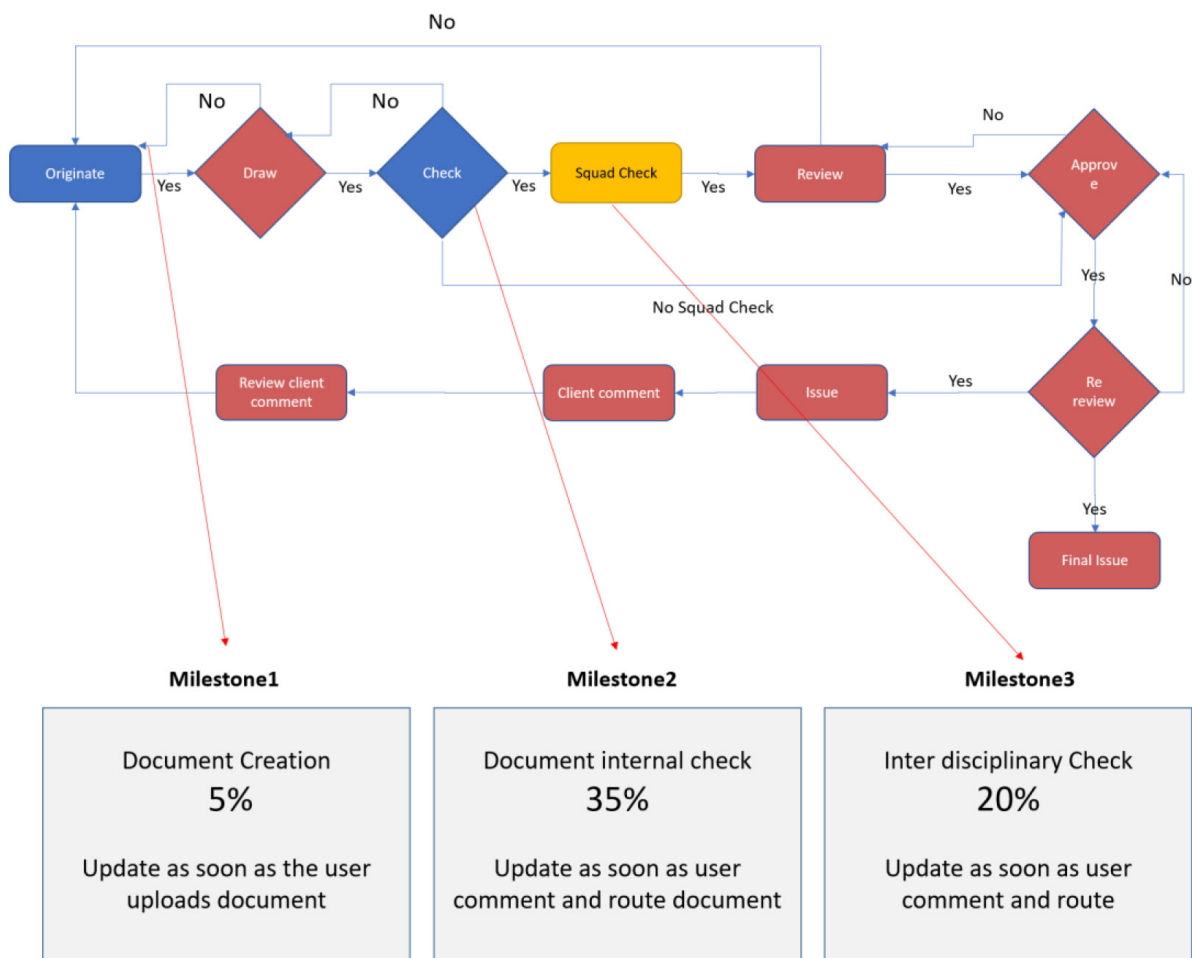


Figure 2: Milestones and Progress

Snapshot of an EVM-powered project

First, the planning department sets dates for each of the following milestones, as follows:

S.No	Milestone	Planned Dates	Progress	Planned Cumulative Progress	Planned Manhour consumed	Planned Cumulative manhours consumed
1	Start	12/09/2021	5%	5%	15	15
2	Checking	30/11/2021	35%	40%	95	110
3	Inter departmental check	05/01/2022	20%	60%	85	195
4	Submission for Review	06/03/2022	20%	80%	160	255
5	Receive Client Comments	15/05/2022	5%	85%	115	370
6	Submission for Approval	20/08/2022	5%	90%	15	385
7	Submission for Construction	01/11/2022	10%	100%	30	415

The planning department prepares an engineering drawings/document register (EDDR) which becomes the master plan for each document.

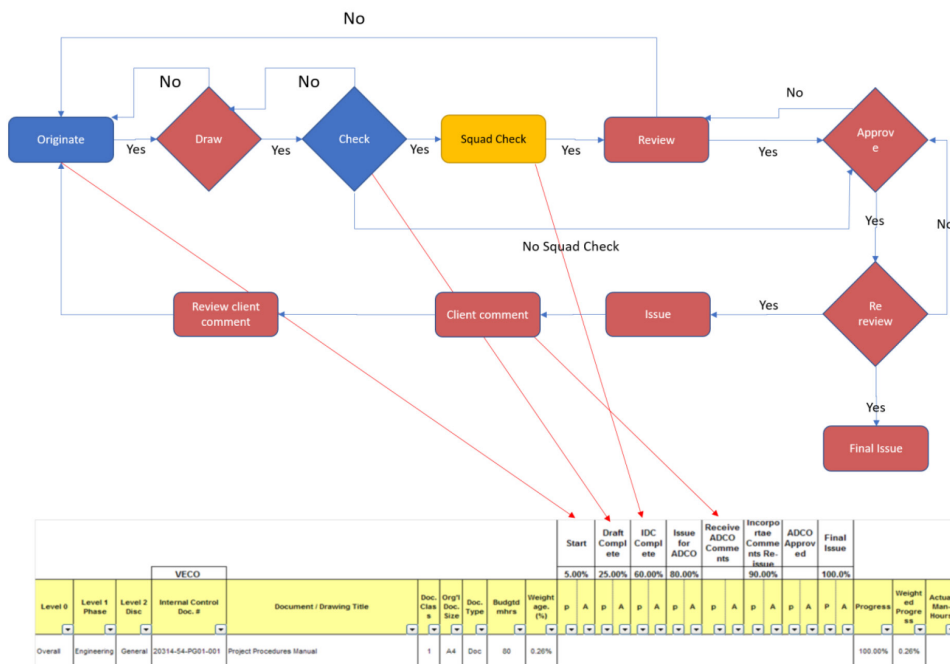


Figure 3: Milestones Mapping

Based on this information, a table can be created which has the cumulative percentage for the specific deliverable for each week.

Sl .no	Week No	Incremental Percentage progress	Cumulative Percentage progress
1	Week 1	5%	5%
2	Week2	0%	5%
3	Week3	35%	40%
4	Week4	0%	40%
5	Week 5	0%	40%
6	Week6	0%	40%
7	Week 7	20%	60%
8	Week 8	0%	60%
9	Week9	20%	80%
10	Week 10	10%	90%
11	Week 12	0%	90%
12	Week 13	0%	90%
13	Week14	10%	100%

The progress percentage for the project is the weighted average of the progress for each deliverable.

To sum up, the planning department makes a plan which contains the following:

- List of deliverables
- Estimated manhours for each deliverable.(If possible each deliverable’s milestones and planned % progress achieved on reaching the milestone.)
- Planned progress S-curves, planned progress charts per week/month.

On executing the project, the planning department measures the actual progress by:

- Getting users to update the actual weekly progress and the actual milestones achieved
- Comparing the actual progress of the project with the planned progress
- Analysing the previous week’s planned vs actual progress, and then analysing the project’s overall planned vs actual planned progress (so far).

Geek Alert: In this snapshot we're referencing a milestone-based plan, where on completing each milestone the deliverable is credited with actual progress and it becomes possible to compare the actual vs planned per milestone per deliverable. If the progress measurement is not through measurable milestones, the planners would have to approach department heads or users to get the progress recorded for each deliverable, which obviously would drain time as well as being unreliable as the users tend to update progress without clear evidence.

Theory understood, now how to execute EVM effectively?

The number 1 objection that most companies will present when it comes to EVM:

“Yes it all sounds good but it will take a huge amount of time-spend in information gathering - prohibitively so! On projects which have 1000 deliverables and about 8 milestones for each task there are about 8000 milestones to be planned ie about 8000 actual dates which need to be monitored and updated! This is impossible! Plus, as this information is being gathered, human error will inevitably creep in and so the authenticity of the information is constantly in doubt”.

A very valid concern, considering how today's systems which handle the planning and monitoring, namely Primavera and Excel work. But what if there was a system that was already EVM-friendly? A system that integrates and automates this entire setup.

Here's how such an EVM-based system would look:

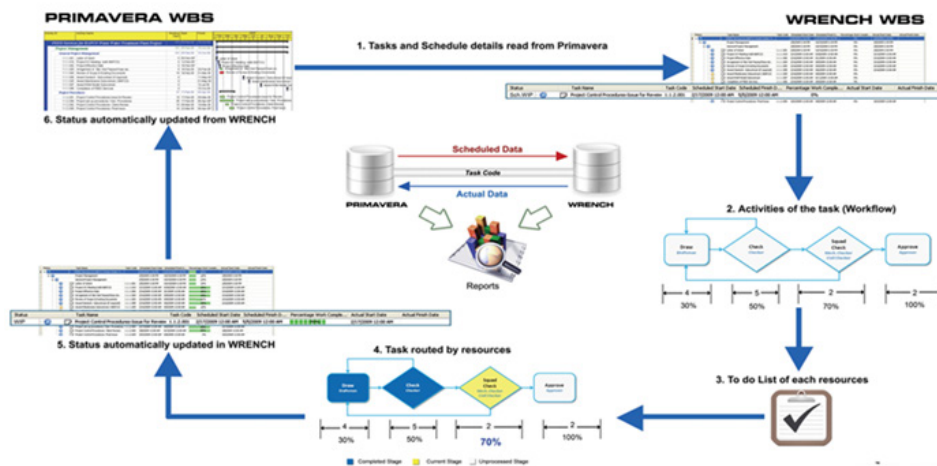


Figure 4: Automation

As with most businesses in the world at the moment, digitisation has made things possible which were simply unthinkable in manually-driven processes.

The future: Digital EVM

Digital EVM is now a reality.

The digital-EVM system, for lack of a better phrase, is what generates S-Curves and histograms, without manual efforts. The system uses the progress data captured by the system, not manually-collected data - so there is very little room for human error. Not only do you get more accurate reports, you get more timely reports ie more on time ie the reports reach you in time to take action in the real world.

The reports are also extremely reliable because they're generated by an incorruptible system; for example when a metric is updated, it automatically updates (ie recalculates and repopulates) the progress percentage of the task back into Primavera/Ms Project. So you have an early warning system, where target dates are built for each user, and the pressure is bottom-up not top-down. Your planners can spend their (costly) time expediting critical path tasks rather than chasing down information.

***Geek Alert:** In a digitized EVM-based system (ref above figure 4), the plans would get published to all automatically (i.e. via the automated system, no human effort required), the people whose job it was to initiate the work would get a to-do list with target dates, and people would be prompted by the system to complete their work, after which they would be prompted to route it through the predefined electronic workflow to the next user in the sequence (who would also be given his own personalized to-do list at the right time).*

Conclusion:

It seems strange that despite the obvious benefits of EVM so many EPC companies are slow to adopt it. The simple explanation is that EVM, although easy to describe on paper, is not at all easy to implement in a real company. The challenges are just too great, involving massive changes in work methodologies and work culture and adding huge burdens to already-overworked managers, and not least, creating high

potential for conflict and discord. In other words, the practical challenges of EVM outweighed its theoretical benefits.

The good news is that the steady digitalisation of the EPC industry has changed that scenario; today the reality is that digitalisation has made EVM not just desirable, but easy.

Implementing EVM, and gaining the benefits of EVM, is literally just a few clicks away.



About the Author:

Varghese Daniel

Chief Executive Officer, Wrench Solutions

Daniel is the Co-founder and CEO of Wrench Solutions. Passionate about the transformative power of information technology, he and friend Aju Peter began with an idea for collaborative data processing for manufacturing companies, which they successfully sold to Kennametal Widia & Mico Bosch (and for which they won funding from the Government of India).

Daniel went on to create SmartProject, the world's first integrated information platform for construction projects, which is used by EPC firms worldwide on 9000+ projects across 27 countries. His focus today is developing global markets for SmartProject. He holds an M.E. in Mechanical Engineering from the National Institute of Technology, Jaipur, India.



Contact Info

✉ getinfo@wrenchsp.com

This article contains copyrighted material, the use of which has not always been specifically authorized by the copyright owner. We believe this constitutes a 'fair use' of any such copyrighted material as provided in the copyright law of your country.

The material in this article is distributed without profit for research and educational purposes. Before making any decision or taking any action that may affect your business, you should consult a qualified professional advisor. Wrench Solutions shall not be responsible for any loss sustained by any person who relies on this publication.