DIGITAL CONTINUITY: BUILDING THE CONNECTED ORGANIZATION

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INTRODUCTION: FOR A SUSTAINABLE APPROACH TO DIGITAL CONTINUITY

Digital continuity involves following the digital threads, or information flows, of an organization. Through this 'intelligent' information sharing and monitoring, Digital Continuity allows the company and its ecosystem to operate more efficiently.

Digital Continuity is the ability to break down barriers between technological domains and services within organizations, as well as the barriers between different companies in the value chain. The objective is to introduce a level of agility that will allow information to be traced, understood, and modified for many applications within the company and its ecosystem. This decompartmentalization requires a standardization of methods, processes, and modeling tools - something that is not yet a reality in many organizations.

The challenges come from various fronts. We need to ensure connectivity between disparate data and systems. And we need to reevaluate our data tools - for example, will the PLM-MES-ERP (Product Lifecycle Management, Manufacturing Execution System, Enterprise Resource Planning) triptych still make sense in the coming years? Historically these tools were built in silos, and connectivity was not the top priority. Now connectivity is key.

Then we must deal with the sheer volume of data that exists in these digital platforms. Is this data useful? Is it necessary? At what granularity should it be shared between organizations?

Answering these questions should help us identify what is important in developing an effective, but less resource-intensive Digital Continuity program.

In this piece, we'll discuss what Digital Continuity is, how it works, why it is important in the new era of sustainability, and how to create it in your own company.

JACQUES BACRY
Executive Vice President – Digital Continuity & Convergence Group Offer Leader

1. UNDERSTANDING THE ROLE OF DIGITAL CONTINUITY

Digital Continuity is about bringing different systems together to provide a joined-up view of products or processes throughout their lifecycle. This is not just an IT issue, but a profound business transformation.

Following the 2020 global pandemic, the industrial world has undergone a major transformation – affecting the entire value chain from suppliers to resellers. Meanwhile, users of products expect more personalization and higher performance, with user experience and ease of maintenance being just as important as technical performance. Sustainability expectations have also grown, as companies and individuals aim to reduce their carbon footprint.

To respond to these challenges, the industrial cycle must reinvent itself, moving from a linear and siloed operation to a collaborative one.

Traditionally, engineers designed, the supply chain delivered parts, manufacturers made, and salespeople sold. Now, designers need to factor in the views of salespeople and supply chain limitations, and routinely update manufacturers, in a fluid environment. Such digital collaboration will enable co-design; and optimize end-to-end processes from engineering, manufacturing, supply chain, and customer service. This will ultimately mean better products, and allow a better return on investments.

Where does Digital Continuity come in?

Digital Continuity starts by answering the question: What do we want to produce?

We then need to define the data to be collected, the sources of that data, and the company functions that need to be coordinated, and the partners that need to be sought.

These will be heavily determined by two things: variability and volume. The variation between two products (eg. a fishing boat and a yacht) and the volume to be produced (eg. one rocket or many cars) will significantly dictate the data we need and the sources of that data, eg. an Enterprise Resource Planning (ERP), Product Lifecycle Management (PLM), or a Customer Relationship Management (CRM) system.

Digital Continuity forces the prioritization of the systems that need to be implemented - and then thinks about how to connect them.

Ultimately, Digital Continuity is a methodological approach based on change management. The goal is clear: reduce cycle times - by 20, 30, or even 50%.

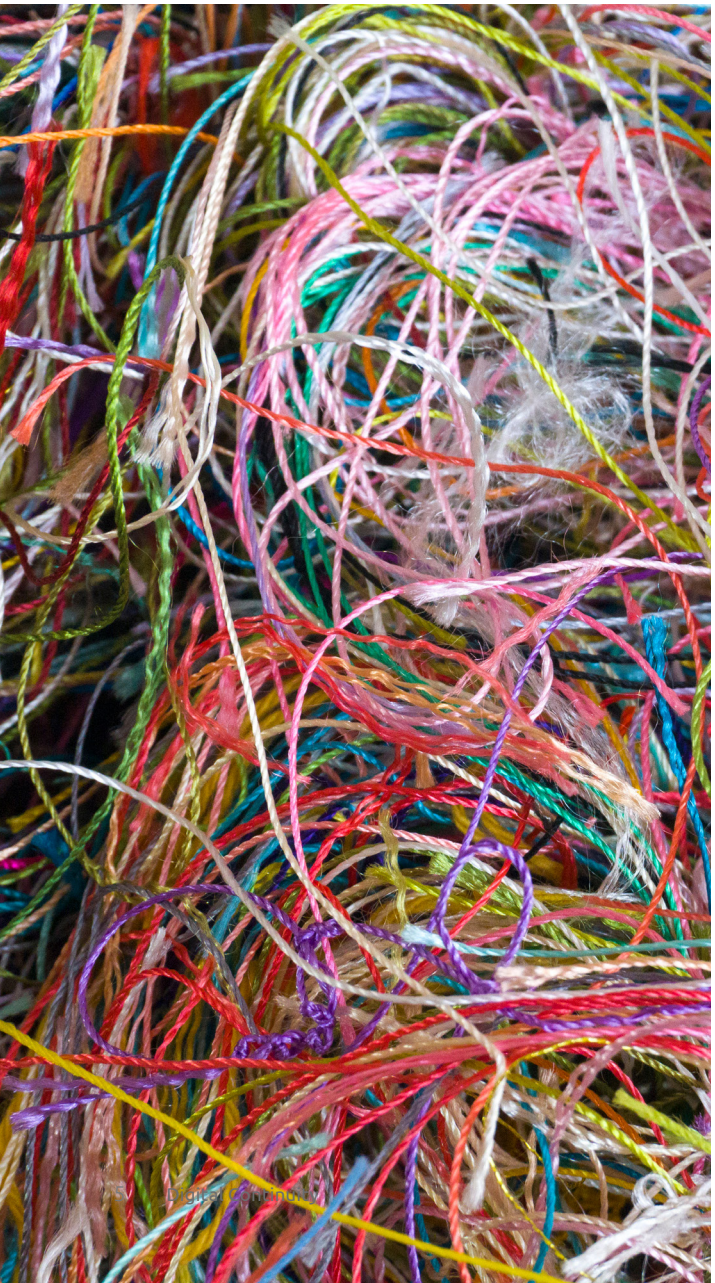
Digital continuity's constituent parts

At the technological level, Digital Continuity is about the connection between different platforms around shared databases.

This involves a mastery of each system to maximize the potential of each. Then, they need to be appropriately connected to provide a global view of the product and company to all users. 'Appropriate' is the key word, this is not about 'connecting everything', but identifying how connections can produce value. This needs not just IT skills, but a well governed process that brings together the stakeholders who will use the system.

Some of Digital Continuity's benefits

- Simulation of the final product, by integrating data from different systems into a single system
- The smooth integration of subsystem designs by different teams into the overall design
- The direct integration of macro-level interdependencies, eg. integrating fixed and mobile equipment with products, assets, the factory plan, etc.
- Improved integration between software and connected hardware
- Improved inventory management
- Working more closely and efficiently with subcontractors and suppliers
- Designing and optimizing for environmental requirements



Why is Digital Continuity complicated to implement?

Historically perceived as a pure IT project, Digital Continuity initiatives within businesses often collide with financial and technical realities, power balances, and organizational structures.

Indeed, it is difficult (or impossible) to set up unified data lakes when machine connectivity is limited, and available data is unstructured. It's also difficult to carry out cross-functional projects when different functions are structured in airtight silos within companies and where the culture of collaboration is weak, and where collective and individual objectives are insufficiently aligned.

The effectiveness of Digital Continuity projects lies both in an understanding of the different platforms, and of the business. It is helped by understanding what can be achieved, for example, by studying other sectors that are further ahead.

Moreover, the role of teams and the human element is too often underestimated. Because addressing digital discontinuities requires us to stop thinking locally, to start thinking globally, and that can be a complete paradigm shift for people. Engineers must shift from making the best technically possible system, to making a system that allows for the best possible overall product - possibly at the expense of the subsystem. That can be a hard mindset to change.

Digital Continuity is, then, a cultural change as much as a technological one.

Author JACQUES BACRY Executive Vice President – Digital Continuity & Convergence Group Offer Leader

2. DIGITAL CONTINUITY: WHERE TO START

Digital Continuity is a natural evolution of the company's internal infrastructure and processes, to allow information to flow more freely, but may require a revolution at your company to deliver. It is a transformation project that must be thought out in advance.

Seek first to understand

Start with the company strategy. For example, if a company wants to reduce cycle time by 40%, how can Digital Continuity help achieve this goal? Start there, and then work out what technologies will help you bring the information together in order to deliver it.

Define the main barriers to digital continuity

Once you have identified the future goals you want to achieve, map out the different platforms needed to achieve it and the blockers to information flows – what we call points of 'digital discontinuity'.

This helps to identify early on what is (and isn't) essential. For example, integrating a small local supplier of a non-critical part, whose IT systems are a bit out of date, into your digital system might not be worth the effort. But, where a dozen critical pieces come from four different countries, all speaking different languages, joined-up data tools to track and manage the supplies will be far more critical.

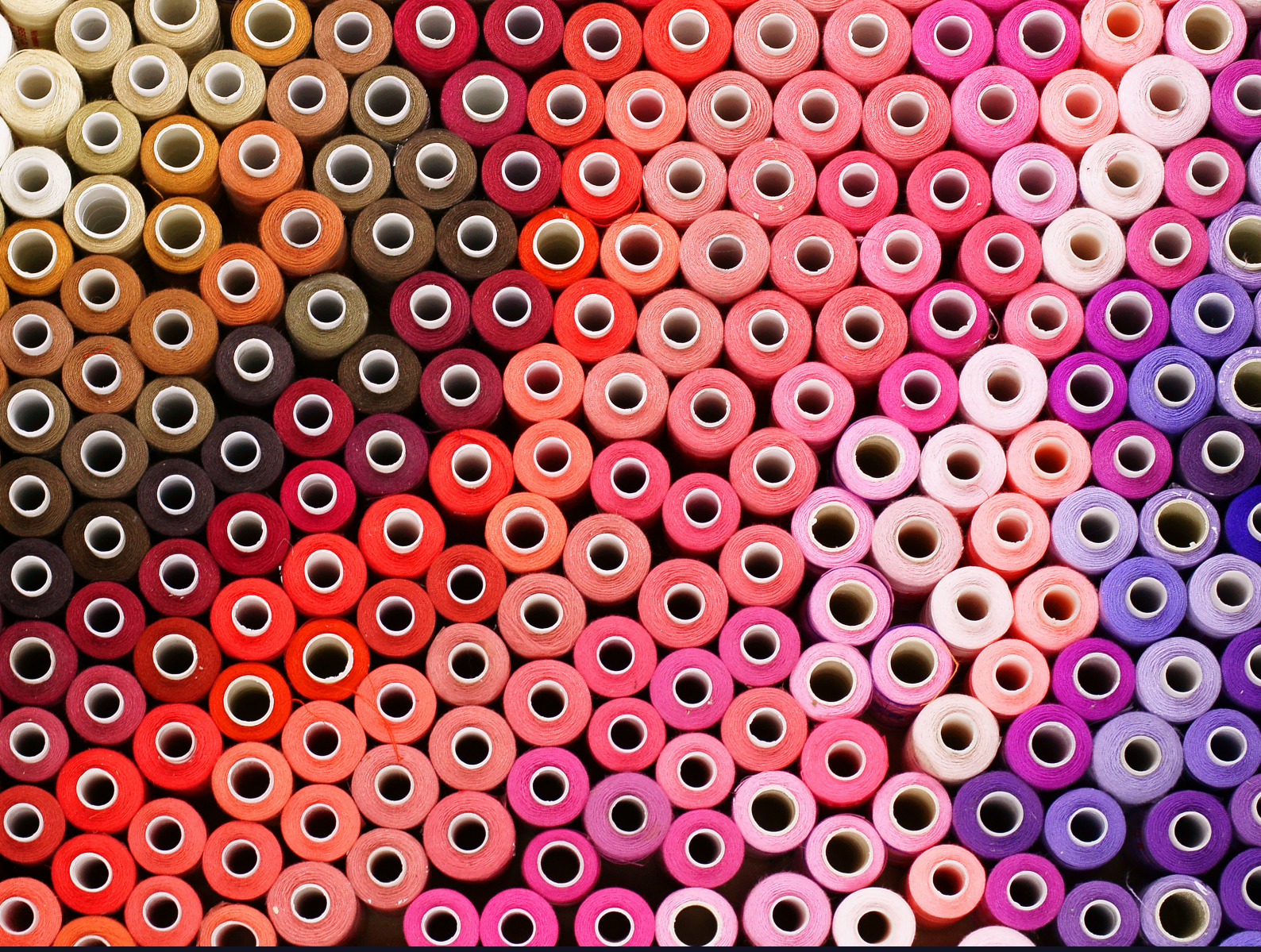
Identify early quick win projects with added value

As with any transformation project, it is wise to quickly onboard as many relevant stakeholders as possible. To do this, we start with major systemic cross-cutting issues that impact a large number of people and identify quick win projects to validate value creation in a short time.

These quick win projects must be easily deployable, for example:

- They focus on easily controlled and clear environments
- They involve smaller teams and/or teams that already use collaborative practices
- They benefit from the support of an internal leader, an identified innovator and/or one with recognized political weight and motivational leadership

One of the most effective approaches is a use-case incubation model, similar to the startup approach to managing a Proof of Concept (POC): test >> get feedback >> fail fast >> learn >> adapt >> deploy >> accelerate



Remember the importance of change management

In parallel, focus must be placed on internal cultural change. This must be supported by management, and deployed at different levels to overcome the organization's natural resistance to change. This can include:

- Collaboration and feedback, at all levels
- Support for teams implementing the project, as deployment can be complex to grasp
- A standard change process for middle management
- Individual and/or team coaching to overcome the obstacles and concerns
- A dedicated onboarding program for senior management to evolve the internal culture

Digital continuity: by the people, for the people

The collaboration required by Digital Continuity should create a company culture which values trust and accountability, risk-taking and working in ecosystems. This requires a real analysis of skills and an adaptation of the training path - so that employees don't feel like the expertise they've built up over their careers is no longer useful in the new environment of Digital Continuity you are building.

Author PIERRE-ANDRÉ VANDELLE, MBSE Offer Leader, Capgemini Engineering

3. EXTENDING COLLABORATION THROUGH DIGITAL CONTINUITY

Digital transformation is a marathon, not a sprint, and will require collaboration to overcome legacy technology challenges.

In Europe in particular, there is often an inherited technological debt (machines, systems, platforms, etc.) that can act as a brake on change. This must be taken into account just as much as delays caused by human behavior.

'Platformization' and 'big data' are recent buzzwords to the general public, but are old news in the context of the industrial environment. MRP, ERP and MES are over 30 years old. The first PLM suites are over 20 years old. That has led to lots of disparate data and systems that were never designed to be completely joined up.

The level of Digital Continuity between industrial companies and their suppliers varies a lot, both between companies and along the supply chain. Major tier 1 contractors are usually well ahead of tier 2 and 3 suppliers in terms of their digital capabilities and IT/OT infrastructure. Nonetheless, companies at all levels are taking this seriously and developing IT/OT strategies to create greater digital continuity and reap the rewards (improved quality, reduced cycle time, etc.) that come with it.

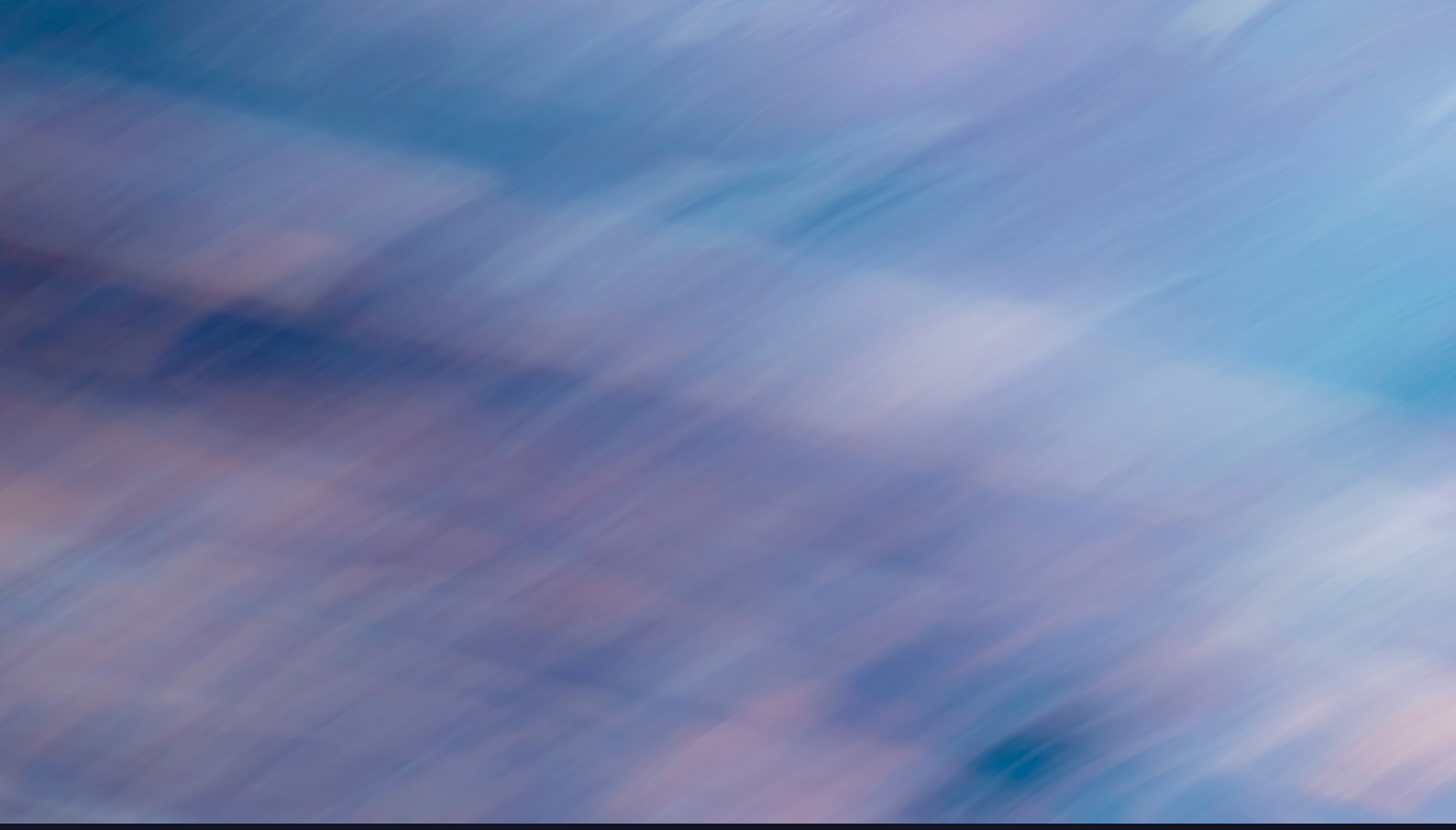
At the same time, these firms are becoming more and more aware of the tremendous opportunities represented by Digital Continuity when combined with other maturing technologies, like Digital Twins and AI.

Technology and trends

To date, we have observed two major trends:

- A drive by certain sectors to analyze digital discontinuities – points where information does not flow adequately for your desired use cases – and assess which are priorities for intervention, mainly in a manufacturing context
- Renewed attention among more advanced players on the links between manufacturing and upstream phases, between system engineering and product engineering, or even for a range of products sharing components or technical platforms

In both cases, Digital Continuity facilitates information exchange and process efficiency, by replacing the existing time, energy and resource intensive information transfer processes that cause errors.



Among more mature organizations, there is also an effort to preserve data on the histories of different versions/generations of products to gain greater insight. For example, Airbus began deploying a global PLM for the A350 ten years ago. Companies also increasingly seek to gain depth by improving exchanges with upstream partners, beyond tier 1.

Digital Continuity facilitates better collaboration, in order to further reduce cycle times, improve the adaptability of the entire chain and meet the expectations of ramp up in certain sectors (aerospace and defense particularly, in 2024 and beyond).

Big vs. small

However, small and medium-sized enterprises may face issues of cost, as well as the complexity of operating and maintaining Digital Continuity technologies. Cloud offerings from the hyperscalers should improve the situation - allowing SMEs to overcome some of the complexity of administering their solutions, whilst reducing hardware and software costs.

Newer players tend to integrate Digital Continuity natively. The absence of “legacy” tech can help companies take advantage of more recent technologies. This is the case for new entrants in electric vehicles or NewSpace. In the past, car and rocket manufacturers could rely on their size and capital to outcompete new competitors, but recent history has challenged this trend.

Author NICOLAS CROUÉ Vice-President, CTO Digital Continuity Capgemini Engineering

4. STRENGTHENING INDUSTRIAL CYBERSECURITY

In all sectors, the challenge of cybersecurity intensifies as connectivity increases. This is also true in the industrial field.

For several years, industrial systems have been targeted by attacks that fall into two main categories.

- Those from major institutional or state actors, targeting networks in critical industries - on the model of STUXNET, malware used to target control systems of nuclear power plants.
- Those from hackers, groups or individuals, using ransomware to block information systems pending payment of a ransom, with potentially catastrophic economic consequences and reputational risk.

Given the evolving geopolitical context, this challenge is paramount for Critical National Infrastructure (CNI) and companies concerned by the Network & Information Security Directive (NIS2) at the European level. CNIs like energy, nuclear, aeronautics, and utilities historically benefit from a culture of computer security, further reinforced by regulatory obligations and close cooperation with nation states.

Much as we approach Digital Continuity globally - in terms of the identification, analysis, and prioritization of discontinuity points according to their potential impacts - it's also essential to consider cybersecurity globally, pursuing deeper analysis in order to secure, intercept, and discourage.

Cybersecurity: what to do

To be effective, some simple points must be understood by industrial companies and the organizations that support them:

1. Before implementing a defensive system, it's first necessary to know what you want to defend. This involves precise physical and functional inventories of all assets to be protected, in order to categorize the criticality levels of systems.
2. Just as we cannot eliminate all blockers to digital continuity, it's probably impossible to protect everything, due to the sheer costs. As such, we must choose where to focus, through risk analyses, by studying the likelihood and potential impact, in order to construct an optimized roadmap of the protective measures to be implemented.

3. We then manage the deployment by:
    - Securing physical networks according to a principle of impermeability
    - Securing the machines themselves (eg. disabling USB ports)
    - Managing access to systems
4. Implement real-time vigilance - with dedicated monitoring and an immediate response team.
5. This process must be followed for all new machines, systems, updates, etc. And it must have management sponsorship, so that it is not seen as an 'IT project'.

Digital Continuity projects are good opportunities to revisit computer security, as cyber risk must be integrated 'by design' into the Digital Continuity process. As with Digital Continuity, cyber risk must include initiatives that concern the company culture - because risk often comes from humans. It must also concern the extended enterprise, the company's ecosystem, and subcontractors.

The big question

The cyber challenge becomes more complex as connections multiply, sensors are added and links are created. This dimension must be taken into account from the outset of Digital Continuity projects by asking (and answering) a simple question: How will the actions and connections necessary to address this point of digital discontinuity impact cyber risk?

Author DIDIER APPELL, OT/IoT Cybersecurity Global Offer Leader

5. DIGITAL CONTINUITY IN THE ERA OF SUSTAINABILITY

Integrating the Sustainable Development Goals has become a major challenge for all industrial sectors. Aerospace, automotive, energy, consumer goods - all are scrutinized, at least in part, on their societal and environmental impacts. Each sector must now transform quickly enough to meet these new demands. Digital Continuity will be a major driver of change.

The early 2023 publication of the Intergovernmental Panel on Climate Change (IPCC) report is just one of many urgent reminders to integrate these sustainability objectives into organizations.

The demand for sustainability adds an extra layer of complexity for companies, generating stronger interdependencies for products and services around energy performance, carbon footprint, repairability and recyclability - not to mention the multiple social and societal dimensions of their design, manufacturing, delivery to the end user, repair/maintenance, and end-of-life management.

This increasingly sustainable world drives industrial and product performance towards low environmental impact. Some sustainability approaches are integral, due to companies' CSR commitments (eg. waste management) or because they are directly linked to operational performance (eg. optimizing energy consumption).

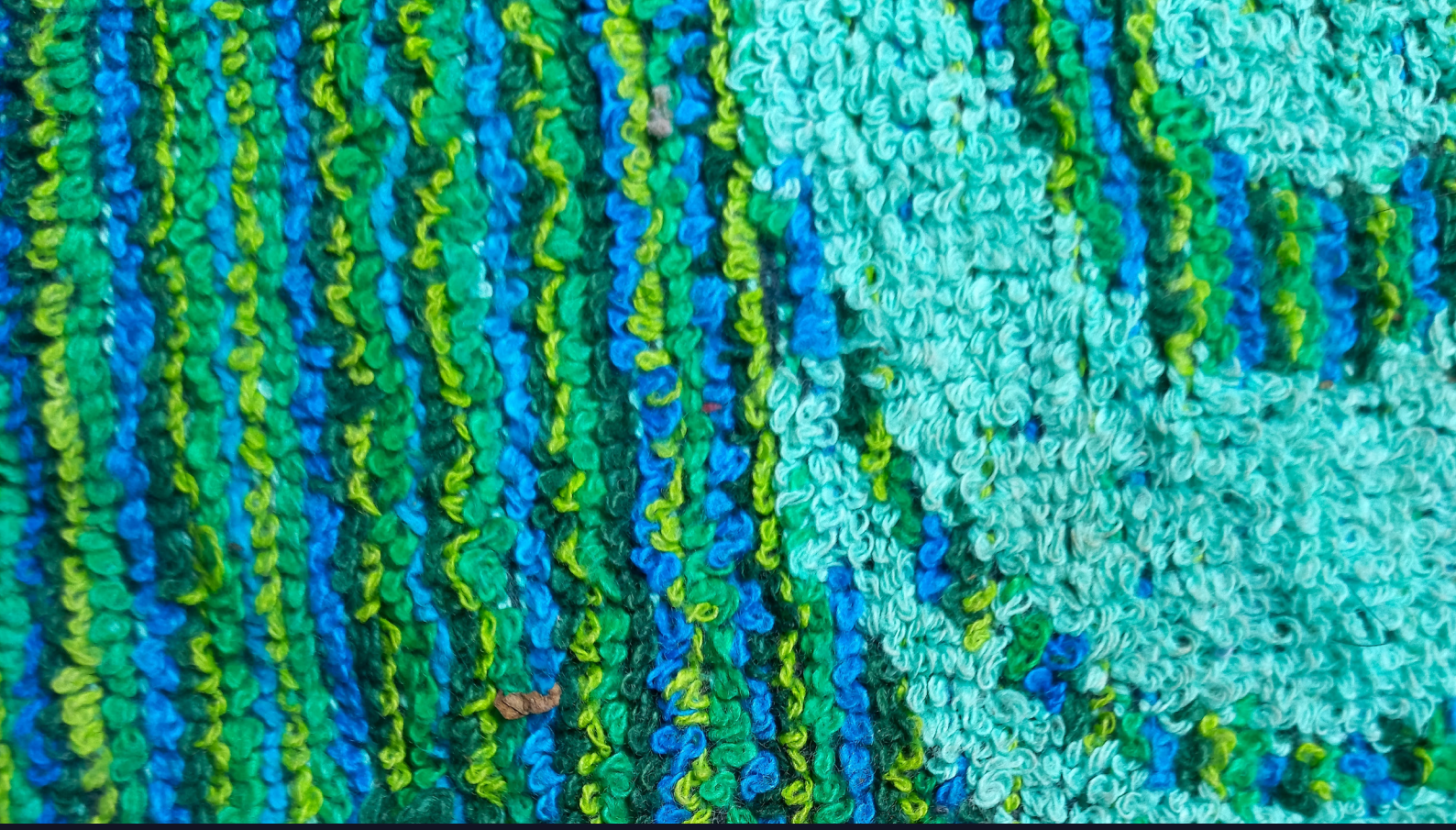
As with digitalization, long program cycle times can mean important measures are delayed until the next industrial cycle, which in some industries is many years away. New regulatory frameworks will compress this timeframe - forcing companies to prove their resilience to the effects of climate change and adapt to major socio-economic transitions (eg. a ban on sales of new internal combustion engine vehicles by 2035).

A strategic challenge for tomorrow?

The magnitude of the transformations to be accomplished is such that many organizations must entirely rethink their function. Designing and manufacturing a sustainable product can mean an end to incremental changes, instead requiring some businesses to reconsider their entire ecosystem.

For example, upheavals related to the use of new energy sources may require us to overhaul sectors (sometimes entirely) and reposition actors in new value chains. This also involves setting up dozens of new indicators, with reliable measurement, accountable to third parties.

Real-time compliance verification at each stage of a product or process's life is necessary to ensure all suppliers are involved in this approach. More broadly, eco-responsibility must be a pillar of the company's brand, in order to recruit and retain young engineers seeking meaningful work and wanting to be part of the solution.



The necessity of data

The need to quickly explore new approaches (and the corresponding need for rapid simulation) means that only digital technologies can manage the complexity of change (human, financial, operational). They alone can mobilize data that is clean, organized, reliable, and sharable.

Mastering data is increasingly important, as this data becomes proof that must be authenticated to both customers and auditors. The value of data; its relevance, its storage in significant volumes, and its exploitation, will become a strategic challenge. And the integrity of this data will become an increasingly important contractual issue.

As mentioned, in this era of sustainability, notions of eco-responsibility, carbon impact, and resource consumption must translate into contextualized and relevant metrics - before becoming actions and behavioral evolutions at all levels within the organization. Taking a broader view is essential - not only to observe the data, but also the data's interconnections. Thanks to Digital Continuity, this broader perspective is now achievable.

The role of Digital Continuity in sustainability

The major advantage of Digital Continuity is that it introduces objectivity to areas where it may have been lacking. For example, it can calculate the overall carbon cost of a product throughout the value chain, by seeking objective elements at all stages of its life.

Digital Continuity operates in the fields of virtualization, simulation, integration (of platforms, systems, software, and hardware) and connectivity - touching multiple points of highly sensitive information. It can thus only be delivered in a highly cyber secure environment.

When amplified by the power of digital twins, Digital Continuity has major potential for delivering sustainability goals. They will be able to enrich their simulation capabilities and aim for:

- **An integration of PLM + ERP + LCA to redefine design principles;** decreasing inconsistency, revisiting process/design faults that cause losses and increasing overall efficiency
- **Reducing the risk of defects,** thus extending product lifespans
- **Revising production cycles** for less material waste and better resource use
- **Integrating environmental data from production as a product design factor**, for example, simplifying design can reduce manufacturing time, and thus energy consumption

If stakeholders understand its power, and extend its scope, Digital Continuity can support industrial environmental goals. In closing, we reiterate that Digital Continuity is about global transformation. It's a tool to support the entire industrial organization, a true companion to global industrial performance.

Author Thomas Bachellerie, Manufacturing & Process Engineering Unit Director, Capgemini Engineering

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Capgemini Research Institute Report - Digital Twins, adding intelligence to the real world

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Digital continuity strengthens customer service

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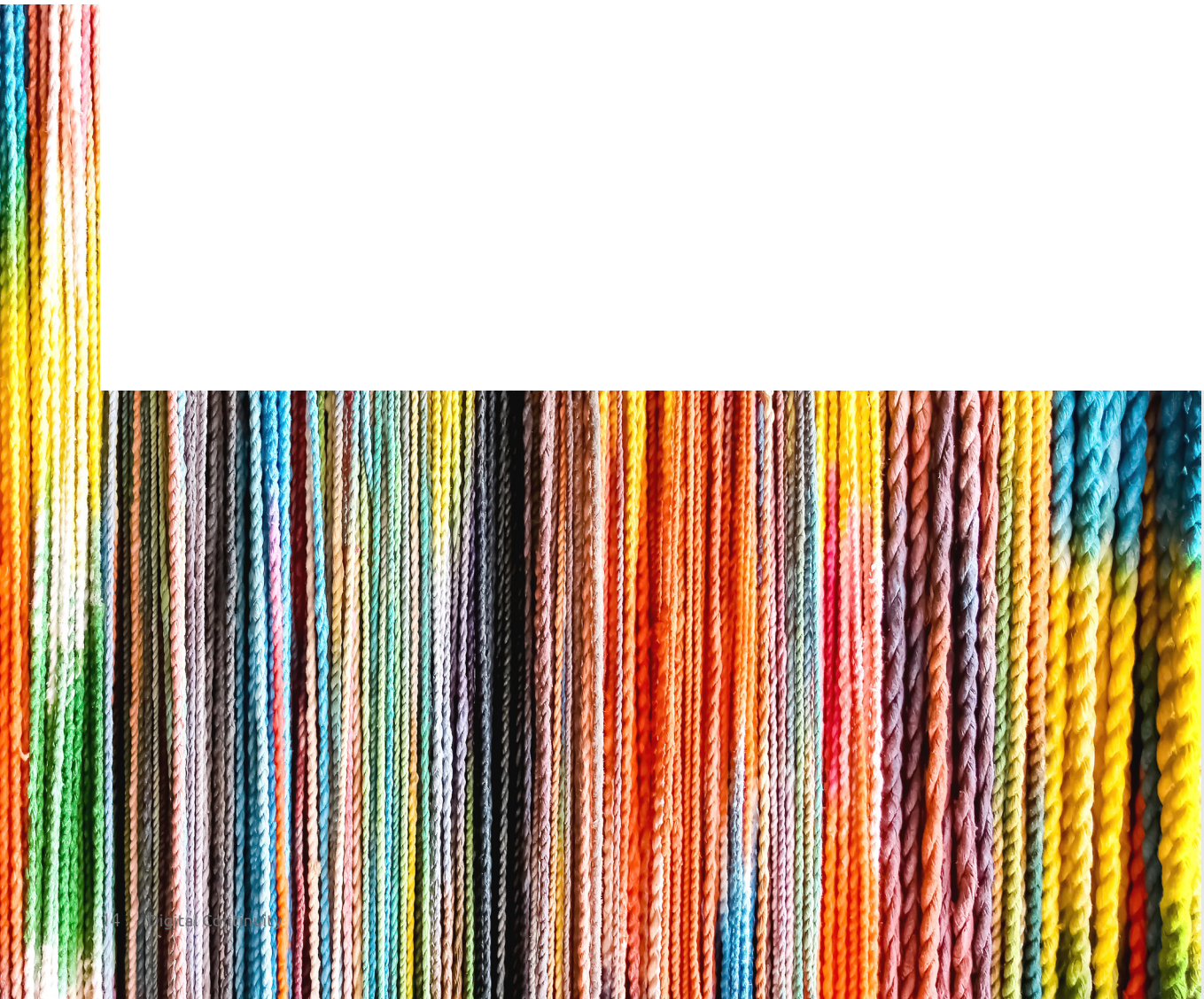
The great convergence of data: why is Digital Continuity essential to the aerospace and defense industry?

Introducing Intelligent Industry Security



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