



A Senior Executive's Starters Guide
to understanding

Digital Transformation



AIA Digital Transformation Council

INTRODUCTION

“We can’t predict the future. So, what we need is the right mix of technology, operational concepts, and capabilities — all woven together in a networked way that is so credible, flexible, and formidable that it will give any adversary pause.” - Secretary of Defense Lloyd Austin, April 30, 2021

We live in extraordinary times in which digitalization is radically changing the business, operations, and collaborative landscape across virtually every industry, government, and academic institution. To meet the challenges of today and to prepare for those yet to come, aerospace and defense (A&D) companies must be able to understand, decide, and act faster to support our customers while remaining globally competitive.

This requires embracing and investing in a comprehensive digital transformation strategy based on an open architecture that can integrate multiple forms of data and vendor tools, with a common understanding of the company’s culture, programmatic goals, and time horizon. Moreover, digital transformation is not ‘one-size-fits-all,’ nor should it be an ‘out-of-the-box’ implementation. Rather, it must be based on the current systems, infrastructure, and needs of each company.

Accordingly, the Aerospace Industries Association (AIA) Digital Transformation Council developed this strategic-level primer to help senior executives understand the far-reaching capabilities of digitalization and to offer a framework for taking the initial steps in their transformation journey.



WHAT IS THE DIFFERENCE BETWEEN “DIGITIZATION” & “DIGITALIZATION” AND WHY DOES IT MATTER?

“When digital transformation is done right, it’s like a caterpillar turning into a butterfly, but when done wrong, all you have is a really fast caterpillar.” - George Westerman, MIT Sloan Initiative on the Digital Economy

To understand the rapidly evolving digital transformation world, it is important to understand some general terminology — the difference between “digitization” and “digitalization.” These

terms are often confused and misused to describe transformative actions being taken in a company or organization. Although these concepts are clearly and intimately related, their power to enable change in an organization are vastly different.

Digitization changes analog processes into digital form, but importantly, it doesn't actually change the nature or kind of process. Although this is a critical first step, the business uses the same process, just in a digital way. It may increase efficiencies and speed but not in a transformative way.

Digitalization, however, is far more powerful. It uses a vast array of available digital technologies to change a process or business model to provide entirely new revenue and value creation. This allows for never-before-realized improvements, efficiencies, and effectiveness. It can lead to opportunities for new products, customers, or even market segments. It is transformative. It is evolutionary.

WHAT IS COMPREHENSIVE DIGITAL TRANSFORMATION?

“There is no alternative to digital transformation. Visionary companies will carve out new strategic options for themselves — those that don’t adapt, will fail.” - Jeff Bezos, CEO, Amazon

Although myriad descriptions exist, comprehensive “digital transformation” is the elimination of the barrier between the physical and digital aspects of a company’s operations. For aerospace and defense manufacturers, as well as their customers, this means the automatic, end-to-end, real-time synchronization of data across products, processes, and performance.

In other words, digital transformation combines digital technologies (e.g., software, sensors, automation, etc.,) to dramatically change existing traditional, nondigital, and siloed business processes and services into an integrated data-centric ecosystem. This allows devices, employees and even customers to innovate, design, review, and share information to enhance visibility, affordability, productivity, and trust.



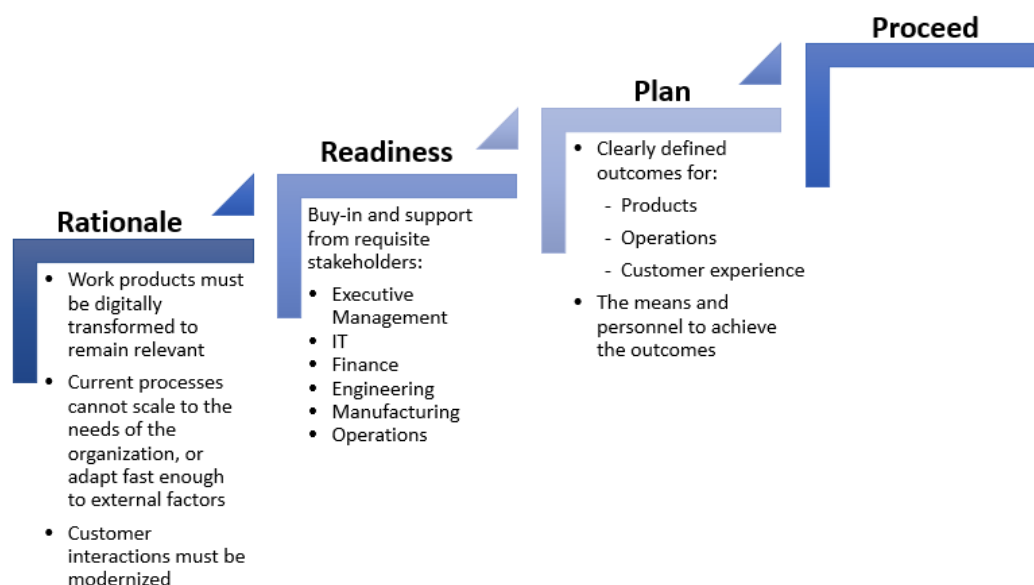
This transformation is often referred to as a journey, as it is not a quick, one-time activity, but rather a true evolution for the company or organization. As such, it takes committed leadership at all levels, a defined corporate strategy, cultural understanding and employee participation, dedicated planning, and strict, goal-oriented project management. The payoff can be extraordinary in terms of decision speed, quality, efficiency, cost reduction, competitiveness, innovation, and productivity.

WHY EMBRACE DIGITALIZATION AS AN A&D COMPANY?

In the past, digital tools were used “primarily in the design side and now we're finding applications of our digital tools across the full program lifecycle — from the very beginning where we're doing the concept definition all the way through the design, build, test, delivery, and sustainment of our systems.” - Carol Erikson, Systems Engineering and Digital Transformation, Northrup Grumman Corporation

Dramatic advances in digital technology and the rapidly changing A&D marketplace are compelling organizations to fundamentally change the way they do business. These changes affect the products that are produced, the ways organizations interact with their customers, and the operational processes that drive the business. However, the transformation required to implement these changes demands a significant commitment of resources.

The return-on-investment (ROI) analysis to inform the digital-transformation go/no-go decision is unique to each organization. The basic considerations that drive the decision to digitally transform are illustrated below.



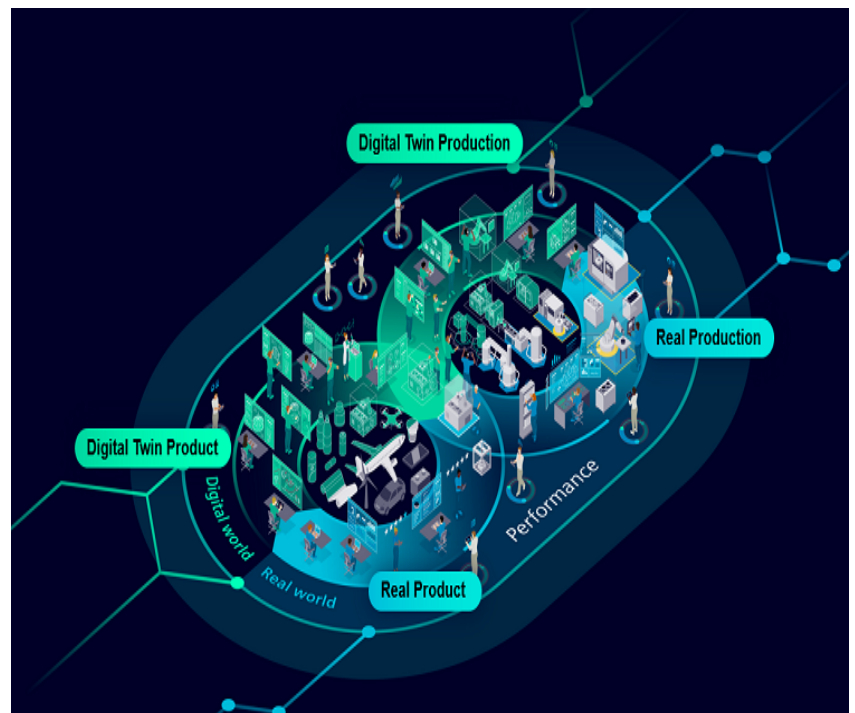
As an organization embarks on its digital transformation journey, leaders must decide what is being transformed. Digital transformations can be generally binned in three major categories: Products (Innovation), Processes (Operations), and Performance (Customer Experience). At the core of this journey is the creation of “digital twins” and combining them into a “digital thread” using a single, seamless ecosystem.

Digital Twins and Digital Threads

Many companies have data sitting in dozens of different systems. “These systems have been running their business for many years, and they are the backbone of their operation; however, when there are multiple systems instead of a single system of record, there is no single source of truth. They need to establish a digital thread across not only their internal business, but also their supply chain.” - Tony Hemmelgarn, President & CEO, Siemens Digital Industries Software

A comprehensive digital twin includes everything about the product, the production process, the simulation, and the feedback loop of what is happening with the product as it is being used. This data is then used to further refine each subsequent generation of product.

To connect design and manufacturing for maximum benefit, digital twins are connected into a digital thread. This thread provides one ecosystem in which everything exists. This includes: model-based systems engineering; program planning; product design and engineering; verification management; supplier management; intelligent manufacturing; and product support (maintenance, repair, and overhaul).



Products (Innovation)

“The ability for us to digitally design, digitally test, and digitally prototype products is revolutionary. At Rolls-Royce Defense, we are building, designing, and testing whole engines

before we ever machine any metal.” - Tom Bell, Chairman and CEO, Rolls-Royce North America

From the moment an engineer has an idea to the end-of-life of a product or production line, it is essential for an A&D manufacturer to have visibility and tools inside of a single open digital backbone. This allows data to be used across the entire enterprise to improve virtually every aspect of manufacturing. End-to-end digital threads allow products to be rapidly developed, affordably tested, and efficiently prototyped. Moreover, it allows for the creation of a closed “feedback loop” providing near real-time visibility of needed adjustments, innovations, or variants to quickly meet market drivers or specific customer needs. Simply put, the time between “flash to bang” is dramatically reduced, thereby improving ROI, competitiveness, and customer satisfaction.

Moreover, digitalization also means making the products themselves “smarter,” connected, or autonomous. These commercial products are either more fun to use or more useful, enticing consumers to buy them as a quality-of-life upgrade. There are many examples from vacuum cleaners to home electrical load monitoring. In the defense case, the goal is to enhance operational availability or improve military capabilities to overcome more enhanced adversaries.

Processes (Operational Excellence)

“Longer term, this is about the digital transformation that is underway. When we’re complete, we will apply the same level of rigor and modeling to our production system design as with the airplane itself. This will let us flatten the learning curve and bring our production system up to rate much faster.” - Dr. Greg Hyslop, Chief Engineer, The Boeing Company

Industrial companies spend massive amounts of money on business and manufacturing operations. By using digital tools and methods, these operations can become more efficient and accurate, saving money through increased throughput, reduced rework, and decreased risk. Organizations are motivated to move from document-based, human-in-the-loop operations to processes that embrace digital artifacts and computer automation. This digital transformation promises to dramatically shorten operational time cycles, reduce expenses, improve the quality of work products, and ultimately provide the potential for higher margins for the company. Below are some examples of this impact across key corporate functions.

Executive Decision-Making: Because product data and operational processes are “un-siloed” during digital transformation, executives and stakeholders have access to a current, consistent vision of what is happening throughout the operational lifecycle in real-time. They understand any associated risks and proactively act to mitigate risks and make improvements.

Innovation: Great ideas can come from anywhere in an organization. When a company undertakes comprehensive digital transformation, it allows access and visibility of data across the enterprise. This drives and encourages innovation, experimentation, and rapid prototyping, which can eliminate potential obstacles and get new models, products, and solutions to market much faster.

Employee Experience: Digital transformation is not just about technology. Above all, it is about people. The employee digitalization experience is often influenced by the right set of tools and technology, and the training and development processes for those tools. Whether it is managing their benefits or doing their work, digital tools with smart automation can enhance the employee experience and make them more productive. The wrong tools can cause frustration and inefficiency. Accordingly, during implementation, employees look to their leaders for clarity, connection, and accountability. Leadership must be proactively involved, collaborative, and empathetic during the entire transformation journey. Implementation teams must include both junior and senior employees under a flat hierarchy. Personnel closest to information should have the authority to make quick and informed decisions. Encouraging staff members who are open to change to be role models and coach their colleagues will further create buy-in, as will personnel with cross-topic experience functioning as “translators.” With the right policies and incentives, companies can institute a culture of continuous, “employee-driven” improvement.

Digital Infrastructure: To keep up with the demand of digital transformation, you must ensure you have a strong and secure digital infrastructure. A digital infrastructure enables business agility, automation, and orchestration of processes, digital connectivity, and requirement verification. Your Chief Information Officer (CIO) is a critical member of your digital transformation team

Digital Engineering (including mission engineering/analysis): Digital engineering is the use of digital modeling, simulation, and analysis to incorporate the operational environment and evaluate mission outcomes and effectiveness at every phase of the lifecycle. Using a digital engineering approach, you can create a persistent digital thread that accelerates development and testing throughout the entire product or system life cycle. Developing a model of your system is step one and should improve the design process; what you do with the model afterwards is what makes digital engineering a lifecycle benefit.

Manufacturing: Digital transformation in manufacturing can lead to enhanced production cycles, higher quality, reduced rework, operational efficiencies, and reduced costs, ensuring quality products, delivered on time. Properly modeled products transition smoothly into manufacturing and supply chain operations. Additionally, it can reduce scrap and concessions. For example, dramatically improving quality and visibility reduces the need for actions by a material review board.



Supply Chain: Fully digitized supply chains allow for more flexibility. Many factories are automating production. Warehouses are making use of robotics to automate transportation of goods. Supply chains can use predictive modeling to predict customer demand. Customers can monitor and track the status of their deliveries.

Service: Digital transformation simplifies and consolidates routine processes and operations for services. It allows for much greater “location adaptation” so the services go to the asset, rather than bringing the asset to where services are located. Additionally, you can analyze service information to detect trends to better anticipate latent defects and correct potential failures proactively. Information on deficiencies found in-service can be routed back through the manufacturing and design organization for correction by use of the system model. Configuration control becomes essentially automatic.

Support: Digital transformation provides new ways of rapidly getting technical support or training. From access to digital models and designs to using virtual reality to engage hyper accurate simulations, digital tools expedite speed, accuracy, and quality.

Performance (The Customer Experience)

Digital transformation “allows us to help our customers design and build next generation platforms using the digital thread to ensure smooth transition from prototype to production, while simultaneously ensuring complete engineering traceability every step of the way successfully in the rapidly changing marketplace.” - Eric Hein, Vice President of Defense Advanced Development and Space Programs, Spirit AeroSystems

Early Customer Involvement & Consistent Feedback: Digital transformation allows for direct customer involvement in and integration across the entire developmental and acquisition cycle. This dramatically improves the customer experience and engagement allowing for more satisfaction. It also enables faster and more effective prototyping, testing, production, and end-product performance. This provides consistent feedback from user to engineer to drive innovation faster than ever before.

Customer Relationship Management (CRM): Since businesses use CRM systems to manage and analyze their customer data, when you employ digital transformation methods, you can streamline your processes and improve your customer experience. Sharing CRM information across business units helps synergize customer engagements and provides more depth to engagement preparation. It also allows the effective application of business analytics across the business lines.

E Commerce: Digital transformation for e-commerce applications facilitates the flow of work and collaboration at different organizational levels. This is one way that businesses are making products more easily available to their consumers. It opens new opportunities and markets that it could not access before.

Customer Support: Digital transformation provides increased opportunities for engagement with potential and existing customers. This includes improved customer experiences, increased customer retention, extensive training on the use and potential of digital twins, and consolidation of channels and data. Digital tools can reduce costs and increase quality in customer service by automating initial contact, reducing personnel requirements, and routing customers to the appropriate specialist to collect feedback for analysis.

GET STARTED AND KEEP IT GOING—FIRST STEPS

“While the world around us has changed significantly, our purpose is more relevant than ever: to help the world run better in times of geopolitical tensions, disruptive industry transformation, and supply chain disruptions, and to improve people’s lives...” - Christian Klein, CEO, SAP

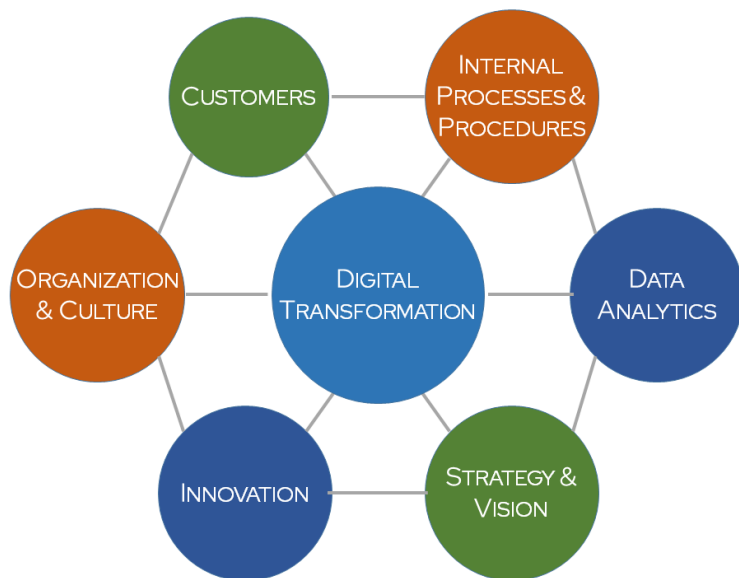
Successful digital transformation requires careful and deliberate planning, and above all, proactive and collaborative change management. All change efforts involve a series of steps, aligned with a clear vision or intent, embraced by the organization’s leadership. To begin, leaders must clearly define the end state they are pursuing — what ‘right’ looks like. As mentioned above, they should decide on which phase of digital transformation (product, production, or performance) to tackle first. Which provides the fastest ROI? Which provides the most value creation for our customers? Which provides the best experience for our

employees? Which is within our available resources? What is our timeline for implementation? Simply put, digitalization involves restructuring or reframing existing processes or procedures, applying both new tools and new techniques, engaging employees at all levels early and often, and developing a deep understanding of customer needs and market trends. Thus, it is imperative that leaders understand their comprehensive end-goal before embarking on any such transformational journey.

Most companies specializing in digital transformation refer to it as a journey, highlighting the long-term and additive nature of digital transformation. It begins with an exploration, or needs assessment of current capabilities, processes, mindsets, and expectations. From there, organizations ascend in competence, understanding, and integration of digital traits and mindsets until they fully embrace and become a “digital” company.

In their book, “Digital Transformation at Scale,” Greenway, Terrett, Bracken, and Loosemore (2021) recommend organizations start their digital transformation journey with small, new, simple, and high-profile projects and avoid attempts to fix the biggest problems first. They outline three challenges faced by change managers, including an expectation to solve superficial issues first, overcoming ‘change fatigue,’ and addressing a false sense of urgency. They provide 10 design principles, or values executive leaders can follow to help guide their digital transformations.

Once the organization defines objectives and the organizational structure to achieve it, a conceptual model should be developed to shape relationships, capabilities, responsibilities, and dependencies. While generalized models are readily available, most digital transformation initiatives are highly contextual and will require an individualized model tailored to an organization’s unique environment and structure. The following model can serve as a starting point.



	IT Uplift	Digitizing Operations	Digital Marketing	New Ventures
What it entails	Modernizing existing IT	Optimizing existing business	Digital tools for marketing e-commerce, customer acquisition	New business models and products
Benefits	Flexible platforms Ecosystem of tools	Cost reduction Efficiency Optimization	Upselling/cross-selling Market/wallet share Brand value	Growth opportunities
Capabilities required	IT architects DevOps teams Change management	Business process knowledge Change management	Data analytics Digital marketing	Business creation Innovation processes Innovation leaders
KPIs	New tools, reduced costs, improved capabilities, employee satisfaction	Savings in time, people, and money Improved customer satisfaction	Return on marketing, leads, client acquisition	New products, access to markets

The Harvard Business Review highlights four pillars of successful digital transformation.(<https://hbr.org/2022/01/the-4-pillars-of-successful-digital-transformations>)

Transformation typically starts with an upgrade to existing technology infrastructure and hardware (an “IT Uplift”). “Digitizing Operations” involves changes to internal processes, including the adaptation of digital approaches to formerly analog activities. This is an efficiency step with which many organizations struggle, as it involves changes to what are often perceived as processes that don’t need to change in the first place. The third pillar, “Digital Marketing,” refers to a focus on the digital tools needed to interact and sell to potential customers, including artificial intelligence (AI) and predictive analytics, establishing digital marketplaces, and geo-targeting campaigns. “New Ventures” involves integrating digital teams to test and exploit new markets for the company, creating new business models, products and services, or collaborations to create new sources of growth. These steps are taken congruently or individually, but they must be fully integrated into a cohesive strategy that is well understood and communicated throughout the business.

For executive leaders, setting digital transformation as a strategic priority is no longer an option; what matters today is how executive leadership teams successfully integrate and use digitally based business models as a competitive advantage in the marketplace. Setting a digital transformation strategy is key — outlining roles and responsibilities at all levels of the organization, as well as relationships with customers and suppliers. Executive leaders own the responsibility for providing understanding and clarity on the options and key elements of the

digital transformation journey. They organize personnel and processes, aligned with the strategic vision to overcome the inevitable conflicts and difficulties these initiatives invariably encounter.

As with any change effort, committed, visionary leadership is an essential ingredient. Executive leadership must demonstrate a commitment to start the journey, see it through the inevitable difficulties, communicate the successes and failures, and instill a mindset change at all levels.

To manage the complex process of digital transformation, leaders must establish a clear line of authority within the enterprise. This often involves assigning responsibility for managing personnel, processes, and expectations to a specific office or person. For example, a Chief Innovation Officer (CInO) or Chief Information Officer (CIO), who is a permanent member of the executive team, may be well suited to oversee this transformation as the company's digital leader.

Another option is to appoint a temporary member of the executive staff in the form of a Chief Digital Officer (CDO), who can report directly to the CInO or CIO. Their role is solely to manage and control the adoption of digital technologies and processes across the organization to completion. They must understand the organization's key strategy and performance goals and align technology and data capabilities to help transform a traditionally analog business operation into a digital one.

Whether CInO, CIO, CDO, or someone else, tech-savvy leadership serves as a key change catalyst, leading technological, cultural, and mindset changes — essentially, creating new ways of working. They develop enterprise practices to encode 'digital DNA pathways' into tactical and strategic business operations. This executive change manager often works with a small team of digital experts, analysts, and business leaders to educate and align the people, processes, and technology required to enable that digital vision.

CONCLUSION—IMPERATIVES NOT TO FORGET

“Innovation is what we do. Our workforce understands that breakthrough innovations require bold ideas and execution. We are committed, company-wide, to developing new capabilities for our customers.” - Raanan Horowitz, President and CEO, Elbit Systems of America

Innovations in the A&D sector will continue to revolutionize the way we live, travel, and defend our nation and its allies. Connecting aerospace products, processes, and performance in a seamless digital ecosystem is imperative to operate at the speed of relevance for our customers.

Digital transformation at any level is a major change for any organization, but especially in a complex A&D company. As a senior leader driving this evolutionary effort, you will need help. Chances are most of your team will have very little experience or knowledge on how to digitally transform your firm. Such a major change requires vision, dedication, and defined resources. Fortunately, you are not alone. There are numerous resources and digitalization experts available to help guide your team to success. Below are some key imperatives to frame your thoughts on this effort.

Change Management is crucial for creating acceptance within the organization. The interests of employees, stakeholders, and even customers must be included as early as the conceptualization phase. Don't wait until implementation to engage these groups as partners in this process. Don't treat it as a separate work stream operating independently. It needs to be an overarching element in your digital transformation. Never forget: This is a team sport.

Time-Based Achievable Goals must be defined, communicated, and measured. Decide and focus on what you want to implement. What will create the fastest improvement in the company? Solving problems is a great way to get buy-in, build excitement, and gain momentum. These "quick wins" not only demonstrate the value of digital transformation but also solve real problems that improve your company and gain stakeholder trust.

Understand the Value you want to create and expected ROI goals. Digital transformation can be a large investment, and you must be able to measure your returns. In the end, you should realize significant improvement in your normal business metrics: revenue, profit, quality, and time-to-market. If you tie your transformational activities to these, you will make better decisions about what to do and stick with it. Customer value is another critical factor. If you spend significant time and money on a new process, product, or infrastructure and your customers never notice, it probably isn't the right digital transformation activity.

Dedicate resources to the transformation. Digital transformation is not a one-time event or a part-time endeavor. Designate a senior leader to oversee the project. Establish teams with the time and budget to execute the plan. Have regular in-process reviews for the executive team to provide guidance and remove obstacles. Establish a method to obtain regular stakeholder feedback, and above all communicate the successes and challenges along the way.