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EDITORIAL STAFF
Publisher: College of Performance Management
Story Editors: Robin Pulverenti and Nicholas Pisano
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College of Performance Management
11130 Sunrise Valley Drive, Suite 350
Reston, VA 20191
Ph 703-370-7885 • Fx 703-370-1757
www.mycpm.org

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LETTER FROM THE EDITOR
Nicholas Pisano

This issue of Measurable News is being published in the midst of the worst public health crisis the world has seen in over one hundred years. As a retired senior U.S. Navy commissioned officer, I know from having faced existential moments and trying circumstances during my active duty service that few civilians usually have to face, that now is the kind of situation for us to come together as a community, while still practicing social distancing and safe social practices.

We do this not only by following the safe practices of handwashing and social distancing prescribed by the public health agencies, but also maintaining social contacts and checking on the needs of those in close proximity to us, especially to those who are most vulnerable. For example, in my neighborhood there are a number of octogenarian and nonagenarian homeowners. Checking on them and their needs is essential for us to maintain the fabric of civil society.

On the other side of the spectrum, our little community has working parents with children. No doubt you may have children who are currently going stir-crazy being cooped up at home, given the school closures. Organizing safe play—such as an idea our community borrowed from one in California where driveways were opened to children for chalk drawing and a neighborhood “showing” of our young budding artists—help to engage minds, both young and old, and help maintain morale; reinforcing the sense of community even as we maintain a distance of six feet from each other and wash ourselves and our clothing afterward.

As the crisis unfolds, it is important for each of us to maintain our daily routines, especially as many of us engage exclusively in work at home for the first time: get up at your usual hour, even without the normal commute, get ready and dress for the day, ensure that regular meetings—albeit electronically—are maintained and your attendance assured, stay informed through fact-based news sources and not just the social networking national rumor mill, check in with your colleagues just as you would at work.

To maintain morale and mental health, take necessary “recovery” breaks from the constant bad news bombarding us day-to-day. Find your safe place and activity: listen to music, do crossword puzzles, watch a self-comforting movie, cook a comfort meal, garden, maintain your normal workout routine, engage in your hobbies, or any activity that helps you maintain perspective and balance. If you find yourself overwhelmed, do not hesitate to seek counsel from psychological helping professionals. Talk about your concerns and do not internalize your anxiety to the point where you cannot carry out your normal routines and responsibilities.

Many of our local businesses and neighbors are also experiencing severe economic repercussions from this crisis. While government agencies figure out a way to deal with the economic crisis, it is also important for each of us to reach out as a community to assist those who are impacted by a crisis beyond their own control. Make sure that friends, relatives, and neighbors have enough food and shelter to maintain their health. While it is a normal human reaction to self-protect and “look out for #1”, the virus does not discriminate. No one is expendable. We fought two world wars and a long Cold War to combat the proponents of that philosophy.

Finally, it is important to be safe and informed. It is impossible to fight a war against an existential threat blindfolded. Our leaders in public and private institutions were slow to see the threat and even slower in acknowledging it when it was apparent. In situations when leadership failed, it is the character of the typical American upon which the U.S. Navy has always depended—a character on display today.

The Commander and a ship’s officers could go down, but the crew still knows what to do because if the ship sinks, we all sink together. Everyone knows their role and the next senior leader steps up, all the way down to the most junior seaman. We must draw on that character: stay informed, be aware, take immediate necessary measures, maintain morale, help the most vulnerable and at-risk, and if we find ourselves infected by the virus, to self-quarantine and seek medical help.

I hope to see you all sometime soon—or perhaps virtually. We have expanded our reach with this issue of Measurable News to include articles from a wide spectrum of the project management, project controls, and earned value community. I hope they are a welcome diversion and spark both thought and comment.

Stay safe.
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I hope everyone had a joyous and safe holiday season. I am excited about our plans for 2020, but first, I want to summarize 2019 events and activities.

In 2019, two new board members, John Driessnack, Executive Vice President and Robin Pulverenti, Vice President for Education and Certification have joined the leadership team going into 2020. In addition, both Kathy Evans, Vice President of Conferences and Events and Brian Evans, Vice President of Finance were reelected to their board positions.

I want to extend my sincere thanks to our outgoing board members, Kym Henderson, Executive Vice President and Bill Mathis, Vice President of Education and Certification. Kym and Bill spent many years and countless hours working on behalf of CPM and its members. Kym wore many hats on the board over the years and was a steady hand and helped to grow CPM around the world. Bill was the driving force behind CPM’s IPPM certification program. All of CPM salutes their significant contributions to the organization and our profession.

The previous leadership team positioned the new team well, improving our financial position and the level of expertise that will result in future growth. Performance management is a skillset that applies to any program and project regardless of size or industry. Of course, the specifics of how performance management manifests on any project can look quite different. I believe this fact is the basis we can leverage to grow and remain relevant to our community.

CPM held two successful workshops in 2019 that continued our strong legacy of providing education and networking. In 2020, we hope that you start to see some changes in our operations that will allow for more member engagement and that broaden our audience.

As evidence of our desire to engage the members, we dedicated our third keynote at the IPMW 2019 to getting member feedback on a draft Vision, Mission, and Objectives update, and to obtain suggestions for how CPM can better serve our members. Items to look for in 2020 include:

- An updated Vision, Mission, and Objectives; members will review and approve in early 2020.
- Providing more opportunities for members to engage at a local level through our CPM Chapters.
- Providing more opportunities for members to engage at the national level through focus and working groups to support our Board of Directors.
- IPMW next year will be on the west coast

Please send us your suggestions for improvement and send us your desire to participate more actively. Again I am looking forward to working with all of you to continue to improve the College of Performance Management.

Gordon M. Kranz
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ABSTRACT

Conventional methods of career development are giving way to modern, tech-driven ones. As the business landscape changes, so do the skills and resources required to build a strong career. In this writing we explore emerging trends, tools and resources, and how to effectively plan for change.

To be the best we can be in our careers and businesses we need a framework, a vision, and the tools needed to navigate this ephemeral landscape.

What we need to understand as we enter 2020:
1. Emerging trends
2. Tools and Resources for professional development
3. How to effectively plan for change

The roads in and around my home in Houston Texas are changing so fast that even Google Maps has trouble staying up to date. This is useful metaphor for the current business environment. It is difficult to get where you are going without some basic understanding of where you are headed. This means that you not only need to know what direction you want to go, but also where the side roads are, what alternate routes exist, where you'll have to pay extra to drive, and where you'll park when you get there. Timing is critical because you want to avoid getting stuck with the masses during rush hour. Often, I find myself finding an alternate place to sit and work into the evening while traffic dies down, just to avoid the stress of driving through what I affectionately call “The War Zone”. Our career paths are no different. The path we travel from the moment we start our journey to our peak potential is highly variably and often unpredictable. It is no wonder many are okay with “faking it till you make it”. It seems like the only reasonable choice, but we can do better than that.

In an age of ever-accelerating technologies, changing business landscapes, and increasing social pressures to do the right thing; it is imperative that we as individuals and businesses work to understand how we fit into the near future. We must become skilled navigators and sometimes reluctant pioneers. The conventional ways of career planning, education, and hierarchical advancement are becoming less stable, and some might argue, the riskiest approach to career stability.

Employee turnover in the world of projects is high and recent generations have become increasingly dissatisfied with the paths they've been led down. This has resulted in negative consequences for the employee and employer alike. Large companies that were once standard-bearers for career and business development are struggling to stay competitive. Small boutique firms are filling many of the gaps, but often lack the resources, vision, or focus to make meaningful long-term changes to the status quo.

However, with the right frame of mind and determination, we can thrive within this transformation. There have never been more tools and resources at our disposal – many at no cost at all. We can market and connect with people from around the world for $0. We can start businesses for a fraction of previous costs, educate ourselves at some of the most prestigious institutions in the world for free, spend quality time on our own well-being like never before, and tap into new innovative ways of doing things that provide massive (read ‘disruptive’) value to business ecosystems. But why aren’t we doing all these things now? Frankly, we are overloaded with choices and possibility. It takes clarity to determine the path, it takes courage to stay on the path, and it takes a strong will to cut through the noise.
Everyone has strengths and limitations. It is wise to use both of those to your advantage. Those who will excel in their careers and businesses work smart, but also work hard. Our understanding of those strengths and limitations will help guide us to the most powerful versions of ourselves. Ignoring them will create frustration, anxiety, depression, a sense of worthlessness. Discovering them and working within them will open you up to the best possible opportunities with the least resistance. Einstein is often credited with stating “everyone is a genius, but if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid.”. Look at strengths and limitations like a personal signature. Each one is completely unique, and no single one is greater than another. We incorrectly get caught up in job descriptions. The reality is that when an individual brings the right mix of skills and strengths to the table, they provide the greatest value independent of that job description.

Understanding this reality is powerful for your career. With this understanding, you can create your own roles, validate yourself without having to compete with peers, you become your own competition. Hierarchies are important to the functioning of large and efficient organizations, but they should not dictate your career path. Let quality, satisfaction, and health dictate your path. We have to think about the tools, resources, processes, personal energy, principles, rules of behavior (and when to break them), professional networks, and the climate of the markets to stand the best chance of being our optimal selves and reaping the harvest of what we sow.

Our livelihoods are the ultimate mission in life. All missions require vision, strategy, and goalsetting. Write it all out, share it with a mentor and even a mentee, use it to draft your LinkedIn profile and resume, use it to guide conversations at networking events. When you are actively looking for a job, do your research and prepare for the interviews. Ask yourself “How does this company and role fit into my mission?”. Self-awareness coupled with a clear mission is critical for confidence. Confidence gets you the job. Paraphrasing Richard Bolles in his classic book on career development “What Color is your Parachute” – it is not the most skilled candidate that gets the job, it is the one who is most skilled at getting the job that gets the job. Don’t let lack of preparation kill an opportunity that you are the best candidate for. Imagine your maximum potential in your career or business and plot the chart to reach that potential. Set goals. Where do you want to be in the next 3-5 years? Write that down. What skills do you need to cultivate now to get there? Develop a strategy to build those skills and execute it.

The list below is a small sampling of what one might consider the most disruptive emerging technologies today. This is not an exhaustive list, but one to provoke thought. Anyone involved in any type of administrative or “home office” work will most likely be impacted by any or all of these. As with any technological transition, those who are quick to adopt will find long lasting job security. Those slow to adopt, will struggle to stay relevant in the job market.

- **Data Tech (beyond Excel and Access)** – project and operational data engineering, analysis, and visualization are quickly becoming a reality for every sector. Demand for these skills will be increasing exponentially over the next several years.
- **Machine Learning and Predictive Analytics** – as we continue to get better at collecting and making data usable, artificial intelligence technologies will get better at taking advantage of that data to speed up business processes. People who understand systems and computer programming will find lucrative opportunities to utilize their talents here.
- **Industrial Internet of Things** – as connectivity continues to grow, technicians will continue to be in demand. Additionally, engineering and designers will be needed to study, design, and maintain these systems.
- **Blockchain** – a technology that comes pre-loaded with a great variety of opinions and predictions. It is thought that the blockchain application of smart contracts will change just about everything we do in business to the same extent that the internet has. One thing is sure, it is a rapidly growing technology that requires skilled people from every discipline. Keep an eye on this one.

It’s not just technology that is disruptive. The way of doing business overall is quickly changing. Some of this is in response to technology, but there are many factors contributing to a fluid business environment. The list below contains a few key points illustrating ways business is evolving.
- **Rise of the freelancer** – professional service business models are changing for several reasons. One important reason is that profits are slim, and competition is abundant. It makes sense then to not bring on full-time employees that may become significant sources of overhead in slow times. Freelancers and employers now have the advantage of online platforms where they can market their services and post jobs. There are also non-profit resources such as the Freelancer’s Union that help find benefits that would traditionally be provided by working directly for an employer. For those with advanced and senior level skill sets, freelancing is a great transition or post-retirement career.

- **Sometimes smaller is better** – boutique firms make up a large portion of the job market. In times past, it would be difficult to research whether smaller companies are a good fit for you as an individual. Now, with online platforms like LinkedIn and Glassdoor you can research and even reach out to current employees to get a better understanding before you apply. Why not check their references for a change? Additionally, startups provide unparalleled upward mobility within the company and are great places to learn a lot about everything in the shortest amount of time. Be aware, the startup may not last long and the pay might be lower than market, but potential for growth and rewards are far greater than many other options.

- **Stability is self-determined** – by this, I mean to say that places that we’ve traditionally considered as “stable” are not as stable as they used to be. For better or worse, it is up to the employee to secure their own stability within an organization. You do this by becoming indispensable in your career. This is what business author Seth Godin refers to as being a “Linchpin”. Being a linchpin is key to fortifying your career. It is about producing instead of consuming, being remarkable instead of status quo, forging processes instead of waiting for instructions, standing out instead of conforming. Everyone has the capability to be unique and provide value. Those who do will always be employed.

Look for tools and resources to help you along your journey. There are innumerable learning platforms available from Massive Open Online Courses (MOOC), to local professional training centers, to on-the-job training (formal or informal). Seek out professional accreditations. These are particularly useful if you are a non-degree professional. Micro-credentials, like Udacity’s Nanodegrees, are a new alternative to conventional professional credentials.

2020 will bring new challenges and new opportunities for all of us. It is how we prepare and respond to those challenges that will determine the quantity and quality of those opportunities. Take advantage of all the available resources that are relevant to your career and industry. Make yourself indispensable. Invest in yourself and live up to your full potential. This is the key to Fortifying your Career.

**About the Author**

Rob Williams is the founder of the Innovate iPM podcast which focuses on the future of the people, practices, and technologies in engineering and construction. His mission is to help professionals and small businesses navigate and thrive in a rapidly evolving business environment. Rob has 20+ years of experience in project engineering and construction within the oil, gas, and petrochemical industries. He has served in management, project management, project controls, and business development roles. His leadership has made positive impacts within some of the largest and some of the fastest growing companies in the U.S.

Rob can be reached at:
- rob@innovateipm.com
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ABSTRACT

The emerging cutting-edge technology trends are changing the landscape of Project Controls at an unprecedented rate. The new technologies will provide us with new levels of visualization, progress tracking, performance measurement, diagnostic and predictive insights, higher accuracy, and efficiency in the successful execution and delivery of projects.

Although the future possibilities are very exciting, it can be a threat for those who are not prepared.

This article covers not only the top 5 cutting-edge project controls technology trends that everyone involved in projects need to be aware of, but it also proposes some forward-thinking future-readiness strategies to foster innovation in organizations.

TOP 5 CUTTING-EDGE PROJECT CONTROLS TECHNOLOGY TRENDS

Many popular technology trends are affecting the way we manage and control projects. Each of these trends will impact the future Project Controls workforce in a significant way. By analyzing these trends, Project Controls and Project Management professionals can design their professional development pathways to suit the demands of the future.

TECHNOLOGY TREND #1: MOVING FROM 2D PLANNING TO 4D/5D THROUGH VISUALIZATIONS

The industry is gradually transitioning from the traditional 2D planning to 4D and 5D planning. Many leading organizations today have adopted the 4D/5D planning in their construction planning process.

What are 2D, 4D, and 5D Planning?

2D/Traditional Planning – Traditional planning, referred to as 2D planning in this article, or a two-dimensional planning method using Gantt Charts, is often reliant upon the imagination and the ability of the reader to see the plan in their mind’s eye. The reader needs a certain level of experience to be able to interpret a 2D-Plan meaningfully.

In a 2D plan, project team can view individual tasks, their durations, and the sequencing of these tasks, as well as the critical path, float, the overall timeline of the project, and the expected completion date. Seeing space in a 2D-plan is hard, and communicating the plan to the team is even harder.

However, construction planning is changing. The new visualization tools such as Virtual Reality (VR), Augmented Reality (AR), and 4D/5D Planning Software (Synchro, Navigator, Navisworks ..) are revolutionizing the way we plan. The industry is gradually transitioning from 2D planning to 4D & 5D planning.
4D Planning - 4D planning also goes by the name 4D BIM (Building Information Modeling). The 4th dimension in the 4D planning is the linking of the 3D CAD components to a time-phased 2D project schedule.

4D = 3D + TIME SCHEDULE (2D)

In simple terms, activity bars on a Gantt chart are linked to corresponding elements of a 3D model using additional software (e.g., Synchro, Navigator, or Navisworks). The sequence can be played back to simulate the planned construction. In order to do this, a 3D model of some kind, software capable of reading it, and a project schedule are required. Figure 2 illustrates a snapshot of a 4D schedule.

Adding the element of time to a project 3D model can help the project team to more accurately visualize and plan for all aspects of a construction project. With this ability, designers can make detailed models that describe exactly how a project would work.

Some of the benefits of 4D Planning are outlined below:

• Facilitates greater engagement in the planning process by allowing everyone to understand time & space.
• Increases the ability to communicate the plan effectively through visualization and simulation.
• Speeds up the peer review and the plan validation.
• Provides a higher degree of certainty by eliminating “educated guess works.”
Figure 1 compares 2D planning with 4D planning. For more visual distinctions between 2D planning and 4D planning, please check this post: https://www.projectcontrolacademy.com/4d-scheduling-vs-traditional-scheduling/

**5D Planning** - 5D Planning, also known as 5D BIM, refers to the intelligent linking of individual 3D CAD components or assemblies with the schedule (4D Plan) and then with cost-related information.

**5D = 4D Plan (3D + TIME SCHEDULE) + COST**

5D-Plan is used for budget tracking and cost analysis. The fifth dimension of the plan associated with 3D and 4D (Time) allows the team members to visualize the progress of their activities and related costs over time.

Figure 3 illustrates 5D planning using the Synchro software. The schedule and Earned Value graph (PMBB curve) are shown on the top while the corresponding 3D model is highlighted on the bottom. This allows the full visibility of the project cost, schedule, and model in one page.

The utilization of 5D planning allows the extraction of cost from the 3D model at any time. Data is provided in real-time as the model is developed or changed. This means that the cost is dynamically evolved and re-adjusted during the project. Therefore, you are working in a living cost plan that helps the project teams to design and budget, allowing for a faster and more accurate project cost at the early stages of the design project.

In June 2016, McKinsey & Company identified 5D BIM technology as one of five big ideas poised to disrupt construction. It defined 5D BIM as “a five-dimensional representation of the physical and functional characteristics of any project.”

These digital models enable us to appreciate the value of EVM visually, making it possible to understand why and where we are spending too much or where we are late.

**TECHNOLOGY TREND #2: INSTANT VISIBILITY INTO PROJECT STATUS**

(Real-time data collection, dashboards, analytics, and reporting)

New digital communication technologies such as drones, sensors, scanners, light detectors, and robots are changing the way we gather data in projects and what we consider project reporting.

Take drone technology, for example. These days, you can fly a drone over a construction site, and within a few minutes, you’ll get detailed, real-time visibility of the project’s current status. No matter how hazardous or hard-to-access an area of the site may be, you can see exactly what’s happening there.
Many startup companies are exploring ways to transform the construction industry using new technologies. For example, a company called Doxel is using robots to laser-scan construction sites to make sure that work is progressing correctly. Their artificial intelligence measures installed quantities and calculate earned value for thousands of line items, telling project teams exactly how much they owe for a day’s work.

Doxel’s robot scanning and it’s real-time progress and Earned Value reporting is illustrated in Figure 5.

**Figure 05 - Real-time Project Status Reporting Using Robots**
(Source: Doxel.ai)

**What does it mean to Project Controls?** It’s simple. These emerging technologies facilitate data collection and analysis for us. Something that usually takes days to weeks to gather now can be done within a few minutes.

Real-time data collection using new technologies offers us greater opportunity for analysis and problem solving rather than compiling and reporting data manually.

**TECHNOLOGY TREND #3: SEAMLESS FLOW OF INFORMATION FROM ONE SYSTEM TO ANOTHER (Fully Integrated Systems Utilizing Cloud Solutions & IoT)**

Best practices are still evolving in creating a smooth integration between systems and the natural flow of data across them. However, it’s increasingly clear that the optimal solution for project technology is a vendor-neutral environment, where all systems speak to each other, and data flows seamlessly.

When the author asked the Project Controls community what they are looking for in project controls/ project management software, they all had the same voice. The project professionals all wanted a single point solution, an integrated tool that allows easy integration between the project estimate, cost, schedule, procurement, construction, and change management.

Yet despite all the advancements in technology, a fully integrated tool that allows seamless integration between different components of the projects is still one of the challenges that we face today. However, it’s about to change in the near future.

Fully integrated systems, utilizing Cloud solutions & Internet of Things (IoT) that will facilitate the near-instantaneous sharing of vast volumes of data across platforms, projects, business units, and geographies, are going to be the trend of the future.

**Cloud Solutions**

Cloud solutions provide access to shared pools of configurable system resources (storage) and higher-level services that can be supplied with minimal effort.

What took months to install and implement new software in a corporation, now takes minutes with the cloud technology. Less time, money, and labor are spent on administering, troubleshooting, and updating technologies in the cloud environment.
Organizations know that cloud solutions can increase flexibility and lower costs. According to the PMI Pulse of the Profession- Maximizing the Benefits of Disruptive Technologies on Projects, "84% of innovators say the cloud is giving their organization a competitive advantage."

**Internet of Things (IoT)**

The Internet of things embodies a vast emerging digital ecosystem that connects devices to collate and exchange information. It’s a network of physical devices that are embedded with sensors and network connectivity to allow those objects to connect, exchange data, and inter-operate within the existing Internet infrastructure.

An excellent example of a business model that uses IoT technology is “Uber.” Uber leverages the positions/times of all connected devices requesting a ride to route passengers and riders intelligently.

The Internet of things in construction can be used in many ways, such as monitoring, supply replenishment, construction tool tracking, and equipment servicing and repair.

The Internet of Things (IoT) may have the ability to change the industry more than anything else.

For Project Controls, the cloud solutions and IoT offer whole new levels of collaboration, information access, integration among various systems, and seamless flow of information.

**TECHNOLOGY TREND #4: KNOWLEDGE BASED SYSTEMS BASED ON BIG DATA** *(Real-time Benchmarking and data mining)*

Project Controls is a data-driven profession. In order to do cost estimating, planning/scheduling, and risk analysis, we need high-quality data.

We do have lots of data in our projects. However, we don’t do a good job with data mining and benchmarking. We either rely on expert guidance, or we start from scratch in every new project instead of studying the data from the past projects and do more predictive analysis using the data at our disposal. However, this is going to change in the future with knowledge-based systems based on big data.

According to the author’s interviews with the Project Controls software providers, most tool providers are considering knowledge-based systems as part of their tool developments.

**What is a Knowledge-Based Systems (KBS)?**

Wikipedia defines the knowledge-based system (KBS) as a computer program that reasons and uses a knowledge base to solve complex problems.

Knowledge-based systems broadly consist of an interface engine and a knowledge base. The interface engine acts as the search engine, and the knowledge base serves as the knowledge repository. Learning is an essential component of knowledge-based systems, and simulation of learning helps in the betterment of the systems.

Compared to traditional computer-based information systems, knowledge-based systems can provide efficient documentation and also handle large amounts of unstructured data, known as big data, intelligently.

Imagine having access to a large pool of intelligently stored data when the subject matter expertise is unavailable.

For Project Controls, the big data and knowledge-based systems allow project professionals to access historical data in one single place at their fingertips, resulting in better benchmarking, planning, analysis, and the rapid production and optimization of project’s cost and schedule.

Being able to systematically analyze a large volume of data can provide us with more precise answers to complex problems.
TECHNOLOGY TREND #5: RELIABLE PREDICTIVE ANALYSIS USING AI & MACHINE LEARNING (More accurate and reliable plans and forecasts)

Artificial Intelligence (AI) is such a hot topic these days. If you check the Google Trends, you’ll notice that the subject of AI has been at the peak of the news in 2019, as shown in Figure 6.

The rise of AI is creating a paradigm shift in how projects are managed. According to the 2019 PMI Pulse of the Profession in-depth Report, AI @ Work “New Projects, New Thinking”, over the next three years, project professionals expect the portion of projects they manage using AI to jump to 37%.

But what is an AI? Artificial Intelligence (AI) is the intelligence demonstrated by machines that are capable of performing tasks that typically require human intelligence.

The author has summarized the concept of three trending topics, Big Data, machine learning, and AI, in Figure 7.

In Project Controls, AI will help us drastically with faster and more reliable data processing, predictive analysis, and decision-making. Utilizing the big data and machine learning capabilities, AI learns from the massive amounts of stored information and intelligently predicts the project cost and schedule outcomes.

AI is changing how projects are managed. AI-assisted technologies could mean that project monitoring and controls require less time and fewer resources. These efficiencies will allow project professionals to devote more time to predictive analysis and stopping potential issues before they occur.
To summarize, here are the top 5 technology trends that the author believes will transform how we manage the projects in the future:

1. Moving from 2D Planning to 4D/5D through visualizations
2. Instant visibility into project status (real-time data collection, dashboards, analytics, and reporting)
3. Seamless flow of information from one system to another (fully integrated systems utilizing cloud solutions & IoT)
4. Knowledge-based systems based on Big Data (real-time benchmarking and data mining)
5. Reliable predictive analysis using AI & machine learning (more accurate and reliable plans and forecasts)

With these five emerging technology trends, the future seems very promising for project professionals. However, turning these innovations into reality requires some future-readiness and forward-thinking Project Controls/Project Management strategies in place.

**FORWARD-THINKING STRATEGIES TO FOSTER PROJECT CONTROLS INNOVATION**

To open the gates to future possibilities and foster Project Controls innovation, let’s reverse engineer the previously discussed five emerging technology trends and assess what future-readiness strategies we need to have in place.

**FUTURE READINESS # 1: GOOD QUALITY DATA**

To take advantage of the Big Data and Artificial Intelligence, having good quality data is a must. The machine doesn’t have the intelligence to distinguish between the good and bad quality data. The machine learns from the data that you feed it and determines algorithms and trends to predict the outcomes. The quality of the data determines the accuracy of your predictive analysis using big data, AI, and knowledge-based systems.

Below are some proposed strategies to ensure the collection of good quality data:

**TAKE LESSONS LEARNED SERIOUSLY (Benchmark your results)**

Everyone knows the importance of lessons learned; yet few organizations do it properly. So much time and effort go into executing a project, yet many organizations literally throw away all the hard work that went into the completion of the project. They rush towards the next project without taking the time to properly capture important information and analysis done on a completed project. This is where lessons learned can be used to improve the success of future projects.

To get ready for the future, we must take lessons learned seriously in every project and benchmark our results.

**GET THE TEAM BUY-IN (Involve the team in every step of the process)**

Another factor that contributes to the data quality is the input and involvement of the project team.

How many times have you assigned a budget or developed a schedule for your team without their inputs? If the project teams don’t believe in their assigned budget or allocated deliverables’ completion dates, they won’t support you in feeding accurate data for your project status reports.

The quality of the cost and schedule reports is highly dependent on the quality of the data provided by the team. Therefore, we should make sure that we involve our team and get their buy-ins in every step of the project planning and development process.

**FUTURE READINESS # 2: STRUCTURED DATA SETS**

In addition to the data quality, how we structure and organize the data is essential.

It’s not the amount of data that’s important, rather, what organizations do with the data that matters. Without having a structured set of data, teams are dealing with a large volume of data that might not be of good use.
STANDARDIZE DATA AND PROCESSES (Develop standard templates and processes)
To leverage the power of big data and AI, make sure to convert the structure of disparate data sets into a common data format by standardizing your data and processes.

Developing standard work breakdown structures (WBS), Cost Breakdown Structure (CBS), code of accounts, standard templates, processes, and procedures are good ways to develop a common format. This allows for collaborative research, data mining, large-scale data analytics, and the sharing of sophisticated tools and methodologies.

Companies with the operational discipline to curate records of their project data and past performances are going to have a head start in adopting new technologies. With structured data, organizations can take advantage of supervised machine learning and AI.

FUTURE READINESS # 3: MULTI-SKILLED TEAM
(CAPABLE OF ANALYZING AND COMMUNICATING THE INTEGRATED DATA)
To turn the large volume of data into meaningful insights, and analyze, and interpret integrated real-time project information, a multi-skilled team is required.

DIVERSITY IN SKILLSETS
When it comes to Project Controls, a multi-skilled team is the one who has developed expertise in various areas of Project Controls, including cost estimating, planning/scheduling, cost management, risk analysis, and forensic analysis. Other skills that the team needs to develop further to foster Project Controls innovations are:

- Data analytics
- Statistical modeling
- Pattern recognition and trend analysis
- Communication and leadership skills

Developing our skillsets in the above areas allows us to understand the integrated project data information better, detect the potential project issues, ask targeted questions that will most likely deliver actionable results, and guide the project to the right track.

FUTURE READINESS # 4: TEAM COLLABORATION & TRAINING
Forward-thinking companies create and nurture a culture that considers new technologies as an opportunity to evolve best practices. They encourage their project team leaders to take advantage of flexible methods that allow them to move beyond the routine tasks to higher-level work, such as strategic thinking and planning.

As project leaders take on more extensive roles, training and skill development are even more crucial. Companies taking the lead on adopting new technologies invest in training and developing their team and fostering continuous learning opportunities and cultures of growth.

To get ready for the future, companies need to embrace an innovative mindset and invest in training and developing the skillsets of their employees. Some of the areas to consider for further development include 4D/5D planning, data science, data analytics, collaborative leadership, and communication skills.

The forward-thinking strategies to foster project controls innovation are summarized in Figure 8 on the following page.

CONCLUSION
Project Controls is undergoing a transformational evolution, as the new trending technologies open up previously unrecognized possibilities. The new innovations will offer greater opportunities for us to do more predictive analysis and problem solving rather than compiling and reporting data manually.

The introduction of new technologies is nothing new in our industry. However, to successfully integrate technology, we must address not only the technology but also the “people” and the “processes” required to deliver these innovative solutions.

Remember, the core Project Controls principles for any project are still fundamental and vital to successful delivery. Once solid foundations are in place, organizations are well positioned to go big and adopt cutting-edge technologies to their competitive advantage.

Embrace this fundamental period of technological advancements and be open to change.
Future Readiness # 4: Team Collaboration & Training

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The forward-thinking strategies to foster project controls innovation are summarized in Figure 8.

**Figure 08 - Forward-Thinking Strategies to Foster Project Controls Innovation**

**Resources:**
- Interviews with Project Controls software providers, Project Control Academy (http://www.youtube.com/c/projectcontrolacademy)
- 4D Scheduling vs. Traditional Scheduling (Which one do you prefer?), by: Tamer Elgohari, Project Control Academy (https://www.projectcontrolacademy.com/4d-scheduling-vs-traditional-scheduling)
- The Impacts Of Megatrends On Future Project Planning & Scheduling Workforce, Project Control Academy (https://www.projectcontrolacademy.com/future-project-planning-scheduling)
- 4D BIM: How it will help the construction industry, by: Jara Lipman
- 98 percent of construction projects go over budget. These robots could fix that. By: Luke Dormehl
- 8 Construction Tech Trends To Watch in 2018, The BIM
- PMI Pulse of the Profession In-depth Report, AI @ Work: New Projects, New Thinking
- Modernize Project Controls or Suffer the Consequences, by: Janet Poses
- Project Controls & Data Analytics In The Era Of Industry 4.0, by James e. Arrow, 2019 AACE Source Magazine

**About the Author**

Shohreh Ghorbani is the founder and director of Project Control Academy, the leading global provider of comprehensive online training programs in Project Controls. She has served tens of thousands of professionals enhance their Project Controls knowledge and helped them advance along their career path. In April 2018, AACE International Source Magazine featured Shohreh as the “Woman in Project Controls” honoree.

She has helped companies like Kentz International, Phillips 66, Waste Management, and Stantec develop Project Controls knowledge and skills in their project team members.

With her impressive track record in teaching and years of hands-on experience on a wide range of project controls technical areas in various industries, clients have acknowledged Shohreh as a passionate trainer who transfers the knowledge of project controls in a simple and understandable manner.

Shohreh is a licensed project management professional (PMP) recognized by the Project Management Institute (PMI) and a professional member of the Association for the Advancement of Cost Engineering (AACE International). Toastmasters International certified her as” Advanced Communicator Silver.” She holds a Master of Science in Industrial Engineering.

To learn more about Shohreh visit [www.ProjectControlAcademy.com](http://www.ProjectControlAcademy.com) or connect with her on LinkedIn.
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ABSTRACT

Due to the unique challenges set by science projects’ exploratory nature and the needs of scientific collaboration, sound project management system in science project requires tailoring to these attributes. The NSF’s oversight process emphasizes the tailoring of EVM to ensure it is being used as a beneficial managing and oversight tool. NSF’s process includes Independent External Reviews, in conjunction with phased EVMS implementation starting at the development stages of science projects. The review process is collaborative and provides in-depth understanding of the technical aspects of the projects. The review and the project’s development process are iterative. The review panel not only evaluates the project, but also provide advice and guidance in all aspects of the projects. The EVMS verification and acceptance review is performed before the construction starts. During the construction phase, NSF performs EVM surveillance in conjunction with the progress reviews. Through these iterative review process, the EVM is tailored to the project. For smaller projects, the review process and EVM implementation are scaled to fit the project’s size and complexity.

The National Science Foundation (NSF) funds the U.S. research community to manage the design and construction of state-of-the-art research infrastructure. For example, NSF funds the ATLAS detector at the Large Hadron Collider (LHC) at CERN. The ATLAS detector is located at 100 meters below a small Swiss village and weighs 7000 tons, similar to the weight of the Eiffel Tower. Beams of particles travelling at a speed of 99.999999% of the speed of light, from the LHC to collide at the center of the ATLAS detector producing collision debris in the form of new particles which fly out in all directions. Over a billion particle interactions take place in the ATLAS detector every second, a data rate equivalent to 20 simultaneous telephone conversations held by every person on the earth. Only one in a million collisions are flagged as potentially interesting and recorded for further study. The detector tracks and identifies particles to investigate a wide range of physics to explore the basic building blocks and fundamental forces of nature, ranging from Higgs Boson search, Dark Matter, antimatter, gravitons, and much more. ATLAS comprises about 3000 scientists from 183 institutions around the world, representing 38 countries. The collaboration depends on the efforts of countless engineers, technicians and administrative staff.

Due to science projects’ exploratory nature, NSF’s recipient management and agency oversight of research infrastructure projects face a unique set of challenges that are inherent to the scientific research endeavor. As we can see from the example, such projects often need to invent new tools, explore new technologies, and build complex, state-of-the-art facilities consisting of unique instrumentation and infrastructure that require extensive research and development effort for their construction and successful operation. In addition, these complex projects may involve large collaborations of institutions across the world, which brings extra complications in areas such as resource allocation, governance, project management and technical decision-making. Despite these complexities, sound project management systems can aid the successful implementation of these projects, but must be tailored and adapted to these attributes.

Earned Value Management (EVM) is a well-established methodology that provides strong benefits for project management in terms of early problem identification and trending forecasting, as well as sound planning and project control. Properly implemented, it is also an invaluable tool for agency oversight. For NSF, the challenge resides in allowing...
EVM implementation by Recipients to be adaptive to the unique demands of research infrastructure projects while maintaining accepted industry practice.

NSF has established guidance to support a comprehensive process for EVM implementation for research infrastructure projects, with emphasis on tailoring and scaling of EVM based on each project’s unique technical nature and characteristics. It takes a very collaborative approach, incorporating planning for agency EVM verification, acceptance and surveillance in a series of independent reviews throughout the project design and implementation stages. NSF’s practices around EVM implementation ensure that EVM can be used as an effective project management tool for the Recipient as well as agency oversight.

A large science facility project usually undergoes a long development process. The development stage is where initial ideas emerge and a broad consensus built for the potential long-term needs, priorities, and general requirements for the Research Infrastructure. This stage can last 10 years before it is ready to enter the design stage. The design stage is where detailed, construction-ready budget estimates, schedules, technical specifications and drawings, and management processes are developed by the Recipient. Entrance into the Design stage occurs when NSF recognizes the proposed project as a national priority and the Sponsoring Organization obligates the necessary funding to advance refinement of the scope and the estimated cost and schedule.

NSF’s tailoring of EVM starts with the project’s baseline formation during the Design Stage. The design stage for large projects often lasts 3-5 years. The project baseline is established through an iterative process which includes three development phases: Conceptual Design, Preliminary Design, and Final Design. NSF’s oversight starts with the Conceptual Design Review as the first stage-gate review. Successfully passing the stage-gate review at the end of each phase is a prerequisite for the project to enter the next phase. The EVM System (EVMS) is also established as part of this iterative process, coherently following and aligning with the project baseline development. The stage-gate reviews also evaluate the project’s EVMS to ensure it adheres to accepted EVMS standards while being appropriately tailored and scaled to the unique aspect of the project.

NSF’s expert stage-gate review panels are independent and external to the project and the agency. They consist of leading scientific and technical experts for respective disciplines and subsystems of the proposed project, project management and EVMS professionals, cost and schedule estimating experts, and environment and safety issue experts. The panels review the project’s science case, technical approach, and cost and schedule estimates, examine the project’s EVMS, and assess technical and management risks in alignment with NSF’s Major Facilities Guide (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf19068). The panel reports represent a combined project evaluation, with the technical experts providing input for cost and schedule estimates and risk assessments. The panel provides advice to NSF which, in turn, becomes guidance to the project management team in all these areas.

During the Conceptual Design Phase, the project is expected to establish the overall scope and high-level Work Breakdown Structure (WBS), system functional requirements and major technical choices, with rough schedule and parametric cost estimates. After the Conceptual Design Review, the Recipient incorporates guidance from NSF and proceeds to the Preliminary Design Phase, if deemed successful. During the Preliminary Design Phase, the
Recipient develops more detailed designs, starts any needed prototype effort and defines more refined scope and detailed WBS, with bottom-up cost and schedule estimates and risk assessment. The EVMS framework is also established in this phase. The Preliminary Design Review assesses the project’s progress in these areas and provides guidance for further development during the next phase.

After incorporating the review recommendations based on NSF guidance, the project proceeds into the Final Design Phase. During this phase, the Recipient develops a construction-ready design, with more mature technical decisions and management plans. The Recipient develops a complete baseline with a fully-defined scope and well-established schedule and cost estimate. The project’s EVMS should be fully established with the resource loaded schedule ready for recording and monitoring EVM performance data. After a successful Final Design Review and incorporation of recommendations, the project is authorized to enter the Construction Stage. Through such iterative development and review processes, the establishment of the project’s EVMS is tailored and appropriately scaled to the project, based on the advice of the panel and subsequent guidance from NSF.

As part of NSF’s oversight process, the project’s EVMS also undergoes a verification and acceptance review before beginning construction. The overwhelming majority of NSF’s recipients are non-profit research institutions or universities. NSF does not perform EVMS certification for the recipient organization as a whole. Instead, we perform EVMS verification, acceptance, and surveillance for the project we fund. The EVMS verification review focuses on verifying that the project’s EVMS will be able to generate reliable and timely EVM performance data. The factors considered for tailoring the verification and acceptance reviews include: characteristics unique to the project, the technical nature of the project, types of contracts the project will utilize for the project execution, the project’s collaboration needs, and the host institution’s indirect cost structures.

The review process is scoped to provide additional guidance to the Recipient based on the project’s EVM maturity. It is also a collaborative and iterative process. The review team not only assesses the project’s EVMS but also provides guidance and advice for improvement to achieve NSF acceptance. This collaborative process helps enable the technical team to master the EVM methodology to support project management decisions and achieve successful project execution.

After the Construction Stage starts, NSF holds annual project progress reviews for oversight purposes. Tailoring effort at this stage is reflected in the EVMS surveillance reviews that are held concurrently with the progress reviews. The progress reviews are scoped based on the project’s performance and perceived risk level based on monthly reporting and any interim site visits. During the progress review, the project’s technical scope, cost and schedule performance against plan, risk profile and remaining contingencies are assessed. The review panel also provides recommendations to NSF on technical and management issues. The reliability of EVM data is assessed by the EVMS review team alongside the technical progress evaluation by the expert panel. The updated project risk-adjusted estimate-to-complete cost is evaluated with input from technical experts on the panel. Performing EVMS surveillance concurrently with the annual progress review ensures that the EVMS is being implemented effectively to monitor progress-against-plan, and that the data are being used by the Recipient for identifying project issues through accurate forecasting to support a management response. The surveillance process gives NSF confidence in the use of EVM data for agency oversight.

For smaller projects, the main effort focuses on tailoring and scaling EVM to the project’s total project cost. For example, mid-scale projects (generally $20M to $100M) have more limited resources for management and need to balance the administrative burden against the benefit of implementing EVM. NSF is establishing scaled EVM implementation for these projects. The baseline development cycle is much shorter, without successive stage-gate reviews, which necessitates more direct interaction with NSF to appropriately tailor and scale the EVMS. The main areas than lend themselves for scaling and reducing the burden of EVM are: the WBS levels, the level of detail in the resource loaded schedule, and milestones. With the WBS, resource loaded schedule, and milestones set at a level commensurate with the complexity and the size of the project, the Recipient can benefit from EVM while keeping the administrative burden of EVM at the level suitable for smaller sized projects.

Properly implemented, EVM can help the Recipient management team quickly identify problem areas from the top down without having to first dive into technical details and is thus a good bridging tool between management and the technical team. This integrating capacity of EVM makes it very valuable in the management of science projects because
of their highly specialized technical nature. Properly surveilled to confirm effective implementation, it becomes a valuable oversight tool for the agency. NSF’s guidance and oversight practices on appropriately tailoring EVM to the scale and technical nature of the project opened an exciting practice area that enables EVM to benefit science projects, and has helped to further extend the value of EVM to smaller research infrastructure projects.

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About the Author
Xiaofeng Guo has a Ph.D degree in Physics. She joined National Science Foundation (NSF) in 2017 to support the development of the NSF guidelines for the EVMS implementation, and the oversight and management of large facility projects. Before joining NSF, she managed the Large Hadron Collider (LHC)’s US-ATLAS Upgrade and High Luminosity LHC ATLAS projects at the Brookhaven National Lab. She led the development of guidelines for EVMS implementation in large science projects and supported the Department of Energy’s EVMS Certification in Brookhaven National Lab. Her project management experience also includes Heavy Flavor Tracker project for the STAR detector upgrade in Relativistic Heavy Ion Collider, and Electron-ion Collider Detector R&D program. Prior to her work in project management, she did research work in the areas of High Energy Nuclear Physics and Quantum Chromodynamics. She published 28 papers in prestigious research journals and delivered 30 invited talks in international conferences and universities. Xiaofeng received an NSF ADVANCE Fellowship award for her research in 2004. She also has PMP certification and passed the Level III Chartered Financial Analyst Exam by CFA institute.
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ABSTRACT

The tagline of the previous article was “If you can’t track the allocations, you can’t understand the situation” and explained how to determine the allocation to the costs of each component project throughout the lifetime of the program. The article showed how to apply that algorithm to the case study and identified that one of the component projects and a number of the intermediate nodes clearly cost more than they contributed to the ultimate benefits. It finished with the warning that more information about the overall program benefits model was needed before any decisions could safely be taken on how the set of components might be modified to provide the optimal business result. The current article will explain the points to take into account when optimizing the portfolio in this way, and will demonstrate the potential issues that could be caused by taking a simplistic approach.

REMEMBER ON BENEFITS MAPS

The first articles [Piney, 2018b; Piney, 2018c; Piney, 2018d] in this series [Piney, 2018a], explained how to build a benefits realization map (BRM), how to evaluate the contribution of each component of this map to forecast the strategic benefits of the total program (the “Benefits Allotment Routine” – BAR), and how to evaluate the corresponding allocation of costs to each element of the realization map by using the Break-Even Everywhere Routine (the BEER). These concepts were illustrated on a simple case study. This introduction provides a brief reminder of these ideas.

A BRM illustrates how to make the benefits happen. It can be constructed as follows.

Once the anticipated benefits have been defined by the strategic sponsor, you need to determine all of the steps that are required to construct this result, thereby allowing you to identify the necessary component projects. The dependencies from each logical step to the next are quantified for each step in the logical chain. The BAR uses the forecast value of the strategic objectives in conjunction with this link information to calculate the contribution of every node in the BRM to the anticipated benefits. In particular, the BAR evaluates the contribution to the anticipated benefits of each component project. This value is known as the “Earned Benefit At Completion” (EBAC) of that component project.

Once the full set of parameters that define the model is known (predicted benefits, estimated cost per initiative, and the structure of the benefits map, including the contribution fractions), no additional assumptions on the model are required in order to use these parameters to evaluate to cost of each intermediate node in the model. The return on investment of any node can then be evaluated from its benefit contribution and its cost allocation.

The Earned Benefit of a component project (initiative) at a given point in time is evaluated from its EBAC in proportion to its degree of completion at that point – i.e., the Earned Value “percent complete” of this project. As a first approximation, the Earned Benefit of the total program is defined as the sum of all of the project Earned Benefits. This definition of the program Earned Value will be revisited in the next article in this series, taking into account concepts defined later on in the current article.

1) This series is by Crispin “Kik” Piney, author of the book Earned Benefit Program Management, Aligning, Realizing and Sustaining Strategy, published by CRC Press in 2018. Merging treatment of program management, benefits realization management and earned value management, Kik’s book breaks important new ground in the program/project management field. In this series of articles, Kik introduces some earned benefit management concepts in simple and practical terms.

Clarifications
I received the following comment on an earlier article (Piney, 2018c):
1. “How can you claim to measure benefits when the project has yet to be completed? [...]”
   Asked another way, how can Activity A produce any measurable benefits until Activities C and D are also finished and the services actually implemented?”

I gave a partial answer in Piney, 2018d and proposed to complete it in the current article.
Once I had started work on the full explanation, I came to the conclusion that it was sufficiently interesting and involved to warrant its own article. This additional article will therefore be added to this series as a follow-on to the current article.

THE CASE STUDY FOR THE CURRENT ARTICLE
The business objective of the program in this example is to increase profits for an organization in the area of customer service. For the purpose of the case study, strategic analysis by senior management has shown that increased customer satisfaction with after-sales support enhances business results and has the potential for delivering additional revenue of €300,000 per annum compared with the current level of business, but that this service will also lead to an increase in operational costs amounting to 25% of the corresponding financial improvement, thereby reducing the net benefit by the corresponding amount.

In the previous articles, the steps to achieving the business objective were developed and quantified, all the way back from the required strategic outcome across to identifying the projects required. The corresponding benefits map for this program, including the financial numbers mentioned above, are shown in Figure 1. One notable point about this case study is that, although the overall figures show a healthy return on investment, one component project (B: Call Handling Tool) costs more to the program than it contributes to the final benefit.

However, the first article (Piney, 2018b) explained why the inclusion of this initiative may still be justified, and more information is needed before a decision can be made reliably on whether or not to exclude it. The current article will address this challenge, explain the potential incorrect decisions, and show the corresponding financial impact that these would have. The first step is to understand the concept of essential links.

UNDERSTANDING ESSENTIAL LINKS
The concept of essential links is based on the following characteristic that can affect a result, when the result depends on a number of inputs: although some of the inputs may contribute very little to the final result, the existence of one or more of these inputs may be an absolute pre-requisite for achieving any form of result. For example, in marathon running, your shoes contribute much less than your fitness to your performance, but without even one shoe, you will be unable to take part. Links in the benefits map with this characteristic are described as “essential links”.

![Figure 1: Complete Benefits Map for the Case Study](image-url)
It is fairly evident that the difference between essential and normal links ceases to be relevant to the result once the corresponding source node has achieved its full potential (e.g., once you are wearing your shoes for the marathon).

The concept of essential links has to be taken into account in two key areas for benefits realization: optimization of the benefits realization model, and the calculation of Earned Benefit.

We will first address model optimization as that analysis will answer the question that has been unanswered since the second article: how best to address an initiative with a negative return on investment? The second point about calculation of Earned Benefit in the presence of essential links will be presented in the subsequent article mentioned earlier which extends the Earned Benefit concepts to provide a schedule forecast for actual realization of the benefits.

**OPTIMIZING THE MODEL**

We will now address the question of what we should do about the fact that, as shown in Figure 1, B: Call Handling Tool contributes less to the total benefit than it costs. Let us start from the obvious approach, before including the possibility of critical links.

**Simplistic Optimization**

The full business plan is based on a total program contribution of €225,000 for a total cost allocation of €150,000 – i.e., a healthy profit of €75,000 and return on investment (ROI) of 50%.

We are now in a position to go more deeply into the question that was raised in April [Piney 2018c]: should we remove node B: Call Handling Tool to address the fact that it costs €75,000 more than it delivers €71,250?

The revised Benefits Realization Map diagram after removal of node B and the corresponding capability (E: Call Documentation and Tracking) is shown in Figure 2.

As can be seen from Figure 2, the loss of node E entails the additional removal of all of its outgoing links – in this case, those to nodes F, H, and M. This removal, in turn requires the contribution fractions to those nodes to be recalculated. The method for carrying out this recalculation is not intuitively obvious and is explained in detail in my book, but it is rather too involved to be explained here. It makes use of the features of the BEER to maintain the inherent logic of the original contribution fractions and thereby avoids the need for any additional, and potentially subjective, hypotheses. The result of applying this Pruning and Link Evaluation (PALE) algorithm is shown in Figure 3.
If we can, in fact, omit this negative-ROI node (B) without generating any side effects, the costs will drop by its cost allocation of €75,000 and the corresponding benefits by its contribution of €71,250, leading to an increase in profits of €75,000 – €71,250 = €3,750. This translates to halving the total investment and an increase in the total profit, with, as result, more than doubling of the ROI. Most managers would jump at that option without a second thought.

However attractive the option appears to be, it still needs to be reviewed in order to assess whether our simplistic analysis is reliable. In the current example, this turns out not to be the case.

**Beware of Essential Dependencies**

Now that the concept of essential links has been explained, the model needs to be reviewed in order to assess whether the simplistic decision just presented is reliable.

The following information has been added to the case study: an analysis of the requirements for effective customer communication has indicated that, although E: Call Documentation and Tracking only contributes to F: Effective Customer Communication to the same level as D: Call Treatment Procedures, if documentation and tracking are missing, there can be no worthwhile communication to provide. For this reason, as shown in Figure 4, the link from E: Call Documentation and Tracking to F: Effective Customer Communication has been identified as essential.
The analysis of the sequence of effects of taking the essential link into account when removing node B is shown in Figure 5 and itemized below.

Figure 5: The Five Steps Involved in the Removal of Node B

1. The first step, by hypothesis, is the removal of node B: Call Handling Tool.
2. Node B: Call Handling Tool is the only project contributing to E: Call Documentation and Tracking. Without node B, therefore, node E ceases to exist.
3. By hypothesis, node E, which has just disappeared, is an essential precursor to node F: Effective Customer Communication, so node F needs to be removed from the map.
4. If node F is no longer a potential outcome, its single predecessor D: Call Treatment Procedures is superfluous and should be deleted.
5. Now that the capability of treating calls – i.e., node D – is no longer worthwhile as part of the map, the corresponding initiative, A: Call Handling Service serves no useful purpose in the program.

In brief, this means that removal of node B: Call Handling Tool makes node A: Call Handling Service surplus to requirements and a waste of time, effort and resources.

The PALE algorithm mentioned above can be applied to this modified model, and the resulting Benefits Map is shown in Figure 6.

Figure 6: The Recalculated Pruned Model after Taking into Account the Essential Link

- The investment allocation is the estimated cost of Node C = €25,000 as provided for the original model. There is no reason for this to have changed.
- The total contribution to the planned benefits is calculated as follows from the numbers in Figure 1 that were obtained using the BAR. Take the original forecast contribution of node K (€225,000) and subtract the “lost” contributions of nodes B (€71,250) and A (€120,000). By definition, this provides the calculated value of node C – i.e., €33,750.

As a result, at best, if the option of cancelling work of the Call Handling Tool is adopted, you will be left with a significantly reduced program, providing an estimated profit of...
As can also be seen from Figure 6 or by direct calculation, taking into account the simultaneous disappearance of nodes B and A, the financial result is as follows:

- The investment allocation is the estimated cost of Node C = €25,000 as provided for the original model. There is no reason for this to have changed.
- The total contribution to the planned benefits is calculated as follows from the numbers in Figure 1 that were obtained using the BAR. Take the original forecast contribution of node K (€225,000) and subtract the “lost” contributions of nodes B (€71,250) and A (€120,000). By definition, this provides the calculated value of node C – i.e., €33,750.

As a result, at best, if the option of cancelling work of the Call Handling Tool is adopted, you will be left with a significantly reduced program, providing an estimated profit of €33,750 – €25,000 = €8,750 and an ROI of 35% - a sadly-shrunken prospect compared with the original plan.

However, and this is where the sad reality of many program decisions is clearly highlighted, if this analysis were not carried out prior to making the decision to cancel work on the Call Handling Tool, the work on A: Call Handling Service would proceed as planned. As our analysis has just shown, this work would deliver no extra value, so total contribution of the set of initiatives is still limited to the contribution of node C (€33,750). However, the costs of both nodes C and A will be included in the allocated budgets – i.e., €25,000 + €50,000 = €75,000.

The reality of this situation is therefore a loss of €75,000 - €33,750 = €40,250 and an ROI of minus 55%.

To add unfairness to incompetence, in this case, it is all-too-common for management to categorize A: Call Handling Service as a “failed project” even if it delivers the required capability on time and to budget, and to make a scapegoat of the project manager of A: Call Handling Service for failing to create any added value. This allows the decision-makers to shirk their strategic responsibility for the failure, and serves to ensure that similar loss-making situations will occur again in the future. Of course, no one benefits from this type of behaviour.

CONCLUSION

We have seen the pitfalls associated with attempting to optimize a program model if the concept of essential links within the benefits map are not taken into account. This simplistic approach can turn a viable dream into an incomprehensible nightmare.

The next article in the series will apply the concept of essential links to provide a more accurate evaluation of Earned Benefit both as a tool for program performance analysis during implementation and also as a basis – taking into account the potential delays between outcomes and benefits – for forecasting and then tracking the schedule for the actual realization of these benefits.

References


About the Author

After many years managing international IT projects within large corporations, Crispin (“Kik”) Piney, B.Sc., PgMP is now a freelance project management consultant based in the South of France. At present, his main areas of focus are risk management, integrated Portfolio, Program and Project management, scope management and organizational maturity, as well as time and cost control. He has developed advanced training courses on these topics, which he delivers in English and in French to international audiences from various industries. In the consultancy area, he has developed and delivered a practical project management maturity analysis and action- planning consultancy packages.

Kik has carried out work for PMI on the first edition of the Organizational Project Management Maturity Model (OPM3™) as well as participating actively in fourth edition of the Guide to the Project Management Body of Knowledge and was also vice- chairman of the Translation Verification Committee for the Third Edition. He was a significant contributor to the second edition of both PMI’s Standard for Program Management as well as the Standard for Portfolio Management. In 2008, he was the first person in France to receive PMI’s PgMP® credential; he was also the first recipient in France of the PfMP® credential. He is co-author of PMI’s Practice Standard for Risk Management. He collaborates with David Hillson (the “Risk Doctor”) by translating his monthly risk briefings into French. He has presented at a number of recent PMI conferences and published formal papers.

Kik Piney is the author of the book Earned Benefit Program Management, Aligning, Realizing and Sustaining Strategy, published by CRC Press in 2018. To view other works by Kik Piney, visit his author showcase in the PM World Library at http://pmworldlibrary.net/authors/crispin-kik-piney

Kik can be contacted at kik@project-benefits.com.
EARNED VALUE MANAGEMENT STANDARDS STRUCTURES, PART 1 – WHY THREE
By John D. Driessnack, PfMP,

ABSTRACT

“Don’t let the tool control the hand that uses it,”
– Lt Gen H. H. Driessnack

This article is Part One of a planned two-part series that will discuss the current three standards and their structures for Earned Value Management. The article will review the EIA-748D 2019, ISO 21504:2018 (mainly by reviewing the AS 4817:2019), and ANSI PMI-19-006 2019 Structures. Part One will discuss the history and background of each standard and its structure, referred to as (1) EIA 5/32, (2) ISO 2/11, and the latest (3) ANSI 5/49 structure.

At first glance, it might appear that there are significant differences, but all three standard types fall in line with Lt Gen H.H. Driessnack and the other original thinkers’ purpose behind the EVM methodology. As Lt Gen Driessnack observed, “…the philosophical approach that we were going to take [within the Air Force]: provide a set of criteria that we expected contractors’ systems to comply with and not a cookbook approach of how to do it.” So then why are there three types?

HISTORY AND BACKGROUND OF THREE EVM STANDARD STRUCTURES

Before reviewing the details of the structures for the three standards, it is important to understand the history of EVM. Many consider 2017 the 50th anniversary for EVM. That year, The Measurable News, 2017.02, published several articles detailing the history of EVM. These articles highlighted key milestones for understanding the path to these structures.

In 1967, the US Department of Defense published an instruction, The Integrated Cost/Schedule Control System Criteria (DoDi 7000.2). EVM began as a modification of standard industrial engineering practices to manage non-recurring engineering work on DoD development contracts. It was an expansion of measurement methods taken “right off the factory floor” that had and still is used for recurring factory work. This DoD Instruction was the main document for 30 years, at which point it evolved into the American National Standards Institute (ANSI) standard, developed by the Electronics Industry Alliance (EIA), an organization which was support by several industry groups. The ANSI/EIA-748-1998, Earned Value Management System Standard, was developed as part of a broader effort to convert US Military Standards to industry standards. The ANSI/EIA document, through various organizational changes, got detached from ANSI and today is under the SAE International Systems Management Standard. Published in January 2019, it is now known as EIA-748D.

Like the original DoDi 7000.2, the current EIA-748D, is structured in 5 sections with 32 guidelines versus 35 criteria. The 5 sections include (1) Organization with 5 guidelines; (2) Planning, Scheduling, and Budgeting with 10 guidelines; (3) Accounting Considerations with
9) Guidelines were originally called “criteria.” This term change came in 1998 when the first ANSI/EIA standard was written by industry.


11) Quote from Kym Henderson in an email exchange with the author on 29 Dec 2019


13) The xx Appendix converts the “should” to “shall” for the 11 steps, thus converting the ISO to a compliance standard for Australia

14) NDIA added an EVM/Risk integration approach to the 2007 edition of the NDIA EVM Application Guide. GAO incorporated the NDIA graphic as a best practice within GAO 09-3SP.


Each PMBoK Guide addition, beginning with the 2000 edition, up to the current sixth edition published in 2017, has documented EVM as an integrated approach within project and program management. In 1999, the PMBoK became an ANSI standard for Project Management in 1999 (the current version is ANSI PMI-99-001-2017).

Updated in 2006, the Australian Standard and its 11-step approach was adopted as the structure for the International Organization for Standardization (ISO) 21508 Earned Value Management in Project and Programme Management. Initially published in 2018, this ISO standard is part of the project, program, and portfolio management standards, found in the 215XX family. See box showing ISO and ANSI standard relationships. The current Australian standard, AS4817:2019 is a “modified adoption” of the ISO 21508:2018 with an appendix substitution of the ISO chapter 51 These standards group the first six steps as “Plan the work” and the last five steps as “Work the plan” within the process steps flow diagram, thus the ISO 2/11 nomenclature.

The US GAO Cost Estimating and Assessment Guide, GAO-09-3SP, Mar 2009, took the 11 steps and expanded them to 13 steps (see Table XX). The increase in steps focuses mainly on including specific steps related to integrating risk management with EVM. This parallels the industry move in the mid to late 2000s integrating EVM and risk management.

The third structure is found in the new ANSI PMI-19-006-2019, The Standard for Earned Value Management. The ANSI standard notes, “The structure of this standard is intended to be compatible with the PMBoK Guide concepts and principles when a more structured EVM approach is desired by the program team.” The structure follows the ANSI PMI-99-001-2017,
A Guide to the Project Management Body of Knowledge, 6th Edition, five Process Group with 49 processes, thus the ANSI 5/49 nomenclature. The ANSI EVM approach does not explicitly call out specific steps or guidelines but generally follows the groups and processes as a structure with the following sections:

Section 2: Initiating Process Group with 2 processes
Section 3: Planning Process Group with 24 processes
Section 4: Executing Process Group with 10 processes, and
   Monitoring and Controlling Process Group with 12 processes
Section 5: Closing Process Group with one process.

The ANSI EVM Standard is unique with the inclusion of an example within a 19-page appendix, “Performance Management Example.” The example creates a fictional organization with experience using EVM with a project management framework. The fictional project focuses on the design and construction of a smart building. It includes both internal and contracted work within different control accounts, with one including contracted resources for software support that uses Agile approaches. The inclusion of an example comes from the previous PMI Practice Standard on EVM, first published in 2004 and updated in 2011.

Note that the example is not called performance measurement, but performance management. The use of management is not to replace measurement, but rather emphasizes the difference between quantification of units when using earned value techniques for analysis versus using Earned Value Management methodology “across the entire management function” which “critically enhances the ability to realize the envisioned business value.” The focus of the standard is on “enhanced performance management” mainly for projects, but also programs and portfolios when “perceived risks drive the need.”

An example of a certifiable standard would be ISO 9001, which a company can use for compliance. EIA-748D may seem certifiable because users, such as DoD and DoE, do validations, however this is not the same as being a certifiable standard.

COMPARISON OF THE STRUCTURES OF THE THREE STANDARDS

The Australian AS 4817:2019, previously noted is a modified adoption of the ISO 21508:2018 (henceforth referred to as the ISO/AS standard) will be compared with two other 2019 standards, EIA and ANSI. This comparison is between the three structures with standards that were all updated in 2019.

In context, the EIA standard is the most stand-alone version, supported by extensive NDIA guidelines that are specific to earned value. The ISO/AS and ANSI standards are a part of a broader set of standards for project, program(me), and portfolio management, which are themselves related to each other as ANSI is the secretariat on the ISO Technical Committee for Project, Programme and Portfolio Management (known as ISO/TC 258). This Technical Committee covers all ISO standards listed in Table 2. The ANSI Standards secretary is PMI; thus, PMI is the secretary on the ISO Technical Committee. Note with the ANSI nomenclature, the first two numbers after PMI denote the year in which the ANSI standard was first published. The ANSI standards generally precede the ISO standards, with EVM being an exception. In the case of the EVM standard, since EIA-748 was previously included as an ANSI standard, the ISO standard, noted as being influenced by the Australian standard, is the exception. In the past, PMI had a Practice Standard for EVM, but it was not considered a foundational standard for PMI and thus was not put in for ANSI review.

As noted at the start of this article the ISO standards are generally broader than ANSI standards in the project, program, and portfolio, though they are usually aligned. Similarly, within the Project Standard there are 5 process groups and 9 knowledge (ISO uses groups) areas. The alignment within the EVM standards is not as clean, as the evolution has been different. The DoD EVM documents were developed three decades before the first ANSI Project standard was published; thus, it is not linked with a specific project or program management approach.

16) Ibid Section 1.5.1 page 10.
17) Ibid Section 2.2, page 18
Despite that, the three standards are still aligned, as is outlined in Table 2, especially at the top structural tier.

A clean alignment is not difficult when comparing the 32 guidelines, 11 steps, and 49 processes. If one looks at the ISO/AS as the broad outline which “complements ISO 21500 (project) and ISO 21503 (program)” and the ANSI as “consistent with the PMBoK Guide,” the two are equally aligned as the ISO/ANSI standards for project and program management. These EVM standards are generally not in conflict with the EIA-784D standard, but the EIA standard is more specific and has a development path that started with a focus on contract management within the Department of Defense in the 1960s as part of a set of documents within the DoD Resource Management System (DoDI 7000.1).

Part 2 of this article, to be published later this year, will provide a detailed table which will show the extent of the alignment across the EIA 5/32 with ISO 2/11, and ANSI 5/49. The development so far has shown significant alignment on the broad EVM methodology. The different standards emphasize and provide guidance based on their historical development path. Each allows for tailoring implementation. The challenge, however, comes in the interpretation and the long history of use of EVM across many industries. On this front, the EIA-748D, with the additional guidance from either NDIA and/or the US and other governments, has further instructions or guidance published with page counts into the hundreds. This can cause misunderstandings on what is in the standard and what is organization or customer added guidance.
The ANSI project, program, portfolio management standards handle this challenge by creating a nomenclature. First is the Organizational Process Assets (OPAs); these are much like the organization’s EVM System Description and EVM procedures, desk guides, etc. The other is the Enterprise Environmental Factors (EEF), which can be compared to customer’s process requirements. For a US DoD contractor, the DoD EVM Implementation Guide, Federal Acquisition Regulation (FAR) clauses, and Data Items Descriptions (DiDs) would all be EEFs. Part 2 will also address the nomenclature as one implements the EVM methodology.

ABOUT THE AUTHOR
John is a nationally known expert in Systems and Portfolio/Program management in the Federal/DoD/Intelligence acquisition environment. He spent 21 years as an Air Force officer, which included senior PM for Global Broadcast System (GBS), and program or functional lead on several other major Aircraft, IT and Intel program(s). Post retiring in 2004, John managed a consulting group, conducts research in the economics of portfolio/program controls and industry structures, and teaches at Defense Systems Management College, American University, and Naval Post Graduate School. He started his own consulting firm, Olde Stone Consulting, LLC in 2014. He holds BS in Industrial Engineering, MS in Economics, and advanced academic work in New Institutional Economics. Certified as a DoD DAWIA Level III Program Manager, Financial Managers, and Acquisition Logistician, as well as Industry Cost Estimator and Project Management Professional certifications. He is also published in defense acquisition journals, co-author of the PMI/INCOSE/MIT guide for Lean Enablers for Systems Engineering, contributor on the GAO best practice guides for cost and schedule, and chaired NDIA working groups, as well as authored several PMI white papers and spoken at the PMI PMO Symposium as well as other conferences. He most recently was on the care committee for the new ANSI standard for EVM. John is also the current Exec Vice President for the College of Performance Management.
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