25 YEARS OF IES

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ENGINEERING THE NXT

EVOLUTION OF DIGITAL ENGINEERING IN THE NEW NORMAL

WHITEPAPER

Connected World.
Connected Experiences.

INTRODUCTION

The pace and degree of digital transformation has accelerated in the past year as businesses were forced to devise newer strategies to ensure business continuity while minimizing the negative impact of the pandemic. Enterprises that had made significant investments in digital technologies were better poised to face the unexpected and rapid changes in business scenarios, whereas those with low digital maturity had to spend a significant part of the early days of the pandemic in transforming their operations to suit the new normal.

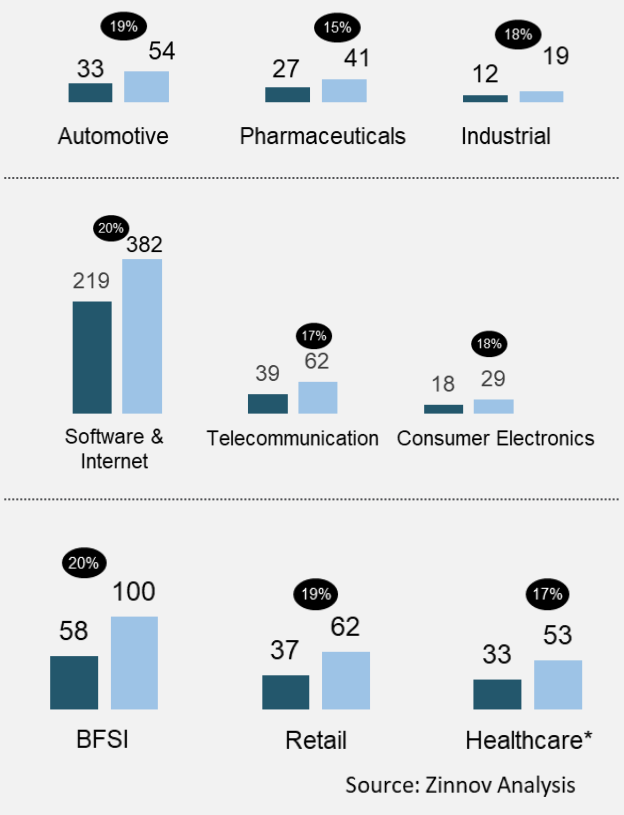
External factors such as customer needs and requirements, quality, reduction of production and control costs, environmental impact of products, etc., are pushing enterprises to re-evaluate their business strategies. They are continuously striving to find the right balance of increasing the margins of legacy products and to generate revenue growth through investments made towards digital innovation, new products, and services. The compelling sense of urgency to solve integration challenges and overcome other shortcoming related to poor visibility into data flows, low data security, overall latency, etc., is pushing enterprises to re-evaluate their legacy systems. While some enterprises prefer to gradually replace the legacy systems, other are carefully assessing risks and identifying ways to modernize legacy systems and tools to improve overall performance. To optimize and derive the maximum value of legacy systems, enterprises are rebuilding legacy elements into the cloud native environment, rearchitecting or re-platforming legacy applications. Looking at the impact on industries in the past year, healthcare, telecom, software and internet have stayed resilient, with increasing investments made towards digital infrastructure and solutions to reimagine nearly every facet of their operations. In contrast, the pandemic has had a pronounced impact on industries such as aerospace, automotive, manufacturing, travel and hospitality, as demand for services took a nosedive. Across industries, digital technologies have been a moat for survival for businesses, having enabled various use cases. This has led to a steep rise in global Digital Engineering (DE) spend, which reached USD 545Bn[1.] in 2020, despite the overall economic downturn.

ENGINEERING THE NEXT

As the world settles into a new normal, enterprises are renewing and recalibrating their digital transformation efforts by investing in technologies such as cloud, data, artificial intelligence (AI)/machine learning (ML), cybersecurity, 5G, etc., to drive use cases across verticals. This is expected to augment the overall digital engineering spend to grow at a CAGR of 19% to touch USD 911Bn by 2023. The illustrative graph below presents the vertical contribution to this digital engineering growth.

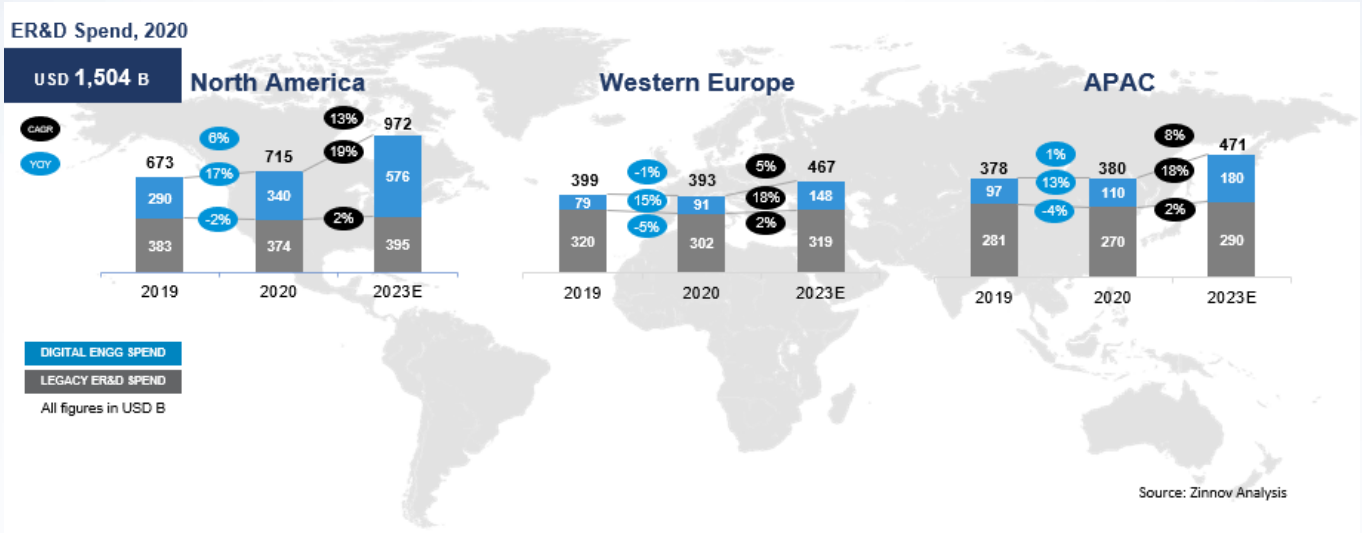
From a geography perspective, North America is the fastest and largest growing region in terms of its total engineering R&D spend in 2020. The region also has the highest growth rate given the high penetration of software and internet firms and will account for 50% of the global ER&D spending by 2023. Digital Engineering spending stood at USD 340Bn for 2020, and this is expected to grow at a CAGR of 19% to reach USD 576Bn by 2023. Enterprises across software and internet, semiconductors, pharmaceuticals, retail will be the key contributors to drive growth in the Noth American digital engineering market.

In 2020, software and internet firms from North America accounted for the highest Engineering R&D spend with USD 208Bn. Advancements in technologies such as artificial intelligence (AI), internet of things (IOT), augmented reality (AR), virtual reality (VR) and driving spend of the software and internet market. Companies are leveraging these digital technologies to enhance customer experience through use cases such as cloud gaming, virtual showroom, interactive chatbots, voice-enabled applications, etc.



Source: Zinnov Analysis

North America accounted for USD 54Bn, which is 66% of the total engineering R&D spend in the semiconductor industry for 2020. Semiconductor use cases are becoming pervasive across industry verticals such as internet and software, automotive, telecom. Native semiconductor expertise is playing a key role in enabling advanced applications such as ADAS, home automation, predictive maintenance, smart PCs, etc.



As enterprises redefine themselves to prepare for the new normal, technology and engineering leaders need to continuously re-evaluate their digital strategies. In this Tech Mahindra – Zinnov whitepaper, we will have a look at the different themes that will be critical for successful enterprises, key technologies that will be at the core of innovation, and important steps that enterprises must take as they look ahead to accelerate their digital engineering efforts and build a roadmap for the new normal.

KEY THEMES IN THE NEW NORMAL

In the past year, enterprises across industries have made significant changes in how they operate and interact with their customers, with digital technologies being the key driver. In fact, the accelerated adoption of digital technologies became the core of building antifragile businesses. Three broad themes, with digital technologies at their core, will shape the future of enterprises. Hence, technology and engineering leaders will need to align their strategies around these key themes and channel appropriate investments to thrive and succeed in the new normal.

TELE-X: People and businesses are relying on digital technologies to ensure continuity and comfort in many dimensions of work and life. In the new normal, 'remote' processes and virtual interactions will see exponential growth. Use cases such as telehealth, remote monitoring in healthcare, online education, etc., will continue to make headway. To fully pivot to remote work and processes, enterprises will leverage technologies to reimagine operational efficiency, improve productivity, increase agility, optimize costs, etc. In fact, technologies including data, analytics, cloud will play an important role in capturing real-time data and insights across various connected devices enabling a tele-everything world.

DIGITAL THREAD: To stay ahead of the competition in an evolving market, enterprises will need to bring products to market faster, along with maintaining high customer satisfaction. The digital thread will play an important role in this pursuit by providing greater visibility and real-time insights into a product lifecycle. To drive business value, enterprises will utilize this intelligent thread to improve operational excellence, increase agility and collaboration across the value chain.

SUSTAINABILITY: Sustainability will be a growing business priority with increasing awareness about climate change, consumer demand for sustainable products, and the need for sustainability reporting. There will be a shift from a linear to a circular economy as enterprises integrate sustainability across their value chain to enable sustainable product innovation and operations. While some enterprises have already made their pledges toward a sustainable future, others are rethinking their sustainability priorities for the new normal.

KEY TECHNOLOGIES AT THE CORE OF DRIVING TRENDS

Preparing for the new normal, enterprises are embracing digital transformation and ramping up investments in building digital solutions to cater to the evolving demands. The key technologies that will play a crucial role in driving the adoption and implementation of innovative use cases include –

5G: The demand to stay connected on-the-go continues to increase, highlighting the importance of ubiquitous connectivity. 5G will facilitate versatile B2C and B2B use cases requiring high bandwidth and faster speeds at low latencies. Through 5G, enterprises and customers will be able to realize the full potential of various applications such as connected healthcare, smart mobility, industrial 4.0, etc. To maximize the benefits that 5G offers, enterprises will need to weave their 5G vision and roadmap into their digital transformation strategies.

CLOUD: In the new normal, enterprises will increasingly focus on building a robust cloud strategy as they migrate their workloads to the cloud. With an increase in virtual interactions and remote use cases, Cloud-centric infrastructure and applications will gain prominence. The adoption of hybrid cloud services and demand for cloud-to-edge applications will increase. Enterprises will commit to the cloud as a core enabler for connected use cases as it provides increased flexibility and efficiency, improves security, and an opportunity to innovate.

DATA: Data will be at the core of key themes shaping the future of enterprises. The increasing adoption of smart and connected devices is generating a vast amount of data on machines, processes, and people at breakneck speed. With evolving consumer behaviour, enterprises will increasingly rely on technologies such as AI, ML, Big Data, and Analytics to identify bottlenecks in processes, forecast risks, match demand and supply, diversify product portfolios, optimize costs, and improve customer experience. There will be a renewed focus on utilizing real-time data to unlock meaningful insights for data-driven solutions, while also ensuring data security.

SECURITY: With the number of connected devices growing exponentially, the vulnerability of systems to cyberattacks is increasing. Enterprises across industries are focusing on having a robust cybersecurity architecture for devices and platforms. Businesses will increase investments in technologies such as AI, ML, blockchain to ensure comprehensive visibility on devices, and enable solutions to detect known and unknown threats automatically.

TELE-X

A WORLD OF TELE-EVERYTHING

While stay-at-home guidelines and mandates were the starting point of the pandemic-induced changes to how businesses operate, enterprises across industries have had to quickly adapt to a remote working business model. It also enhanced the reliance on smart and connected systems for continuity with work, education, healthcare, commerce, social interactions, and more. Tele-working, telehealth, tele-shopping, tele-manufacturing, etc. – that were once considered novel and niche use cases, are now becoming core to societal infrastructures in a 'tele-everything' world.

The past year has not only seen the acceleration of sophisticated immersive experiences, but has also made virtual spaces more real, authentic, and effective. At the core of various Tele-X use cases, technologies including augmented reality (AR)/virtual reality (VR), AI, internet of things (IoT), 5G, etc., have a crucial role in further enhancing the user experience. Below is a glimpse of a 'tele-everything' world across different industries.

HEALTHCARE: Patients are taking charge of their health by learning about their health risks, communicating with doctors in new and different ways, and gradually changing their perception about data privacy. They will continue to have greater participation and demand more autonomy over their healthcare decisions. In the new normal, Telemedicine and remote monitoring strategies will shift with evolving patient expectations and standard of care delivery. Big data, AI/ML, healthcare platform, image recognition, etc., will drive efficiencies across the healthcare value chain by strengthening the infrastructure to manage patient data, derive meaningful insights for healthcare stakeholders, improve patient outcomes, and enhance the overall remote experience for patients and doctors. The advancements in at-home diagnostic tools will drive the scope of services that doctors can provide remotely.

RETAIL: Evolving consumer preferences for personalized and interactive experiences from the comfort of one's home will drive the e-commerce market. From giving consumers the chance to visualize products before buying, to creating a virtual dressing room in the comfort of their living rooms, technologies such as AR, VR, mixed reality, and 3D holograms hold the potential to influence different aspects of the shopping experience.

EDUCATION: Tele-education, supported by ed-tech solutions will see an uptick. By enabling personalized education for students to learn at their own pace and skill levels, eliminating geographical barriers, and reducing costs, tele-education will create a continuous learning experience beyond the confines of a classroom. Gamification, AI, and AR/VR will play a crucial role in identifying specific needs of students and engaging them through an immersive and interactive virtual environment.

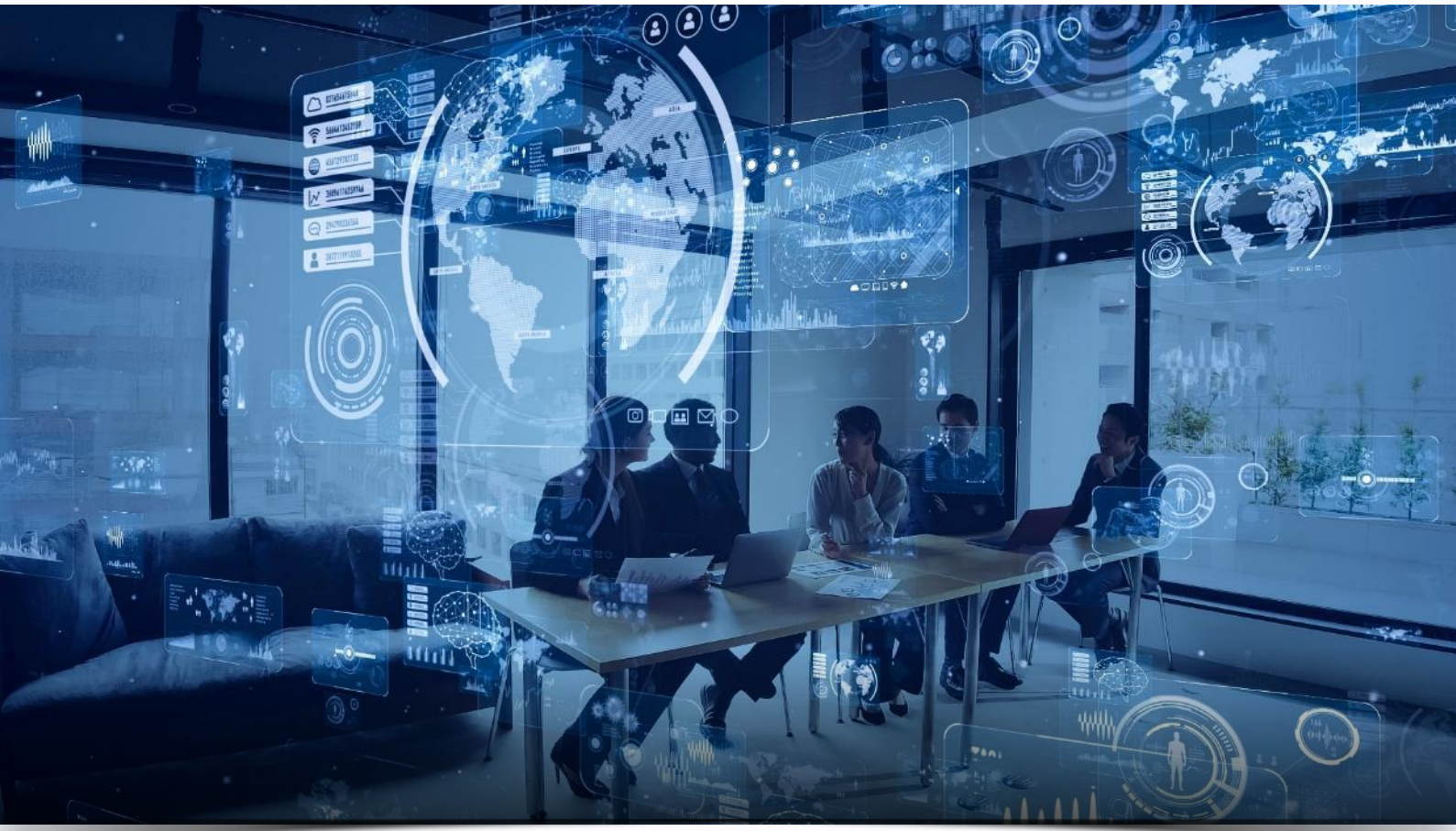
MANUFACTURING: Tele-manufacturing will allow workers to operate equipment from a remote location. Technologies such as 3D printing, mixed reality, cloud, automation, etc., will enable manufacturers and designers to collaborate and design products remotely, modernize maintenance, and facilitate knowledge sharing. Remote monitoring and machine health prognostics through sensors and internet of things (IoT), automation will be some of the investment areas in the Manufacturing space.

REMOTE WORK ENVIRONMENT: The forced telework situation in view of the pandemic has given companies the ability to unify distributed talent bases from around the world and eliminate geographical boundaries. Advancements in cloud solutions, platforms, AR/VR will enable engineers to remotely access and share data and collaborate with colleagues on different tasks. Enterprises will leverage technology to automate tasks that employees can oversee remotely, utilize productivity tools to optimize performance, upskill talent through different virtual learning programmes, etc. Improved worker productivity that many businesses are witnessing, coupled with improvements to the bottom-line, will encourage businesses to adopt policies that allow flexible or full-time remote work for their employees.

The reality of a 'tele-everything' world may be too futuristic; however, choices on a daily basis will pave the way towards it. Consumers will unlock benefits in terms of accessibility, comfort, and flexibility, that will further encourage enterprises to prioritize remote services in all areas of human interactions. Digital technologies such as IoT, cloud, 5G, AR/VR, etc., will act as the strong foundation for enterprises on which to build a robust infrastructure for a Tele-X world. While a Tele-X world has its benefits, certain concerns prevail regarding the power of technology to cause harm. Power imbalances between those who can and cannot afford technology and compromises to and infringement on individuals' privacy, are some of the concerns that will need to be addressed by enterprises as they head towards making 'tele-everything' a reality.

DIGITAL THREAD

Smart manufacturing promises to improve competitiveness and profitability for manufacturers. To enable this, there is a need for a comprehensive solution to realize every step in the manufacturing process. The digital thread is fast becoming the key enabler in digitizing core processes for enterprises by connecting data and physical assets from designing to manufacturing to servicing and beyond. Through this data thread, enterprises will have more visibility across the entire product lifecycle, helping them increase the quality of products by minimizing defects and obtain process efficiencies. Manufacturers, especially those producing complex, highly engineered products in the aerospace, electronics, medical devices, and industrial equipment industries are increasingly integrating digital thread into their functions to maximize benefits.



KEY OUTCOMES FOR ENTERPRISES IN THE NEW NORMAL

To remain relevant and compete in global markets, enterprises will need to direct their efforts toward integrating data and technologies at each step to bring in more efficiencies, flexibility, and agility across the value chain while optimizing costs. The digital thread will hold significant value in leading these efforts by driving three key outcomes.

PRODUCT DIFFERENTIATION: As enterprises start increasing their focus on customer-centricity, there is an increasing demand to deliver high-value customized and complex products. To enable this mass customization, product designers and engineers will need a 360-degree view of the product lifecycle from downstream to manufacturing and distribution. This single thread of information will provide product designers and engineers with both proactive and reactive (performance feedback) options to iterate on product designs, advance product innovation, reduce failure rate through advanced design techniques, and drive product differentiation.

PROCESS EFFICIENCY: Efficiency and productivity are the main focal points for manufacturers to drive success. By enabling smart tracking solutions, manufacturers will have access to traceable and unified access to digital data captured during design, virtual simulation, and physical operations. This information thread casts light on the end-to-end manufacturing process by connecting disparate systems and teams. Real-time visibility across production lines, assets, and capacity will help determine machine health inputs, process inefficiencies, etc. Access to this information will also enable manufacturers to make data-driven decisions and take proactive measures to reduce asset downtime, increase overall throughput, and improve worker productivity. Therefore, this results in improved overall efficiency across the value chain.

AFTER-SALES SERVICE: Service innovation and optimization is an important metric to drive repeat business. By linking service technicians to digital thread, enables them to schedule maintenance of the asset, thereby proactively engaging with customers and facilitating faster mean-time to resolution.

TECHNOLOGIES AT THE CORE OF DIGITAL THREAD

Digital thread, enabled by the powerful convergence of certain key digital technologies, has the potential to transform the organization by driving business value. While different technologies can be involved at different stages in the value chain, these technologies form the core of the digital thread –

BIG DATA ANALYTICS – Data management and data analytics are at the core of the digital thread. AI/ML and analytics will help simplify a large amount of real-time data into actionable insights. This will further drive data-driven decision-making across enterprises to optimize products at the warehouse, forecast demand/supply, forecast risks, and potential issues such as machine failures, component shortages, quality issues, etc. Data models created on similar types of equipment and usage patterns will help enterprises enhance their future processes at reduced cost and time.

CLOUD – To build a connected enterprise with digital thread at its core, Cloud plays a crucial role in providing a flexible architecture as well as data storage and computing capabilities. Enterprises are shifting to the cloud from their traditional on-premise models to improve quality of service, maintain security at optimized costs, to name a few. Cloud-based collaborative designing will gain traction as the urgency to expedite new product development and time-to-market increases.

AR/VR – AR/VR solutions are gaining traction among manufacturing companies as they help designers, engineers, and field technicians to work on and execute complex processes with deeper access to visual schematics and models. These solutions create next-level interfaces to simplify human-machine interactions, deliver real-time contextual data about machine performance, streamline maintenance, repair, and virtually test the impact of changes.

Incorporating digital technologies at each stage of the value chain, enterprises can enable smart manufacturing, smart tracking across the supply chain, and smart insights for after-sales. With an increase in the adoption of cloud-based design, smart designing of products in the R&D phase leveraging digital technologies will start to accelerate. As the digital thread connects across different functions of the organization, it will become imperative for enterprises to secure the process of data collection by implementing necessary security standards.

SUSTAINABILITY

Climate change is increasingly becoming a matter of concern for businesses and the society in general. Addressing climate change through company-wide strategic efforts is increasingly becoming a priority on the corporate agenda. To this effect, enterprises around the world are signing up for ambitious goals to help reduce carbon emissions by improving energy efficiency, reducing waste, optimizing supply chains, and ensuring sustainable options throughout the value chain.

Various initiatives such as the Paris Climate Agreement focused on the reduction of global warming, and the European Green Deal promoting carbon neutrality by 2050, are encouraging enterprises to actively incorporate sustainability as part of their strategies. Countries like the USA, Germany, China, etc., are using their COVID-19 stimulus packages to promote sustainable initiatives such as hydrogen and e-mobility infrastructure, low carbon buildings, to name a few. In addition to these initiatives, increasing consumer preference for sustainable products and investors including sustainable risk at the center of their investment strategy are pushing enterprises to re-evaluate their position on sustainability, sooner than later

UNLOCKING SUSTAINABILITY DIGITALLY

Enterprises are beginning to interlink their digital prowess and sustainable practices to achieve their sustainability goals. They will leverage digital technologies such as data analytics, AI, automation, etc., to build sustainable engineering solutions with a focus on sustainable products and automating operations to reduce their carbon footprint.

PRODUCT INNOVATION: There will be an increasing preference for green, recyclable, and smart products among consumers. Businesses will need to incorporate sustainable engineering practices at every stage, from designing the product to its development phase. Sustainability will be deep-rooted, right from the choice of lightweight materials to innovative packaging to building energy-efficient products. Enterprises will invest in ER&D to design smarter and connected products that are energy efficient. Technologies such as analytics, AI, and automation will be leveraged in the research phase to identify and develop low emission materials/products, test product performance, simulate, and improve the design before its actual production. Manufacturing certain components will be digitized through additive manufacturing, 3D printing, and line automation. Overall, there will be a shift to the circular economy model to prevent wastage by reusing and recycling old products and waste materials.

OPERATIONS EXCELLENCE: With consumers demanding more transparency in the supply chain, creating sustainable operations will be an important milestone for enterprises. Sustainability initiatives across assets and infrastructure, manufacturing engineering, and waste management leading to a reduction in carbon footprint and energy-efficient processes will be imperative. Designing sustainable operations and automating supply chains will ensure sustainability across assets and infrastructure. Industrial internet of things (IIOT) solutions and sensors across the value chain will help keep a tab on material handling and reduce waste. A key metric to measure success will be implementing methods to create visibility and accountability across the value chain, in real-time, thereby reducing environmental impacts before they are magnified.

Sustainability will be an important metric to measure success in the new normal. Enterprises will aim to reduce carbon footprint across their digital engineering stack by adopting sustainable measures during product innovation and across manufacturing operations. Doing so will mean embracing digital in all aspects of business, access to data-driven insights on environmental impact, and having greater transparency across the value chain, which in turn will increase the brand's reputation.

RECOMMENDATIONS:

ACCELERATING/BUILDING A ROADMAP FOR THE NEW NORMAL IN DIGITAL ENGINEERING

In the new normal, it will be critical for enterprises to define key outcomes and work towards enhancing their Digital Engineering capabilities as they aim to stay ahead of the curve. Below are five important steps that will help build and accelerate the roadmap for the new normal.

Define key outcomes for the business The pandemic brought with it a sense of urgency to change, pushing enterprises to accelerate their digital transformation journeys. While enterprises have implemented processes and achieved short-term goals to ensure business continuity, it has also enabled them to test new waters vis-à-vis products/offerings. With the worst behind them, enterprises must now reflect on the changes made, chalk out key business outcomes that will redefine success and differentiation in the new normal.

Identify and invest in technology infrastructure Whilst preparing for the new normal, enterprises must re-evaluate their technology infrastructure to align with larger strategic goals and hybrid working models. To identify investment areas, technology leaders must identify top use cases to implement, that aligns with customer demands. Prioritizing these use cases and identifying relevant technologies will be key in determining the return on investment (ROI). While strengthening the infrastructure to meet the current requirements is necessary, businesses must have a futuristic view on dealing with any pandemic/challenge of the current magnitude. Across industries, some common areas of investment are data, cloud, and connectivity to unlock significant values.

Build agile and flexible talent structures While technology has the power to boost the business, for enterprises to stay competitive, having employees with specialized knowledge and commitment is equally necessary. There must be a focus to hire the right talent for the required digital initiatives. Enterprises must also emphasize on the criticality of reskilling and upskilling their existing workforces through personalized training that will help them stay relevant and updated about current technological advancements.

Define and track key metrics A successful digital roadmap is complete only when its performance is measured and achieved. Businesses can define key performance metrics that align with their overall outcomes for the digital engineering initiatives. A non-exhaustive list of metrics that can be considered, include –

- Return on digital investments or from new digital use cases/services
- Time to market of a use case or product or offering
- Top technical talent attracted, promoted, and retained
- Cost and time saved
- Percentage reduction in carbon emissions

While companies are on their unique digital transformation journeys, collaborating with the ecosystem will considerably augment this process. By leveraging ecosystem partnerships, enterprises can boost innovation, speed up products to market, and enhance customer experience. Through these partnerships, the companies can benefit from shared assets, employees, and connections, thereby significantly reducing cost. This will also positively shift their position in the competitive market.

CONCLUSION

Innovation-led growth will be a top priority for enterprises in the new normal. Across organizations, leaders will encourage a technology-driven approach to increase productivity and drive innovation. It will become critical for enterprises to re-evaluate their digital agendas, incorporate themes such as digital thread, sustainability, Tele-X that align with business outcomes, and map investments to appropriate themes/technologies. By unlocking the value of legacy systems through digital technologies, and investing in new digital capabilities, organization will be well prepared to thrive in the new normal.

Citations

1. (2021, June 10). Zinnov ER&D Analysis. Zinnov. from https://zinnov.com/enterprise-engineering-rd-strategy-focus-digital-engineering-to-build-an-antifragile-future/

ABOUT ZINNOV

Founded in 2002, Zinnov is a global management and strategy consulting firm, with a presence in Silicon Valley, Houston, Paris, Bangalore, and Gurgaon. Over the past 16 years, Zinnov has successfully consulted with over 250 Fortune 500 customers to develop actionable insights that help them in their transformation journeys. With core expertise in product engineering and digital transformation, Zinnov assists clients by:

- Providing research and strategy consulting for technology service providers in the areas of product engineering and digital transformation
- Enabling companies to develop and optimize a global engineering partner strategy to achieve higher throughput, innovation, productivity, and cost savings
- Growing revenue for companies' products and services in India and other emerging markets
- Helping MNCs expand and/or consolidate their globalization footprint.

With its team of experienced professionals and research teams, Zinnov serves clients from across software, semiconductor, consumer electronics, automotive, telecom and networking, healthcare, banking, financial services, and retail verticals in the U.S, Europe, Japan, and India.

INTEGRATED ENGINEERING SOLUTIONS (IES)

Tech Mahindra's integrated engineering solutions (IES) delivers solutions enabling "digital engineering enterprise" across aerospace and defense, automotive, industrial, telecom, healthcare, energy & utilities and ISVS. With 50+ exclusive global engineering centers supporting new program launches and 350+ active global customers, Tech Mahindra IES is an established leader for engineering services in the industry.

Tech Mahindra delivers exponential value to engineering enterprises by collaborating with them across three key tenets: **robust products, ubiquitous platforms and cyber factories.** The vision for Tech Mahindra engineering is founded on the new digital economy considering emerging market trends like digital engineering, intelligent workplaces, adoption of tele-everything, end-to-end connected and immersive approach covering smart manufacturing and the need for an overall resilient business framework.

We call this approach of **accelerating** outcomes, **inventing** better products and **transforming** businesses into digital as – Engineer your NXT.NOW!

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