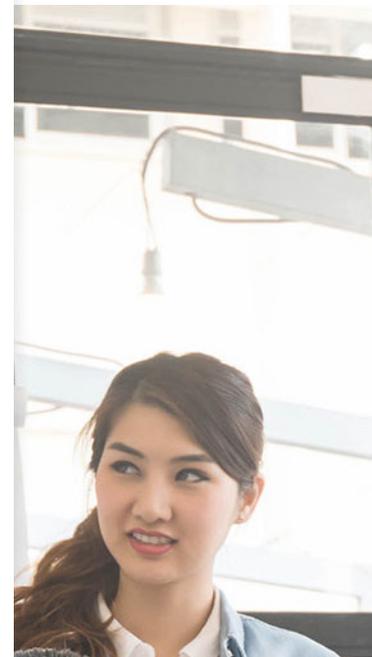


# Accelerating Product Development with Digital Innovation

Digital innovation (DI) is critical for organizations that want to stay competitive, allowing them to bring products to market faster and with better quality. Companies that follow a well-thought-out DI strategy can shrink operating costs and become more profitable, while improving their customers' experiences. But what exactly is DI and how do you incorporate it into your product development process? This paper will explore the benefits of DI, along with common challenges and how to overcome them. Learn about practical tools, techniques and guiding principles that can help ensure the success of a DI initiative. Regardless of whether your organization is embarking on a new development project or aiming to improve the performance of an existing one, you'll learn how to get started without getting overwhelmed.



# Accelerating Product Development

Amid today's rapid pace of business, companies who want a competitive edge need to embrace digital innovation – new technologies, methodologies, and culture – to accelerate and improve their product development. Faster, higher quality product delivery can reduce operating costs, increase the scale of product delivery, and shorten time to market – all of which contribute to a better customer experience. Ultimately, satisfied customers drive your business and revenues, whether they are consulting customers, internal customers, or end customers.

Accelerating product development isn't just a matter of improving software engineering; it also requires a focus on comprehensive Systems Engineering best practices. This is especially true in highly regulated industries such as aerospace and healthcare, where changes to product development can have wide-ranging impacts that must be taken into account. Organizational and cultural challenges are often more difficult to overcome than adopting new technologies.

A case in point is when a leading aerospace manufacturer wanted to reduce the number of expensive test flights required to resolve issues prior to delivering new airplanes to their airline customers. It required looking beyond the company's quality management system and taking a cross-functional team approach that actively involved multiple internal stakeholders as well as customer acceptance flight crews.

A Flight Improvement Team with systems engineers at its core gathered data on all recurring issues and dug into their root causes, identifying patterns across manufacturer quality, supplier quality, and engineering design problems. The systems engineers worked across organizational silos to help resolve the origins of the issues. At the same time, they developed a containment strategy to shield the flight line from continuing failures while waiting for resolutions to be implemented.

Over two years, test flights in excess of those mandated by the FAA for new aircraft delivery were reduced by 72%. This dramatic increase in production flight efficiency improved on-time customer delivery, enhanced customer satisfaction, bolstered brand equity, and saved tens of millions of dollars annually.

## What is Digital Innovation?

People are often unclear about the difference between digital transformation and digital innovation (DI). Digital transformation is the adoption of digital technologies in the enterprise to enhance the way a company does business. Conversely, digital innovation refers to tools, techniques, processes, and cultural changes used to accelerate and improve an organization's product development and delivery. It is a culture of continuous learning, bringing in ideas from the outside, being willing to try new things and possibly failing but recovering quickly, and giving everyone an opportunity to participate.

*DI is a culture of continuous learning, bringing in ideas from the outside, being willing to try new things and possibly failing but recovering quickly, and giving everyone an opportunity to participate.*

Although DI spans numerous areas within a company's development organization, including agile software development, security, data analytics, machine learning and artificial intelligence (AI), this paper will focus on DevOps and Systems Engineering.

Closely related, DevOps refers to the software domain of productization, whereas Systems Engineering deals more broadly with the overall product or project. The adoption of best practices in both of these domains has been proven to help accelerate product development.

The [Development Operations Research Association \(DORA\)](#) found that teams who adopt DevOps best practices deploy their code 46 times more frequently and as their skill levels increase, they can deploy more than 400 times faster than teams who don't. These high-performing teams also suffer one-fifth as many failures in deployment, and, when there is a failure, their mean time to recovery (MTTR) is 96 times faster. Consider the benefits to your business if your software developers could deliver code at these speeds and levels of reliability.

Teams that adopt DevOps best practices deploy their code

**46x** more frequently and  
**400x** faster

Companies that adopt best practices and digital innovation have

**20%** less failures  
in their deployment

And when they recover, their mean time to repair (MTTR) is

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Digital Innovation in Aerospace

## Aircraft Telemetry Platform-as-a-Service

### Objective

iJet Onboard wanted to develop a system that aggregates data across 1950s-era proprietary and disparate avionics systems to give their airline customers real-time monitoring, preventative maintenance, and predictive analytics capabilities.

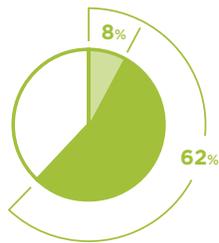
### Solution

The initial plan was to develop a series of discrete applications, but after discussions with a consulting firm that has extensive aerospace experience, the decision was made to create a modular, open software platform upon which applications can be built. The resulting solution is resilient to changes in avionics hardware and allows iJet's airline customers to easily integrate with third-party systems to capture real-time aircraft data. Within six months, the consulting firm had built a prototype running on a real system that could be demonstrated to customers.

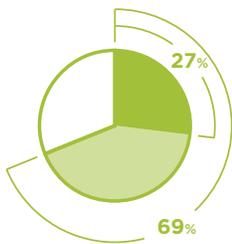
### Outcome

iJet Onboard's new platform is the aerospace industry's first open platform-as-a-service for aircraft telemetry. iJet can quickly spin up new applications; for example, they built a fuel analysis application in just 10 days that allowed an airline to evaluate the profit potential of various new routes. An application that connects to an engine's health system allows airlines to monitor data in real time, detect abnormalities, and identify problems that can be addressed with preemptive maintenance – saving money, avoiding delays, and protecting lives. An added benefit is that the IP created during the platform's development has become iJet's most valuable competitive edge.

In the Systems Engineering domain, product development initiatives that adopt SE best practices have a 62% likelihood of success, compared to 8% for those that don't, according to [research](#) from the Systems Engineering Institute (SEI) in collaboration with International Council on Systems Engineering (INCOSE) and other organizations. Inversely, those who don't adopt best practices have a 69% chance of failure compared to 27% for adopters.



The likelihood of success for companies who engage INCOSE best practices for product development increases from **8% to 62%**.



The inverse is also significant. The likelihood of failure decreases from **69% to 27%**.

## Why Adopt Digital Innovation?

Improving product development has real business value, from reducing operating costs to improving customer experiences, and digital innovation is a proven way to improve development processes and output.

Developers and systems engineers working in an environment of digital innovation are challenged and more satisfied with their work, leading to higher quality work and job satisfaction. Team members can focus more on creative solutions to problems and new features rather than time-consuming rework. Enthusiastic, engaged teams have more successful product outcomes than teams who operate in a more independent, isolated fashion.

Organizations that embrace DI realize many benefits:

- Increased agility and flexibility in bringing products to market
- Improved product development velocity
- Higher quality product development that results in more stable products
- More predictable, repeatable results

These benefits come together to generate a greater research and development Return on Investment (ROI) by achieving faster time to market, better quality, increased scale of delivery, more cost-effective tooling, and higher team engagement.

To get a clearer view of how DI best practices impact productivity, let's take a look at some examples of deficits that occur without it and surpluses that arise with it. First, the deficits:

### ⊖ Lack of executive sponsorship

The lack of executive sponsorship is one of the biggest contributors to a development project being deprioritized and/or not adequately funded. It is absolutely critical to get buy-in at the business leadership level so that there is agreement and understanding at all levels that the project is necessary and a priority. This leadership propagates a sense of shared vision that leads to alignment in project direction and has the added benefit of making team members feel valued. Projects that germinate at the individual or organic team level typically don't take hold without executive sponsorship.

### ⊖ Disjointed technology

Outdated legacy technologies are often fragmented, which makes it difficult to scale product development efforts. The longer a technology is entrenched in a company, the more expensive it becomes to replace or update it. By comparison, DI technologies such as containerized software are agile – designed to be swapped in and out so they can grow and change with the pace of your organization.

### ⊖ Skillset

The skills and capabilities of developers working with legacy technologies tend to be fragmented along with the technology. Developers are very skilled in their particular area of expertise, but are unlikely to be able to perform – or even understand – anyone else's job. As a result, they don't grow or learn new skills through training or interaction with other team members.

### ⊖ “Not invented here” mentality

This cultural mindset arises when an organization believes that if something wasn't created internally, then it's not worth adopting. This is the antithesis of the digital innovation culture of continuous learning, trying new things, and participation from everyone.

## Physician Dashboard for Better Patient Experiences

### Objective

US Healthworks Medical Group wanted to gain better insight into the waiting rooms and patient experiences of its nearly 200 locations across 17 states. They also wanted to monitor the quality of care provided by their 1,100 physicians.

### Solution

US Healthworks had begun using Business Intelligence (BI) to analyze care and satisfaction data to improve services and lower costs, but wanted to expand their capabilities. They turned to a Systems Engineering consulting firm to create a BI roadmap and develop an agile, innovative technical architecture. The result is a dashboard that allows managing physicians to view 17 Key Performance Indicators (KPIs) such as number of patient visits, visit durations, diagnoses made, and drugs prescribed so they can quickly detect trends and improve customer experiences. In just five months, the dashboard and a data warehouse that pulls in data from finance, marketing, and patient management were production-ready. Taking a phased approach provided an operational system in a matter of months, with an architecture that is easy to extend over time. KPIs can be refined or added as needed.

### Outcome

US Healthworks has improved its patient experiences, which translates into higher quality care and the ability to attract new patients. Being able to analyze KPIs and operational data helps them detect and respond quickly to changing patient and market trends.

Once digital innovation has been adopted, the deficits listed above can be turned around and become accelerators of project success that lead to productivity surpluses:

### **+ Built-in security**

Security is built in to new, modular technologies, providing higher quality and risk management without the need to invest endless man hours developing secure software.

### **+ Increased automation**

New development approaches make it easier to incorporate automation for tasks that previously required manual work or tedious development. Automation saves time and increases development velocity, flexibility, and quality.

### **+ Agility**

Because new DI technologies are designed for rapid, flexible development, they allow development teams to quickly experiment and try new approaches with relatively little risk. When problems do arise, finding a resolution is orders of magnitude faster than with traditional approaches.

### **+ Integrated team**

Probably the most important productivity surplus is the creation of integrated teams that span the organization, including operations, support, maintenance, sales and marketing. Representation from all groups drives product definitions that embody core requirements and the highest business priorities from the outset. This avoids the inevitable problems that arise when only one department defines the product or project.

## **— PRODUCTIVITY DEFICITS WITHOUT DIGITAL INNOVATION (DI)**

Lack of DI creates a drain on projects and decreases the likelihood of success

Drain	Realized Deficit
Lack of executive sponsorship	No financial support, deprioritized
Fragmented technology	Expensive, slow
Skillset	No growth, training
“Not Invented Here” mindset	Arrogance, ignorance

## **+ PRODUCTIVITY SURPLUSES WITH DIGITAL INNOVATION (DI)**

Successful DI creates accelerators for projects and increases the likelihood of success

Accelerators	Surpluses
Security built-in	Higher quality, risk management
Increased automation	Savings, velocity, flexibility, quality
Agility	Experimentation; risk mitigation
Integrated team (operations, support, test, sales, marketing)	Faster iterations; high quality

# Tools and Techniques

Within both DevOps and Systems Engineering, there are many best practices to help improve product development. For our purposes here, we will focus on four key areas that can help your DI initiative succeed: integrated product teams, product roadmaps, risk management, and microservices architecture.

## Integrated product teams

Cross-functional teams are vital to drive product definition, but creating such a team can be easier said than done. It takes considerable time and effort to determine who should be involved, and not everyone's voice can be heard all the time. It is important to appoint someone such as a product or project manager to act as the interface to all the stakeholders and to make sure team members are engaged in defining and steering the project.

## Product roadmaps

The product roadmap is one of the most important tools needed for a DI initiative to succeed. The roadmap documents the team's vision, requirements, goals, priorities, and the minimum viable product (MVP) definition. It becomes a single source of truth that the team can use to collectively move development forward. It also provides a framework for negotiation when, as inevitably happens, someone asks for new features to be added to the product. The roadmap sets out features and functionality that can be reviewed to determine what can come out in order to support the new request.

## Risk management

Organizations that are too risk adverse are unlikely to remain competitive. Companies should understand that risk is not failure, risk is planning. Each stakeholder involved in the project needs to know and understand the risks; whether they will impact development, delivery, and/or budget; and take ownership of mitigation plans. There are excellent Systems Engineering tools to help identify, score, manage, and communicate risks. Often what initially appears to be a problem can actually turn out to be an opportunity to make changes that improve outcomes.

## Microservices architecture

A very successful DevOps best practice is the use of microservices architecture. This allows a monolithic architecture to be broken down into a series of very small, self-contained services, each of which operates independently. They are typically implemented in a container-based environment such as Docker so that services can be easily swapped out. Using good architecture design practices where every interface is well-defined, these microservices should be able to be swapped out without cultural or technology friction. A microservice architecture is self-governing, meaning the development team defines features and release cadences that ideally do not impact other release cycles. In a DevOps best practice, the development environment should mirror the production environment, just at a smaller scale. Teams adopting this approach are able to push code to production faster and at a higher velocity.

*Companies should understand that risk is not failure, risk is planning.*

# A Word about Culture

Culture cannot be forced, and yet it is such an important aspect of a successful DI initiative that it's worth the effort to look at how your organization's culture can be improved. Quality is a perfect example of how a cultural change can dramatically improve product quality. Just like executive sponsorship of DI, leadership must make it clear from the outset that everyone is responsible for quality – not just the quality assurance team. This sense of ownership needs to permeate every person involved with the project, from developers and DevOps to test technicians and project managers. Developers need to keep quality in mind when they cut their code, which leads to fewer defects and fosters collaboration with the QA team.

Every contribution should be heard and valued, fostering an environment where people are not afraid to share or try new things and are able to learn and grow. With this mindset, all contributors care deeply about the outcomes.

At the same time, contributors need to be held accountable to deliver on their commitments to establish trust among the team. Leadership also needs to set reasonable goals to further the trust relationship. It is well documented that teams with a high degree of trust significantly outperform those who don't.

## How to Get Started

The first step toward adopting digital innovation is just to start! There will always be reasons why it's too difficult to get started, but the simple act of making the decision to start can make it happen. Once you've taken that first step, here are some principles and tips to help guide your initiative.

### STEP 1

#### **ASSESS YOUR SITUATION**

If you are not sure where you should focus your efforts, take advantage of tools such as the Software Engineering Institute Capability Maturity Model (SEI CMM), which will help you determine your organization's situation, what gaps exist, and what can be improved.

### STEP 2

#### **CONSIDER YOUR TEAM'S SKILLSET**

Determine whether you have the skills in-house to successfully implement DI methods and technologies and, if not, look to outside experts to help guide and accelerate adoption.

## Disruptive Life Sciences Cold Chain Logistics Platform

### **Objective**

BioLife Solutions wanted to develop a cloud-based app for managing cold chain shipments of high-value, time and temperature-sensitive personalized medicines.

### **Solution**

BioLife had the vision but needed outside product development expertise in regulated environments to match their market window. The result was a user-friendly SaaS cold chain application that integrates with smart shipping containers, generates excursion alerts and delivery notifications, and provides real-time tracking. It also includes a patent-pending shelf-life timer solution for supply chains handling time-sensitive shipments.

### **Outcome**

Precision medicines made up of live cells now have a much lower risk of in-transit cell damage from environmental conditions because of the app's real-time monitoring and recording capabilities. Drug developers have higher confidence levels in cell viability, and better compliance with emerging reimbursement models that are based on therapeutic efficacy and patient response.

### STEP 3

## MAKE A PLAN

Once you've determined where to focus your efforts, create a backlog, determine what your priorities are, and focus on the areas where you can achieve the greatest impact. It is often smart to start small by identifying a portion of a larger project where you can implement and prove the new approach before tackling a larger portion.

A perfect example of the difficulty of taking on too much at once comes from Boeing. The aerospace giant wanted to modernize its software distribution system, which still used floppy disks to load software into its airplanes. The company had worked for five years without success until they finally employed Systems Engineering and project management experts to come in and help. The team invested significant time up front to build trust, gain consensus on what was needed, and tease out the true story of what existed, regulatory requirements, and cross-company impacts of the project.

The SE team worked with their counterparts at Boeing to break the project into phases in order to contain the scope and demonstrate rapid success. Ultimately nearly 80% of the company's manufacturing and distribution processes were affected. What initially appeared to be a technology or manufacturing process challenge was equally a people and process alignment issue.

Within 18 months, the entire system had been overhauled. Airborne software is now online and downloaded to a laptop, which connects to aircraft or factory equipment anywhere in the world. By starting small and using SE best practices, the project proceeded swiftly and successfully. With the improved system, Boeing has improved operational efficiency and customer satisfaction.

### STEP 4

## OODA: OBSERVE, ORIENT, DECIDE, AND ACT

Determine where you are and what you have. Make a decision about what direction you want to head, and then do it. Afterwards, go back and do a retrospective on what worked and what didn't work. Incorporate this loop in order to learn from your mistakes and embrace a learning culture.

### STEP 5

## KEEP SIGHT OF YOUR BUSINESS GOALS

It's easy to get lost in details, so keep your business goals and objectives in mind as you make decisions. Ask whether a particular change or request supports those objectives. If it doesn't, add it to your backlog and reevaluate later to see if there is better alignment down the road.

### STEP 6

## GET EXECUTIVE SPONSORSHIP

Be proactive and establish executive sponsorship so that your team sees that this project is a priority at all levels. In turn, they will make it a priority. It's also important to make sure your team has the capacity to adopt these new ways of working. If they are already committed at full capacity to other things, they won't have time to engage and the initiative is likely to be unsuccessful.

### STEP 7

## ADOPT A LEARNING CULTURE

Give your team the time and resources they need to learn, and encourage a desire to pay it forward so they will teach others. Support classes, research, and other learning activities to allow your team to get ahead of the curve and share their knowledge.

# Tapping Outside Expertise

If previous attempts at digital innovation have stalled, or you have avoided undertaking the move to DI due to your team's lack of skills, choosing a partner with DevOps and Systems Engineering expertise can get the ball rolling. Experienced consultants can inject the right talent exactly where it's needed, and provide training for long-term success. For organizations in highly regulated industries, consultants with experience in those industries can help ensure that DI initiatives take regulatory requirements into account.

Successful consulting firms are made up of top talent that is well-versed in industry trends and the latest approaches in product development. Their deep bench of experts can provide innovative problem solving in engineering, project management, and technical services, helping create the process, technical, and cultural changes necessary for DI success. They also bring an impartial perspective that can make it easier to reach across organizational boundaries and take the bold actions often required for successful DI adoption.

# Achieving Success with DI

Adopting digital innovation can dramatically improve your product development lifecycle and reenergize your development teams. Using the principles and

*You will be able to accelerate the delivery of higher-quality products that delight customers, scale product delivery, reduce operating costs and elevate profits.*

guidelines outlined above – and being honest about your team's capabilities – you can successfully bring DI into your organization for measurable business results. You will be able to accelerate the delivery of higher-quality products that delight customers, scale product delivery, reduce operating costs and elevate profits. Engaging outside experts, particularly in highly regulated industries, can help ensure that your DI efforts take hold quickly and effectively, for more rapid ROI and long-term viability.



## ABOUT BASE2

Base2 assists companies in giving form to digital innovation and delivers the processes and practices needed to develop complex interconnected systems. We help companies solve challenging problems by taking a whole systems approach to designing and developing the technology, processes, security and Systems Engineering required for success. Companies across heavily regulated industries, such as aerospace, defense, transportation and medical devices, have utilized our expertise and best practices to speed up product development and accelerate time to market. To learn more about how Base2 helps drive digital innovation, please visit [www.base2s.com](http://www.base2s.com).