



How Lean Digital Manufacturing Enables Innovation in the Defense Industry

IN THE PAST TWO AND A HALF YEARS, AS MANUFACTURING COMPANIES IN THE DEFENSE SECTOR HAVE STRUGGLED TO COPE WITH UNPRECEDENTED CHALLENGES AND DISRUPTIONS, LEAN DIGITAL MANUFACTURING HAS GAINED PROMINENCE AS AN IDEAL METHOD TO SOLVE THE KINDS OF COMPLEX PROBLEMS AND DISRUPTIONS CAUSED BY THE PANDEMIC, THE WAR IN UKRAINE, AND OTHER WORLD EVENTS.

Connected technology and advanced automation are revolutionizing the industrial sector, and the defense industry is facing enormous pressure to keep up with the pace of [innovation](#). Recent industry research by Teksystems found that companies that invested in digital technology as part of their pandemic response realized a 12-percent higher return on their investments than companies still relying on [traditional systems](#).

Manufacturers in the defense sector would seem to be ideal candidates to join the technological revolution that many call [Industry 4.0](#), since efficiency, precision, speed, and coordination are critical in the design and manufacture of defense equipment and components. In addition, defense sector manufacturers face increasingly complex challenges in supporting products once deployed around the world.

That said, the defense sector also faces specific challenges that can cause hesitancy and slow adoption of new technologies. In particular, manufacturers in the defense sector operate under some of the strictest regulatory requirements in the world, especially when it comes to cybersecurity.

Supply chain problems are wreaking havoc on manufacturers in all industries. But supply chain interruptions are an even more significant concern for manufacturers in the defense industry because they could lead to security breaches, thus becoming matters of national or even international concern.

How Lean Digital Manufacturing Benefits Defense Contractors

Developed by Japanese automakers in the 1980s, Lean according to its simplest definition is a manufacturing system designed to eliminate unnecessary operational steps and reduce waste in labor, materials, and time. With the advent of advanced digitization in industrial settings, Lean is gaining new prominence thanks to its ideal suitability as a management system for complex systems. Lean's core benefits such as adaptability, resiliency, quality control, productivity, and strong ROI that are much needed in these challenging times.

The goal of Lean manufacturing is to achieve a stable and adaptable production cycle through which products move smoothly and without interruption from initial design to end-point sale or shipping. An important component is Lean's concept of continual flow, with steps introduced to identify and remove obstacles.

The Lean process can be outlined as:

- Identifying Value – Identify the product needed by the consumer and the exact steps needed to produce it.
- Mapping the Value Stream – Designing a process in a sequence of necessary steps. An important component of this is the removal of waste, which is defined as anything that does not add value to the product.
- Creating Flow – Identifying and removing obstacles for seamless process
- Establishing Pull – Working backwards from the final product or consumer demand to establish demand-driven production
- Seeking Perfection – Continuously scanning for opportunities to improve

Within the concept of waste reduction, there are seven common categories of waste:

1. Inventory – Products, components, and raw materials that require storage
2. Overproduction – Manufacturing capacity beyond what's needed
3. Overprocessing – Unnecessary use of technologies, equipment, and processes
4. Defects – Labor, materials and time used to produce unusable goods
5. Wait times – Time lags that delay fulfilling customer demand
6. Transport – Unnecessary transportation of materials across locations
7. Motion – moving workers or equipment in ways that don't add value

The intersection of Lean principles and digital technologies, known as Digital Lean, accelerates waste reduction with real-time visibility into the value stream. For example, Digital Lean eliminates waste due to defects by more precisely identifying the exact asset or step causing the problem. Digital Lean reduces waste due to wait times by simulating scenarios, identifying bottlenecks as they occur, rerouting production steps, and optimizing operations.

How Digitization Helps Manufacturers in the Defense Industry Succeed

As the global economy continues its halting reopening, more defense industry companies are pursuing the latest digital technologies to connect their machines, people and value streams and keep data flowing throughout the [chain](#).

[Industry research reveals](#) that many manufacturers in the defense and aerospace industry used the early phase of the pandemic to invest in digitization to obtain a more integrated view of and control over operations.

Companies positioning themselves as leaders in what is also known as the 4th Industrial Revolution are harnessing Big Data, AI and robotics, cloud computing, the Industrial Internet of Things (IIoT) Augmented and Virtual Reality (AR/VR) to enhance workplace safety, develop workforce skills training, and improve sustainability efforts, as well as increasing operational efficiency and optimizing production.

Predictions for 2022 and beyond suggest that those defense sector manufacturers that have not already done so, will now begin implementing smart factory initiatives, while those that have already started will now expand the roll-outs across their [enterprises](#).

Smart factories use sophisticated data collection and real-time intelligence to make well-informed and nimble decisions about products at every stage from conception through design, performance, and the test of consumer demand. Sensors, IoT, artificial intelligence (AI), and cloud computing enable predictive analytics and machine learning capabilities that allow for active forecasting and quick decision-making when data reveal the need to [pivot](#).

The goal is what is referred to as a “digital thread,” which tracks and connects a product’s end-to-end life cycle, extending from initial concept to final production. Real-time data and feedback collected throughout the process enable insights, decisions and actions to modify, streamline, and support production along the way. Industry 4.0 manufacturers can leverage the digital thread to shorten production time, cut costs, and most importantly become more adaptable in assessing and meeting the needs of purchasers and end users.

By enabling transparency, the latest digital technologies link all aspects of a defense or aerospace product to a chain of custody when there’s a need to identify the source of defects. Industry 4.0 technologies also help manufacturers assess the performance of products in the marketplace and integrate feedback obtained from sales and customer usage [data](#).

“Using cutting-edge digital tools within the Lean structure enables defense industry manufacturers to design, produce and maintain equipment, parts, components, and other products utilizing only the minimum required amount of resources,” says Seif Shieshakly, Co-Founder and Managing Partner of Four Principles.

Sustainability is an increasingly important focus in the defense and aerospace industries, as well as in related industries such as oil and gas, where companies are successfully using smart factory data to increase energy efficiency, enhance environmental protections, improve worksite safety, minimize environmental impacts, and reduce their carbon footprints.

At Saudi Aramco’s Uthmaniya Gas Plant, drones and wearable technology have helped protect workers while slashing inspection times by 90 percent while advanced robotics enable underwater inspection and leak detection at shallow water [pipelines](#).

Lastly, defense manufacturing is one of the most globalized industries in the world, and smart factories offer an integrated view of operations that enables companies to compare operations and make decisions across their global [structure](#).

“Services powered by digital technologies could prove the crucial differentiator for manufacturers in the defense industry, advancing customer and user engagement and driving new revenues,” says Mehdi Chelhi, Principal at Four Principles.

Lean Digital Success Story: BAE Systems

BAE Systems, the seventh largest defense manufacturer in the world, attributes its success to what the company calls its “culture of total performance,” which is based on a combination of Lean-Six Sigma management and Industry 4.0 digitization.

Founded in 1999 through a 7.7 billion merger of Marconi Engineering Systems and British Aerospace, BAE Systems has its four principal operations in the Kingdom of Saudi Arabia, Australia, the UK and the US. With a workforce of 90,000 people worldwide, BAE also has significant operations in Qatar, Oman, Turkey, and [India](#). Last year, BAE Systems expanded and reorganized its operations in Saudi Arabia to form one company, emphasizing its partnership with [Riyadh Wings](#).

For 25 years, BAE has utilized a combination of Lean manufacturing processes and Six Sigma methodologies - which the company terms Lean Sigma – to boost productivity, improve lead time, increase reliability, and improve customer satisfaction and demand while also positioning itself on the leading edge of [technological innovation](#).

Despite the economic turbulence of the past two years, a period in which many manufacturers have seen significant losses, BAE has increased revenues and profits year over year. In Qatar, 2021 also saw the success of BAE's development of the Typhoon and Hawk aircraft. The first Hawk flights took place in June 2021 and the first Typhoon flight took place in November 2021 with deliveries beginning in 2022.

Not satisfied just to be in the forefront of Lean digital manufacturing, in 2021 BAE positioned itself at the leading edge of Industry 4.0 with the construction of a Factory of the Future, a prototype connected intelligent factory designed to demonstrate how military aircraft could be built in the future. In collaboration with more than 40 companies and academic institutions, the project brings together specialists in data, robotics, 3D printing, and connectivity to create a state-of-the-art experimental hub to invent, research test new technologies and ways of working.

BAE's quest for innovation has also made the company a leading force in the field of advanced military GPS receivers and precision monitoring and the past six months have seen the company win hundreds of thousands of dollars' worth of new contracts in this area.

Lean Digital Manufacturing Cuts Obsolescence-Related Manufacturing Costs

As manufacturers of highly advanced, complex equipment, aerospace and defense companies face what McKinsey, in a recent report, called the "two speed" challenge. Much of the equipment they produce operates on a long lifecycle, which traditionally has required significant support for legacy parts. At the same time, high-tech components like microprocessors and semiconductors have a much shorter life cycle, leading components to become obsolete.

The problem is responsible for \$50 to \$70 million in aggregate costs, McKinsey estimates, as manufacturers must design replacements for these unavailable parts and components.

Digital lean manufacturers can save these millions by integrating internal data with external market-based information to create an alert system that predicts potential obsolescence issues and plans in-advance for solutions.

The Power of Partnerships in Lean Digital Transformation

While until a few years ago the Middle East lagged behind the United States and Europe in digital maturity, recent developments between global manufacturing and technology giants and their regional partners are rapidly harnessing the power of the 4th Industrial Revolution to drive digitization advances in the defense and security industries.

In 2019, Siemens opened The Digital Grid Center, a digitization hub in Abu Dhabi, to develop, test, and showcase digital energy solutions in collaboration with partners in the industrial, infrastructure, oil & gas, and [utility sectors](#). Siemens' regional investment in digitization also includes opening a series of MindSphere Application Centers in Saudi Arabia, UAE, and Egypt, that demonstrate the power of advanced analytics to solve [industry-specific challenges](#).

Lockheed Martin's defense incubator, the Center for Innovation and Security Solutions (CISS,) which opened in Masdar City in 2014, has pioneered numerous digital defense, security and technology-related solutions. Recent achievements of Lockheed Martin's UAE partnership include production of the F-16 Desert Falcon and [Black Hawk](#). In March, Lockheed Martin announced a \$1 million dollar investment in Saudi Arabia to support the expanded scope of its joint venture with the Saudi Arabian Military Industries (SAMI.)

Saudi Arabia's defense industry is growing rapidly through such global partnerships, as evidenced by the World Defense Show held in March 2022, which was sponsored by Saudi Arabia's General Authority for Military Industries (GAMI) and featured the participation of global defense industry leaders Boeing and [General Dynamics](#). In addition to Lockheed Martin.

Lean Digital transformation is the foundation of all this innovation, as highlighted by Lockheed Martin's announcement in January that it had chosen Siemens Xcelerator to be its digital platform for [future operations](#).

[Siemens Xcelerator](#) was likewise selected by Northrop Grumman, which has robust defense industry partnerships in Saudi Arabia and the UAE, including collaborations with King Saud University (KSU), King Abdullah University of Science and Technology (KAUST), the UAE Higher Colleges of Technology, and Abu Dhabi Autonomous Systems Investments (ADASI).

"The Defense industry is under intense pressure to modernize and become more productive and more collaborative," says Patrick Wiebusch, Co-Founder and Managing Partner at Four Principles. "Sophisticated digital solutions together with Lean management practices can help defense industry manufacturers embrace the complexity of the current landscape and innovate beyond the competition."

GET IN TOUCH

Should you be interested to know more about our Lean services regarding this topic, then please contact us:

Tel: +971 4 368 2124

Email: info@fourprinciples.com

UAE Office Address
Dubai Media City
Building 8
Office 212
P.O. Box 502621
Dubai, UAE

KSA Office Address
Office 2902
Olaya Towers (Tower B)
Riyadh 12213-8022
Wasel Building number 3074
Riyadh, Saudi Arabia