birlasoft

Manufacturing to the Power of Digital

Intelligent Products:

A manufacturing executive's guide to digital transformation in R&D

Enterprise to the Power of Digital™

Introduction

The manufacturing industry is currently in the midst of a tectonic shift, led by the intersection of operational systems and digital interfaces. In many ways, this is a leap from the automation-focused technologies of the third industrial revolution. In the era of Industry 4.0, manufacturers must embrace intelligent systems and processes to build game-changing products.

However, the transition to this new paradigm has not been seamless, with manufacturers' perception of their digital maturity far from on-ground realities. For example, over 90% of enterprises say that they are positioned well above the average in digital manufacturing -- an inference that is statistically impossible.[1]

This is why it is so important to explore an intelligent manufacturing paradigm at the early stages of the manufacturing value chain, looking beyond operational efficiency and bottom-line improvements. It isn't enough to only reduce costs and efforts – by leveraging this new generation of "intelligent technology", manufacturers can address key customer challenges, achieve resilience in the face of dynamic market movements, and cement long-term leadership. This is essential in manufacturing, given this sector's ongoing margin compression and fierce competition from digital-born disruptors.

What is an intelligent product in the context of manufacturing?

An "intelligent product" is a direct outcome of smarter research & development (R&D) in the manufacturing space, enabled by timely digital interventions.

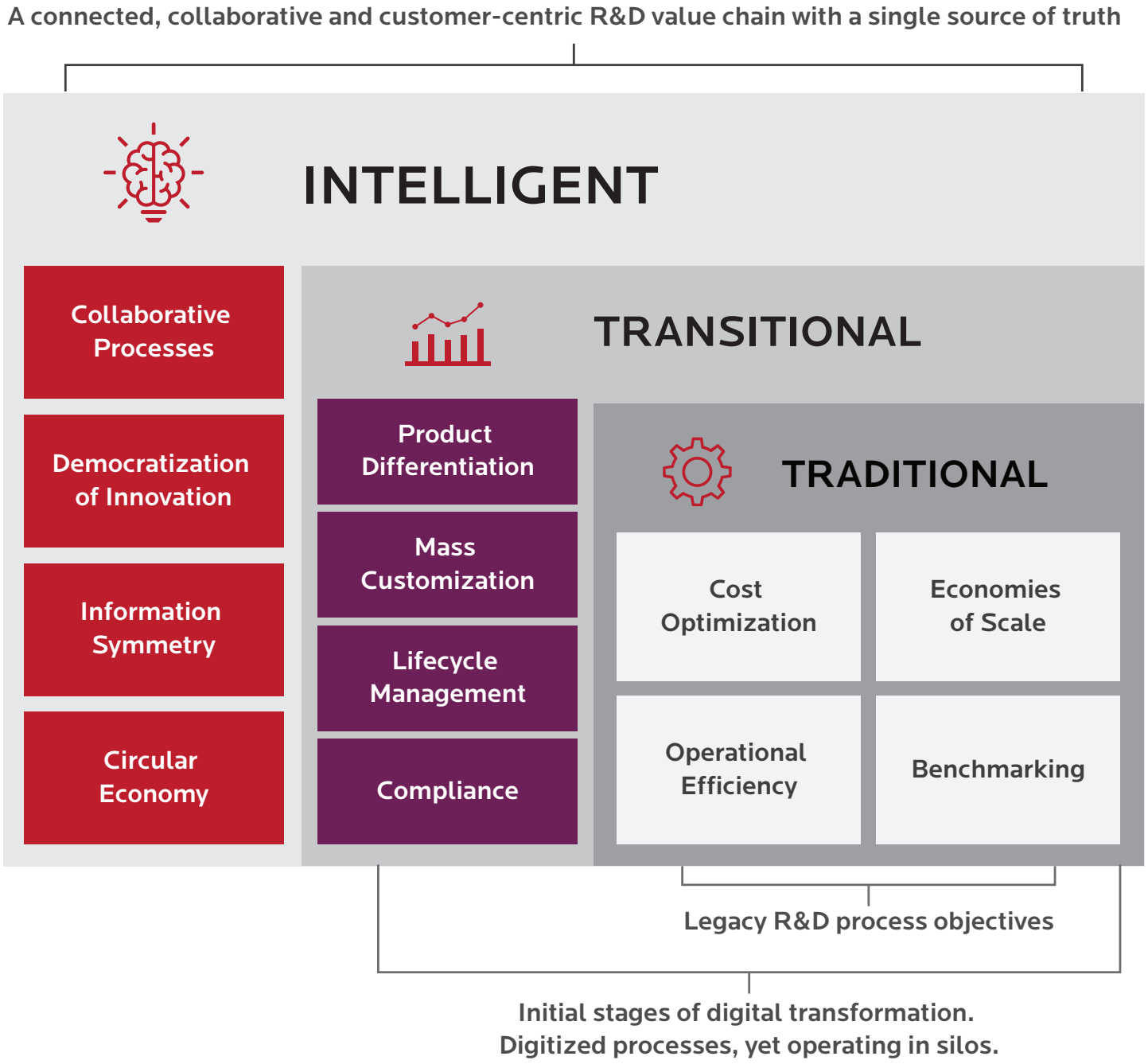
Today, manufacturers can no longer afford to be held back by outmoded processes. For example, traditional supply chains are replete with inefficiencies at multiple touchpoints, hindering the optimization of product lifecycles and making innovation extremely cumbersome. By embedding the supply chain with IoT technology, manufacturers could envision real-time monitored product pipelines, reinforcing quality and adding exponential value.

Current R&D processes aren't always in sync with intelligent products principles. Paper-based data handling continues to be the mainstay for several manufacturers, leading to near-obsolete products and assembly lines. Even in cases where digitization is in place, systems and platforms exist in silos, preventing collaboration and the realization of an efficient, circular economy. After ideation and conceptualization, compliance becomes another hurdle owing to fragmented data records and the lack of transparency. This creates an unsustainable atmosphere that's not ready to take on game-changing R&D in manufacturing.

In the place of traditional models, cutting-edge innovations can help transform activities such as product design, prototyping, testing, and compliance, in order to achieve what we call an "intelligent product".

manufacturing@birlasoft.com

Intelligent products, on the other hand, create a smart, connected digital environment by taking advantage of the latest technologies out there – such as IoT, robotics, wearables, advanced analytics, AR/VR, and the like.



manufacturing@birlasoft.com

Some of the key use cases of intelligent products include:

New product design and development

Manufacturers are now looking to stand out against fierce competition by offering highly differentiated products. However, ensuring that the design meets customer expectations and is able to perform in real-world scenarios could be a challenge. Frequently, protype testing becomes protracted and cost-intensive, owing to multiple iterations. This is where an intelligent product technology such as digital twin could play a major role. Digital twin recreates physical product, experiential, and environmental parameters in a digital format. By trialing concepts via digital twins to arrive at the best-fit design, manufacturers could ensure first-time-right for their products. One could even imagine the data from a digital twin platform feeding directly into a 3D printing tool to build a prototype, with zero loss of information.

Viable mass customization

Mass customization is among the key trends in manufacturing today, combining customer-specific personalization with high volume delivery. For a long time, mass customization was limited to theory and experimental initiatives, as profitability continued to be a challenge at scale. AR/VR simplifies mass customization by enabling simulated prototypes for different variants. Additive manufacturing (powered by 3D printing) also makes it easier to deploy customized products regardless of order volume. 3D printing can enable on-demand availability of discrete manufacturing tools and equipment, shrinking changeover times between multiple product variants and while making it easier to build custom prototypes.

Smarter product lifecycle management (PLM)

In a fast-paced business landscape, product needs and requirements are rapidly shifting. Manufacturers need to reduce time to market as much as possible – without compromising on quality – if they are to capture customer demand and loyalty. Next-gen technologies such as advanced analytics, business dashboards, and artificial intelligence can offer granular visibility into customer sentiment and market dynamics. This builds the foundation for targeted manufacturing, along with seamless collaboration between stakeholders on the value chain. For example, persona-based business dashboards could be used to democratize access to data insights and simplify cross-disciplinary collaboration.

Clearly, the intelligent product paradigm brings several benefits and promises to transform a number of critical manufacturing use cases. However, it does not work in isolation – many trends have together led to the rise of intelligent products in manufacturing R&D.

5 trends leading to the rise of intelligent products

An effective R&D process is at the cornerstone of success in the Industry 4.0 era, setting the foundation for intelligent products, especially as the manufacturing sector faces multiple pressures. Five trends, specifically, make intelligent products highly relevant today.

1. Seamless collaboration across the value chain

Traditional manufacturing was a siloed process, with stakeholders at each stage of the value chain contributing efforts without centralized visibility into the conception-to-production/ distribution process. Now, with the breaking down of global barriers (thereby introducing competition from across the globe) and rising customer expectations around speed and quality, it is essential to enable cross-disciplinary collaboration. This is why a robust PLM solution is fast becoming an industry must-have, with this software segment growing at a CAGR of 7.2% to cross $26.33 billion by 2023.[2]

2. The need for concurrent manufacturing

A traditional pipeline follows the sequential process, where an inordinate amount of time is devoted to product design and development, become the manufacturing process can even begin. As a result, enterprises are faced with the pressure of churning out high volumes in tight timelines – instead, concurrent manufacturing, powered by collaboration on PLM platforms, 3D printed prototypes, and other innovations help to detect defects earlier, minimize waste, and speed up production.

3. Greater accuracy in prototyping

A corollary to the last point, manufacturers cannot afford any defect or discrepancy in the design stage. This can lead to faulty prototypes, as well as high sunk costs once development is initiated. Therefore, it is advisable to use next-gen technologies such as 3D simulations and additive manufacturing; these, coupled with computer-aided design/ manufacturing (CAD/CAM) software can drive R&D accuracy like never before. Importantly, CAD/CAM tools are now a manufacturing staple, owing to its ability to effectively visualize tooling paths and machine requirements.

4. Reduction of waste and the introduction of a circular economy

62% of companies in the US are eager to shift to a circular economy, with 51% of the automotive sector specifically having undertaken circular supply chain initiatives in the last three years.[2] This implies an extension of the product lifecycle to push back obsolescence and thereby reduce waste, as well as optimizing the usage of resources with an eye on carbon footprints. Intelligent product technologies will be critical to achieving this goal – for instance, using PLM software to keep products relevant for a longer time or the application of digital twin to prepare for resource efficiency, even before starting production.

5. Discerning customers and fierce market competition

No matter the sector of operation (automotive, aerospace, consumer goods, etc.), it is undeniable that we are witnessing a customer-centric economy. Not only are there more alternatives in the market than ever before – making differentiation a challenge – but even existing customers demand the highest level of quality, cost advantage, and value-added experience to remain loyal.

Together, these forces are bringing about a shift in manufacturing processes, compelling enterprises to embed cutting-edge innovation into the operational DNA. Interestingly, this could solve several long-standing challenges for the sector.

How intelligent products can solve age-old manufacturing problems

Given these five trends, traditional manufacturing simply cannot keep up. There are a number of challenges arising out of dependencies on legacy processes. For example, offshoring has been a popular tactic for optimizing cost and efforts; but in the light of today's geopolitical climate, looking for the best-cost manufacturing location is not a sustainable answer. A focus on intelligent products, and realigning the R&D process to efficiently operate the manufacturing process, is the way forward.

A report into the world's top manufacturing innovators reveal that global spends on manufacturing R&D has crossed the $700 billion mark, and today, manufacturers are spending 10x more on R&D that on advertising, signifying the importance of continuous innovation to retain market leadership.[4]

However, a critical concern that continues to plague manufacturers, is the fragmentation across the R&D value chain. The design team may not be aware of how the engineer is approaching a project; the testing team might lack visibility into the original product vision. In sectors such as automotive and aerospace, such fragmentation could severely hinder the chance of being First time right, which is why it is so important to have a comprehensive PLM mechanism in place.

Another challenge is the question of compliance – with the regulatory environment constantly shifting and varying manufacturing norms across locations, ensuring compliance for the different aspects of product design and delivery is an arduous task. This is made even more complex due to the fragmented nature of the value chain, as well as inorganic growth (due to mergers and acquisitions). In 2018, $680 billion was spent on mergers and acquisitions in the industrial sector[5] – a significant uptick from the previous year.[5] As a result, dissonant infrastructures and R&D approaches must frequently intersect towards shared outcomes. Finally, all of these challenges together lead to inefficient processes, a formidable cost component, and products that are far from reaching the 'intelligent' objective.

Applying intelligence at the product, R&D and design stage

On the one hand, the five trends discussed are necessitate a complete overhaul of the existing manufacturing paradigm. On the other hand, enterprises that fail to transform in tandem, risk falling prey to the numerous challenges that hold back innovation in manufacturing R&D. That is why it is vital to introduce technology interventions at strategic areas of the value chain; this includes:

Modeling and simulations to boost R&D efficiency

Technologies such as 3D simulations and digital twin could prove invaluable to manufacturing R&D. A digital twin recreates the physical product and its multiple usage parameters in the digital world; these parameters can be easily altered to simulate the resulting impact on the product. As a result, manufacturers can fine-tune product design with inputs from a variety of stakeholders, with massive investments in iterative physical prototypes. By 2020, IDC predicts that digital twins can unlock as much as 25% in efficiency and productivity gains.[6]

3D printing to augment engineering capabilities

Manufacturers are under pressure to hyper-personalize their offerings, while maintaining margins and scalability. This can also be looked at as a "segment of one", with each customer bringing unique and differentiated demands. Now, 3D printing can help accommodate this requirement by allowing manufacturers to tweak each prototype for the customer at hand. Further, specific manufacturing equipment can also be built via additive production technologies, reducing changeover times between different products. German automotive solutions provider, LÄPPLE Group, manage to cut effort and timelines by half using 3D printers at its press shops and assembly lines.[7]

Real-time data validation to minimize risk

As mentioned, regulatory compliance is a major challenge for manufacturers – one that's difficult to address once the development process is commenced. It can be extremely beneficial to detect any instance of non-compliance to quality, safety, or other laws right at the R&D stage – minimizing risk and the possibility of penalties. Tools such as collaborative data visualization dashboards and real-time data streaming can help obtain validations and approvals on an immediate basis, accelerating development and reducing risks.

Digitally empowered business models to generate revenues

Needless to say, disruptive technologies such as the ones discussed here with drive brand new ways of doing business. One such clutter-breaking business model is Manufacturing as a Service or MaaS. This creates a centralized platform where digital infrastructure such as 3D printers, analytics engines for advanced data processing, powerful cloud resources to drive heavy computational needs, and the like can be aggregated and accessed in a shared format.

MaaS would shrink resource wastage dramatically – manufacturers would only pay for their utilization of a 3D printer, without any capex. Netherlands-based 3D Hubs took advantage of intelligent products to set up a MaaS platform where 3D modeling as well as traditional techniques like CNC machining and injection molding, could be used on a Servitized basis.[8] And manufacturers themselves are leveraging Servitization as a compelling business model – nearly half of the revenues at Rolls Royce now come from services, enabled by digitalization.

These are only some of the ways how manufacturers can utilize digital innovation to achieve intelligent product pathways. Of course, a shift in skillsets will be imperative, as data literacy and familiarity with cloud-based technologies take center-stage.

Data flowing in from IoT, digital twins, collaborative platforms, and other sources must be read and comprehended by every stakeholder to add genuine value. Even as data dashboards become more intuitive, a degree of data literacy will help manufacturers gain a competitive advantage. And the majority of these technologies will be hosted on the cloud. It will be vital to develop could competencies to navigate and successfully maximize this ecosystem.

Intelligent Products: Reimagine your R&D Value Chain

Envisioning solutions for the manufacturing of tomorrow

To reimagine operations in line with Intelligent product principles, enterprises must first implement an end-to-end Product Lifecycle Management (PLM) solution that eases technology intervention from the cradle to the grave. Not only will this improve accuracy at the R&D stage, but it will also simplify maintenance and end-of-life management. A PLM platform creates a single source of data, addressing fragmentation and identifying strategic areas for digitalization. It will also function as a collaborative interface, inviting inputs from multiple stakeholders from the cradle to the grave.

As the Fourth Industrial Revolution reaches maturity, the manufacturing industry is at an inflection point. One can either pivot towards intelligent products, powered by advanced technologies coupled with new operational and business models. Or, one could hold on to legacy practices and face increasing competition, regulation pressures, and customer demands. Intelligent products are central to building an agile, value-generating manufacturing enterprise – and PLM tools can streamline the transition to this bold new world.

Final words

Intelligent products, in principle, can help manufacturers find innovative ways of solving for future challenges, and cement long-term leadership. To gear up for the industry 4.0 age and beyond, we recommend manufacturers follow the below listed roadmap.

Get to the root of the challenges

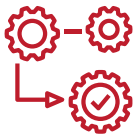
- Breakdown your present product R&D planning, design and management value chain to a granular level and identify improvement opportunities that will have impact on the strategic goal of the organization. E.g., if product strategy planning is crucial to your growth, break that value chain step further until you hit the wall in terms of finding out the challenge.

Explore digital interventions to solve for those challenges

- Figure out the economic business value that you can derive by benchmarking against industry use cases and organization's current capabilities and end transformation goals.
- Map out the digital interventions required to fix the existing gaps be it process centric or technology centric. E.g., digital twins, 3D Printing, e-PLM, etc.

Flesh out your execution strategy

- Run a cultural audit for internal and external stakeholders to understand the appetite for digital transformation initiatives.
- Figure out the stakeholders who'll play their part in the entire change management exercise.
- Get your priorities in place by using ROI, budgets, choice between a full-scale implementation or improvement, risk-impact analysis, as the filters.



Rubber hitting the road

- Select the technology, methodology and vendor of choice.
- Establish requirements, timelines and minimum viable outcomes.
- Scale and reinforce compliance parameters for the transformation.
- Get the right set of checkpoints in place to keep your execution on the right track.

References

1- “Future-proofing a digital manufacturing transformation.” Retrieved from https://www.mckinsey.com/business-functions/operations/our-insights/operations-blog/future-proofing-a-digital-manufacturing-transformation

2- “Market Outlook: Product Lifecycle Management (PLM), 2018-2023, Worldwide.” Retrieved from https://www.pdsvision.com/wp-content/uploads/2019/05/Quadrant-Market-Outlook.pdf

3- “Global R&D spend surpasses $700 billion, but threatened by protectionism.” Retrieved from https://www.consultancy.uk/news/14238/global-rd-spend-surpasses-700-billion-but-threatened-by-protectionism

4- “R&D Spending Has Dramatically Surpassed Advertising Spending.” Retrieved from https://hbr.org/2019/05/rd-spending-has-dramatically-surpassed-advertising-spending

5- “$700 billion spent on mergers and acquisitions in industrial sector.” Retrieved from https://roboticsandautomationnews.com/2019/04/18/700-billion-spent-on-mergers-and-acquisitions-in-industrial-sector/21955/

6- “Digital twin technology and simulation: benefits, usage and predictions.” Retrieved from https://www.i-scoop.eu/digital-twin-technology-benefits-usage-predictions/

7- “LÄPPLE Group uses MakerBot 3D printers to halve lead times and costs.” Retrieved from https://www.tctmagazine.com/3d-printing-news/lapple-group-makerbot-3d-printers-halve-lead-times-cost/

8- “Manufacturing-As-A-Service Platforms: The New Efficiency Revolution.” Retrieved from https://www.forbes.com/sites/marcoannunziata/2019/05/13/manufacturing-as-a-service-platforms-the-new-efficiency-revolution/#6d7c6aa457fd

Enterprise to the Power of Digital™

Birlasoft combines the power of domain, enterprise and digital technologies to reimagine business processes for customers and their ecosystem. Its consultative and design thinking approach makes societies more productive by helping customers run businesses. As part of the multibillion-dollar diversified The CK Birla Group, Birlasoft withits 10,000 engineers, is committed to continuing our 158-year heritage of building sustainable communities.