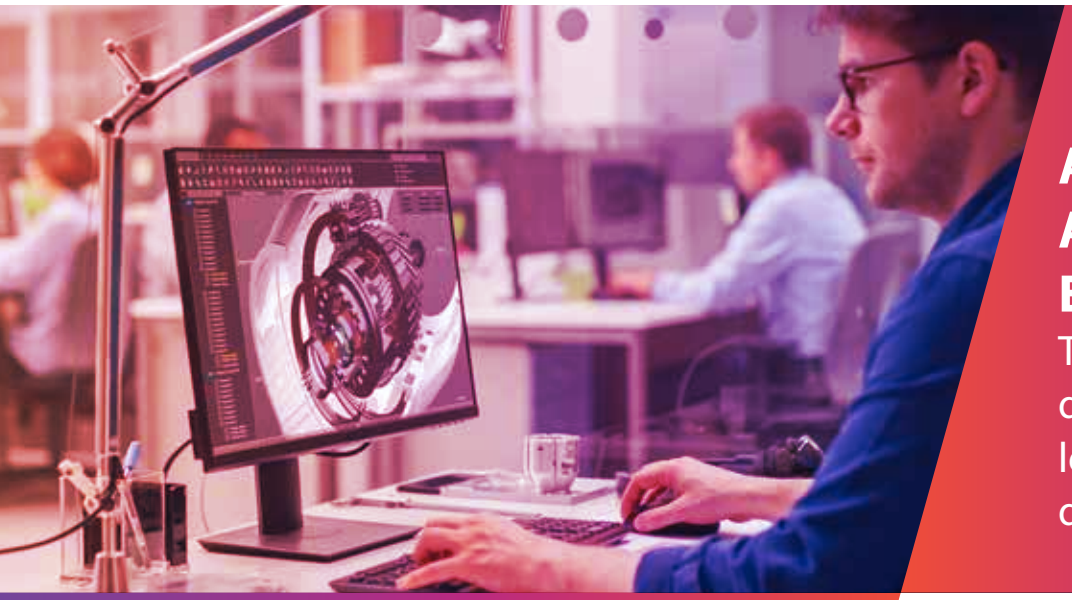

Accelerating Automotive Product Engineering

Taking product development to the next level by blending IT and digital solutions

WHITE PAPER

Abstract

Product engineering as a function is increasingly finding itself becoming an innovation and value delivery process for automotive manufacturing organizations. A digitally mature organization with a strong focus on a collaborative IT operating model can transform product engineering on its head - enabling successful product launch and sustenance. Combining the strength of digital technologies and the IT function, automotive original equipment manufacturers (OEMs) can develop more innovative products faster while simultaneously lowering overall product cost. This combination can help OEMs offer enhanced product design and development, reliable verification and validation, and robust product information management.

This paper outlines the key drivers for a new operational IT model along with the business challenges faced across the above-listed functional areas in product engineering. It also provides recommendations for digital solutions and examines their applications within a business context by the IT function.

Mastering product complexity with a digital-led engineering approach

The quantum shift in the role of IT, rapidly changing business ecosystems, and the increasing use of digital assets are transforming the way organizations are developing products. These changing paradigms have mandated manufacturing organizations to adopt a mindset that not only sees the IT function as an innovation partner in its growth and transformation but also sees digital assets and capabilities as the 'new balance sheet'. Figure 1 depicts the key tenets and drivers that will shape collaborative IT models.

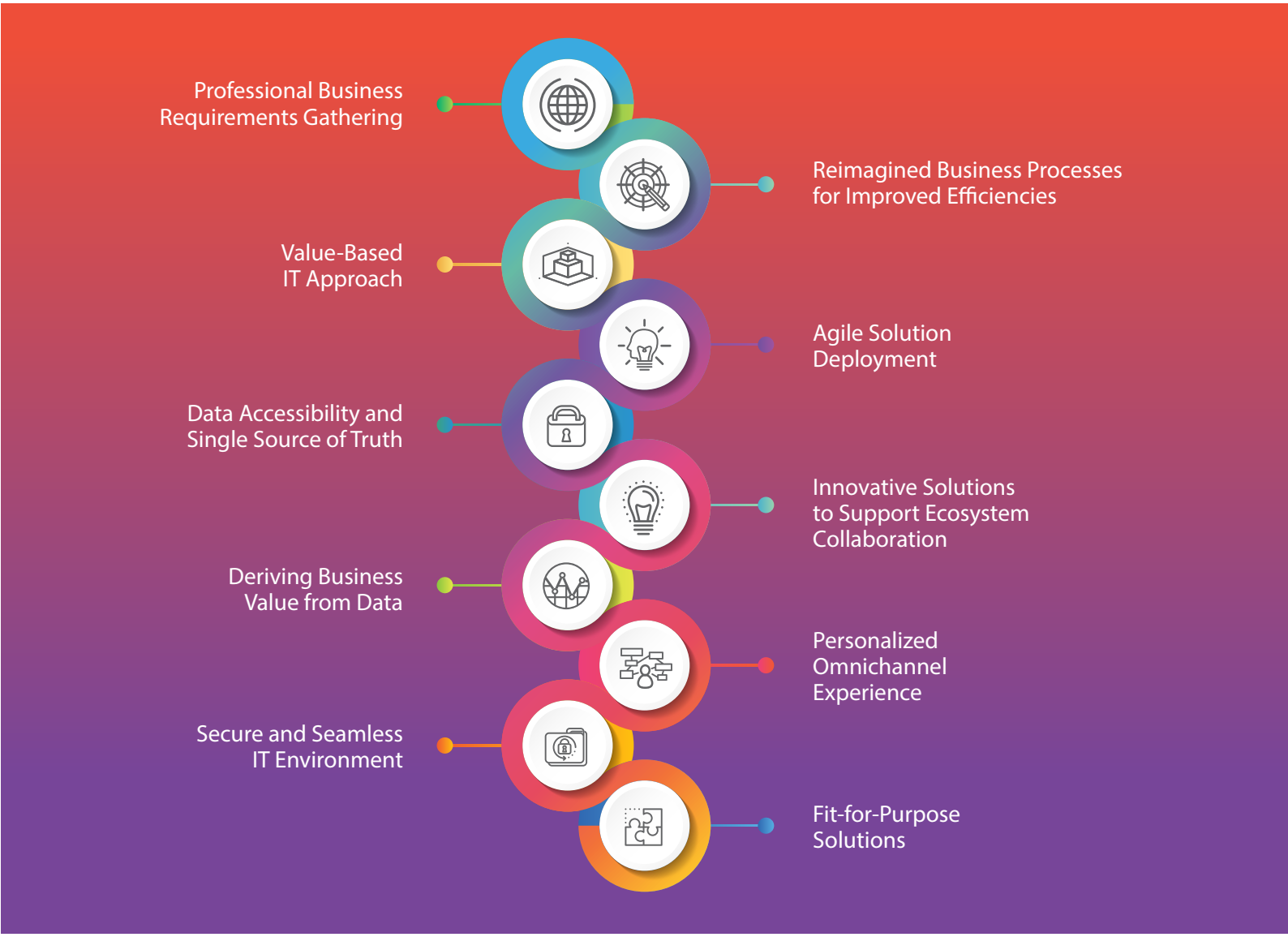

Figure 1: Key tenets and drivers of the new IT operational model

In line with the Neural Manufacturing thought leadership framework, building a successful innovative product requires an intensely networked set of collaborative partners aligned to a purpose-driven ecosystem. With digital technologies, product developers can make the entire product lifecycle management responsive, adaptive, and resilient while driving their business agenda. The blend of digital technologies and IT will transform the high potential business areas across the three product engineering functions, as illustrated in Figure 2 below:

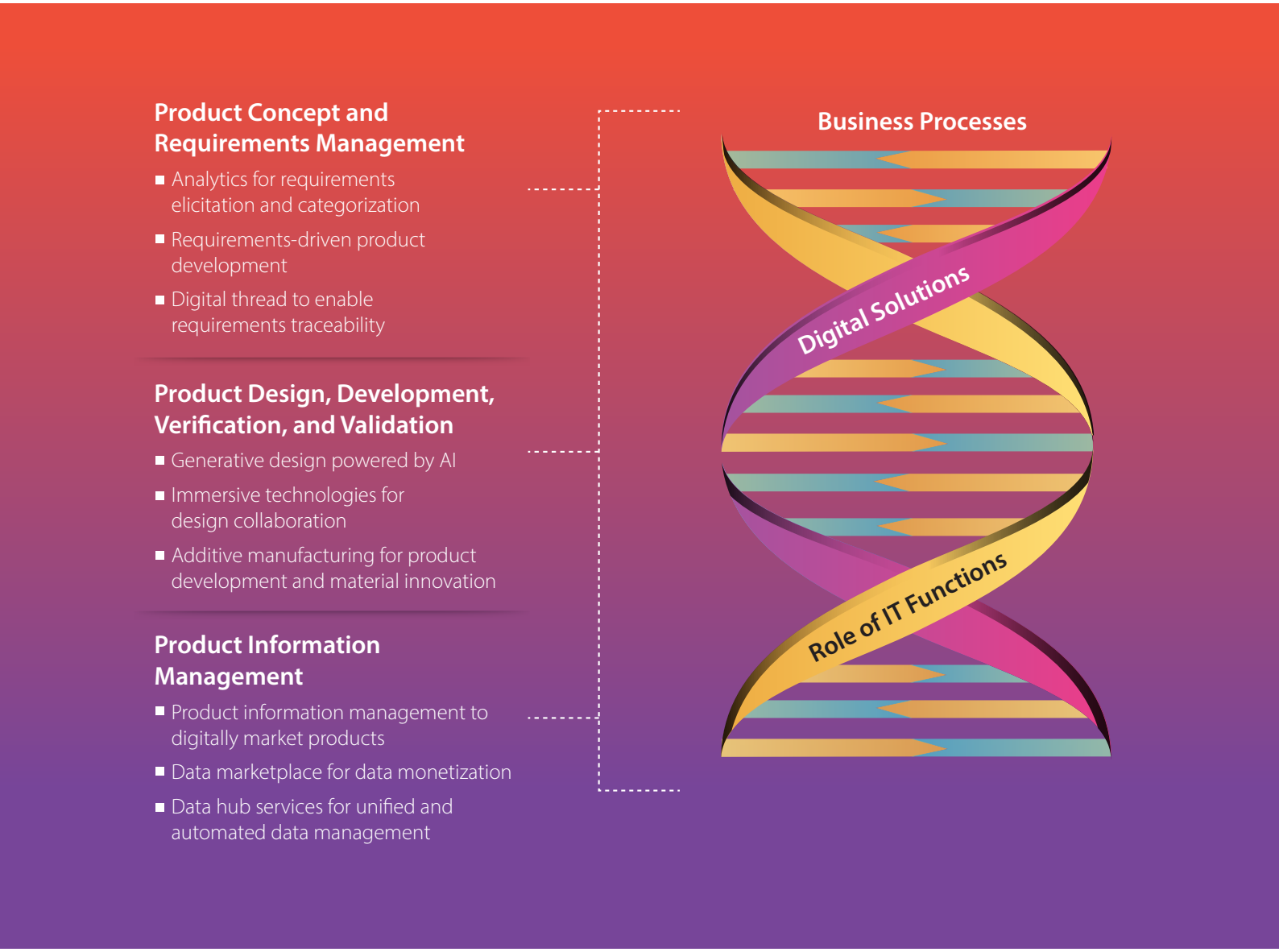

Figure 2: The DNA of successful product engineering transformation

Product concept and requirements management: An analytical-driven model

Increasing demand for autonomous and connected products, increasing product complexity, and ever-increasing costs are pushing product development limits, creating a need to improve product reliability and compliance. However, delayed changes to product definition, unwieldy integration, and lack of traceability of functional requirements hamper how products are defined and their requirements managed while increasing product cost. A digital solution underpinned by an analytical model supporting text analytics enables classification and categorization of requirements. This helps build a library of requirements based on the requirement category, in turn streamlining downstream processes, and facilitating concurrent engineering across vehicle lines and variants for increasing design reuse.

Moreover, standardizing requirements definition across different systems can provide an organization access to a common requirements library at the time of authoring. Organizations can also integrate product requirements across different systems under a common unified model as an aggregation layer with flexible application programming interfaces (APIs) for users to access the right data.

In addition, decomposing requirements for a model-based system engineering approach – requirements, functional, logical, and physical – can improve requirements traceability across the product lifecycle stages by enabling close collaboration among the various engineering disciplines.

Building a high-performance product with artificial intelligence

Much of product launch delays result from newer product complexity, poor collaboration between business and IT, improper adoption of both concurrent engineering methodologies and design for manufacturing and assembly (DFMA), service, and design for excellence (DfX) methodologies. For instance, it is a challenge to seamlessly adopt new electric and hybrid vehicle product strategies into an organization's product portfolio

planning without having established engineering practices, a view of the IT roadmap, and digital technologies. An artificial intelligence (AI)-powered digital solution for generative design can enhance design for manufacturing (DfM) and design for service (DfS) and optimize engineering change process by feeding manufacturing, service (actual product usage), and regulation data into the design process to form appropriate design constraints. This can help manufactures make decisions on various design options, reducing engineering changes and product lifecycle cost. Organizations can also leverage simulation-based analytical models powered by AI to build generative designs. Immersive technologies such as augmented reality (AR), virtual reality (VR), and mixed reality can also improve design collaboration by visualizing design models in 2D or 3D. This can also help define model-based product definition by overlaying all product information onto the 3D model for faster design updates and finalization. This model-based product definition powered by immersive technology can be applied in manufacturing operations and service training.

For manufacturing organizations, the most urgent problem is developing products that traditionally have a longer development cycle time. Additive manufacturing (AM) can shorten the cycle time for prototypes and new products/features development by building them faster and at low cost for complex products and features. At the same time, it can improve material innovation for developing sustainable products. Organizations can also take advantage of computer-aided design (CAD) for mobile-based real-time collaboration, design automation, and standardized template creations to reduce product complexity and design cycle time.

Redefining product information management for faster decisions

Successful product information management requires storing and maintaining data at low cost, and ensuring data accessibility, usability, and security across the extended enterprise. However, most organizations have disparate and homegrown systems and data in multiple formats across the product lifecycle. An underlying product information management (PIM) solution based on service-oriented approaches is key to integrating product information across various sources. It can provide consistent product information and flexible services across multiple distribution channels. It is also crucial to develop a data management strategy to stream and store zettabytes of data being generated per year from automobile onboard systems. This will lower the cost of data management, reduce processing time, and enable data access faster for improved decision making.

Setting the right goals can be a game changer in defining the right data management strategy - one that aligns with the overall business strategy and includes data governance, data services, foundational infrastructure setup, and the right definition of system of records and system of insights. However, with large volumes of data at their disposal, organizations have set up industry-specific communities of buyers and sellers to share data. This hampers data privacy, security, traceability, quality, and accuracy. A data marketplace platform, enabled by microservices with data privacy and security at the core, can help firms collaborate for trading and monetizing data. For example, such a marketplace platform can monetize organization data by making it available to third-party entities for ecosystem insights.

Cultivating a digital and IT approach for faster innovation

Advancements in technology have certainly provided organizations with a bouquet of solutions to overcome traditional product engineering challenges and to have a more objective view of what their product needs to offer. However, the key to successful product engineering lies in adopting a collaborative IT model, leveraging a digital solution that is fit for purpose and aligned to the future roadmap of organizations. This will help firms adopt a value-based IT approach and drive advances for an ultimate business transformation journey.

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