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Purpose-Driven Technology Adoption for People and the Planet

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ABSTRACT: In an era where technological advancements hold the potential for both immense progress and significant challenges, the concept of purpose-driven technology adoption emerges as a critical paradigm. This abstract explores the intersection of technology, society, and the environment, emphasizing the importance of aligning technological innovation with the collective well-being of humanity and the planet. By prioritizing purpose over profit, stakeholders can leverage technology to address pressing global issues, such as climate change, inequality, and health disparities. This abstract examines various examples of purpose-driven technology adoption across sectors, highlighting initiatives that promote social equity, environmental sustainability, and economic resilience. Through interdisciplinary collaboration, ethical considerations, and inclusive decision-making processes, purpose-driven technology adoption can foster positive societal impact while safeguarding the long-term health of our planet and its inhabitants.

I. INTRODUCTION

Technology, at once, has been both the pariah and the hero in the world of industry. For more than a decade, companies have had to live with the specter of either embracing a digital transformation, or sullenly standing by while competitors become stronger, faster, more efficient – and more financially successful. But this digital embrace – including Industry 4.0 -- has delivered significant positive impacts while sometimes supplanting humans in the workflow process. Technology, as a silo unto itself, tends to deliver the goods while keeping humans on the sidelines – relegated to less hands-on, and more analytical, roles. According to the report “Technological trends and policies” produced by the European Union, the cresting wave of a digital transformation extends beyond the factory floor and into society, creating uncertainties for industry workers who have had to find new purpose to conform to changing roles. At the same time, rapid advances in the power of technology easily outpace the ability of organizations to align priorities to take effective advantage of new capabilities, leading to the need for vision – and guidance to help put things into perspective. This is where Industry 5.0 comes in. Conceived as a way to complement the groundwork laid by Industry 4.0, it seeks to advance transformation are held in the same regard as technological advances.

Industry 5.0 – The Esg Union Of Man And Machine

Technology has driven progress in industry, business, and society in ways that once seemed unimaginable. Automation, analytics, and connectivity have reshaped how we work, how goods are manufactured, and how supply chains are linked together. But these rapid advances in the power of technology easily outpace the ability of organizations to align priorities to take effective advantage of new capabilities, leading to the need for vision and guidance to help put things into perspective.

Industrial Revolution, Revised

The vision of Industry 4.0, initially meant for the German manufacturing industry, was officially presented in 2011 at the Hannover Messe fair. The vision was about transforming the value chain through “smart” technologies like connected physical systems, cloud computing, artificial intelligence, and the Internet of Things. Just three years later, Japan published a complementary vision, termed Society 5.0, at the CeBIT fair – focused on the human impact of automation.



Fig (1) Industrial Revolution

The European Union has merged these perspectives to create a manifesto for “purpose-driven” technology adoption: Industry 5.0. This vision emphasizes a triple-bottom-line of economic, environmental, and societal impact, bringing ESG (Environment, Social and Governance) perspective and balance to what have often been technology-led and economic-driven choices. The core principles of Industry 5.0 are that the industry is Human-centric, Sustainable,

A People-Centric, Esg-Driven, Post-Pandemic Shift

The guiding tenets of Industry 5.0 draw upon the growing interest in the factors that are also driving increased interest in ESG investing. Some of the key related themes include sustainability and the environment, purpose, and values, corporate ethics, diversity, as well as circular economies. In the wake of the disruption and dislocations caused by the global COVID-19 pandemic, along with increasing reliance on digital infrastructure, there is also a focus on organizational, economic, and cyber resilience. Lastly, the integration of human factors into complex technology value chains is paramount with priority on the role of people in the future of work with increased human-machine collaboration and human-centric solution design.

Industry 4.0 and the Internet of Things

The vision for Industry 4.0 gained steam with the emergence of the Internet of Things (IoT) technologies, including the proliferation of smaller, cheaper, and better performing sensors. When deployed across factory floors and mated with advanced equipment, IoT sensors generated petabytes of data that facilitated extremely detailed measurement, monitoring, and analysis of systems and processes. It didn’t take long for Industry 4.0 to deliver financial efficiencies – companies that fully embraced the fourth industrial wave saw the cost of processing, bandwidth, storage, and sensors drop by huge margins that were measurable on the bottom line.

With advances in wireless technology, including 5G and wide-area, low power communications standards such as LoRaWAN, data can be uploaded to the cloud for high-performance analytics processing. Advances in artificial intelligence (AI) and machine learning (ML) technologies have accelerated the development of powerful algorithms that can drive real-time actionable insights. A recursive loop evolves – collect data, analyze, measure, refine, predict – that enables self-improving (and correcting) automation. The business benefits from the decreased downtime, improved operational efficiency, and better quality that are central guiding tenets of Industry 4.0.

Beyond the Machines :

Though highly automated processes work well, there are limitations. Automated, repetitive functions benefit from consistent improvements, and for scenarios that involve producing identical products manufactured through pre-defined processes, the combination of powerful technologies generates compelling benefits. Though this works well for homogenous products, it tends to fall short where greater customization and sophistication is demanded.

The (R)evolutionary Foundations of Industry 5.0 :

The promise of Industry 5.0 – and the vision for its immediate predecessor, Industry 4.0, has been nearly 250 years in the making. The First Industrial Revolution dates back to the 1780s, with the innovations around generating power from water, steam, and fossil fuels. The Second Industrial Revolution emerged in the 1870s, with the introduction of electrical energy, which allowed for the development of assembly lines and mass production. The Third Industrial Revolution emerged in the 1970s, with the rise of Information Technologies and semiconductors, enabling unprecedented automation across industries. The Fourth Industrial Revolution – which we have referred to as Industry 4.0 -- incorporates the components of Internet of Things (sensors, low power connectivity, etc.) with cloud computing and advanced analytics to create realtime interactions between virtual and physical environments – giving rise to cyberphysical systems. Industry 4.0 originated from a German government strategy project focused on transforming manufacturing into cyber-physical systems that generate significant savings in costs of production, logistics, and improved quality management

Industry Waves :The essential Industry 4.0 approach involves the deployment of IoT technologies in manufacturing facilities to collect and analyze data using cloud computing – then, using big data insights to power more efficient value chains. Effectively, Industry 4.0 is about automating processes and incorporating edge computing (both sensors and actuators) – the pure application of technology to create smart factories, leverage digital twins, and realize hyper-optimized production lines and smart products



Fig (2) Industry Waves.

1. Water/Steam: The mechanics of the steam engine to power industry
2. Electricity: The innovation of the assembly line enabling mass production
3. Automation: The speed of the computer to automate production
4. Cyber physical Systems: Digital systems to optimize production
5. Societal: Balancing industrial productivity with the impact on people and planet

Industry 4.0 - the digital transformation

3rd platform, innovation accelerators, OT and manufacturing meet in transformation.

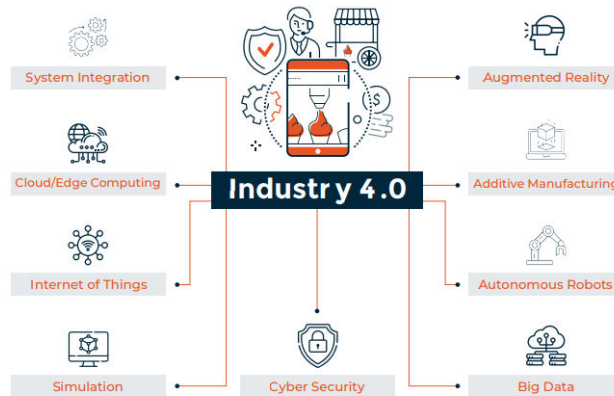


Fig (3) Industry 4.0 - the digital transformation

While Industry 4.0 is still in the initial stages of evolution, industry leaders have been looking ahead to the concept of a Fifth Industrial revolution that incorporates the principles of human-centricity, sustainability, and resilience

How to Get Ready for Industry 5.0 :

As we have discussed previously, the vision for Industry 5.0 builds upon the technological and business principles of Industry 4.0 with a focus on three ESGlike tenets: Human Centricity, Resilience, and Sustainability. With many businesses completely committed to adopting technology-enhanced processes and systems, it’s an ideal time to look ahead to the next generation of innovation. Industry 5.0 can be rightly seen as an evolution, incorporating foundational elements of Industry 4.0 into a more broadly encompassing vision that delivers a wider range of benefits to a broader set of stakeholders

Multiple Forces are Driving Change :

It’s become axiomatic that change is a constant for firms across industries, and businesses need to plan how to ensure their value chains can weather disruptions and ensure that there is an ample, appropriately trained workforce sufficient to meet production, sales, and support demands. The “great resignation” wave, in which employees are leaving their jobs at record rates, along with difficulties in filling open roles, underscores the value of talent management and particularly the need to attract and retain highly skilled workers. Increased trade protectionism, overwhelmed cargo chains along with shortages of key components and materials highlight the role of resilience. Greater focus on Environmental, Social, and Governance (ESG) factors from the investment community, regulatory emphasis on clean energy, and rising societal prioritization, are compelling organizations to articulate sustainable strategies

Positioning For the Future of Manufacturing :

The World Manufacturing Forum has identified 10 critical skills that will be needed in future manufacturing, and what’s important is that the mix of skills includes both digital and technology as well as cross-functional skills that relate to creativity, flexibility, and open-minded thinking. Leaders, managers, and line workers will all need to adapt and upgrade their own skills and capabilities to meet Industry 5.0 demands



Fig (4) Positioning For the Future of Manufacturing

Aligning Priorities for Industry 5.0 :

The concepts and principles of Digital Transformation have been explored at length in recent years. Most executives have gained fluency in the capabilities of technology and Digital Business. Building upon these foundational ideas, it’s prudent to focus on incorporating the principles of Human Centricity, Resilience, and Sustainability. The following are a few key concepts upon which to focus:

1. **Re-Orienting for Human Centricity:** There are several dimensions to advancing human-centric business. The first, and top priority, should be attracting and retaining talent. Particularly to technology-centered organizations, human capital is the most strategic asset and businesses will need to accommodate the growing cohort of Gen-Z and Millennials’ changing needs. For younger generations of workers, the commitment to environmental and social factors becomes increasingly important in their choice of employer, and this may include a commitment to community initiatives, flex working arrangements, and the cultivation of historically underrepresented minorities in leadership

roles. The human-centric vision also critically involves re-thinking how workers and machines collaborate. Traditionally static manufacturing processes can be updated with new collaborative robotics (co-bots) with line workers empowered to exercise greater flexibility in production. Worker safety and health can also be improved with advanced monitoring capabilities and ergonomic design. A healthy and happy workforce with opportunities for creative personal and professional advancement is likely to create lasting value for the business.

2. Bolstering Resilience: Recently, businesses have been forced to cope with increased uncertainties and adapt to cope with change. It's important for organizations to engage in planning exercises that account for potential disruptions across the value chain, from the factory floor to the supplier network, to transportation channels, to regulatory and geopolitical change. Digital technologies and methodologies (simulations and AI-enhanced modeling) can help identify optimal alternative paths in the event of disruption, weighing different factors such as cost, substitution, quality, and logistical concerns into the mix. Start with identifying the greatest points of vulnerability (whether in process or supply chain), isolate the key inputs, and then formulate contingency planning for any disruptions. It's better to have a plan and not need it than be caught unprepared. Aligning Priorities for Industry 5.0 Industry 5.0 Part 5: How to Get Ready for Industry 5.0 16 © 2022 | MOMENTA - DIGITAL DELIVERED

3. The Importance of Sustainability: With the growing regulatory and investor emphasis on reducing carbon emissions and environmental impact, businesses need to evaluate their resource footprint. This may involve analyzing the source of raw materials, the proportion of waste generated, along with an evaluation of the environmental impact, the energy efficiency of processes, as well as the sources of energy. Many firms have committed to specific reductions of fossil fuels and clean energy generation sources. Additionally, the adoption of new materials and composites (away from petroleum-based for instance) can reduce environmental impact while increasing the practices of recycling and repurposing materials can also help to achieve objectives.

Beyond Better, Cheaper, and Faster :

Preparing for Industry 5.0 is not inconsequential, but there are multiple forces arraying to compel businesses to adopt the core principles of human-centricity, resilience, and sustainability. It's far better to take the opportunity to prepare ahead of time, rather than react to an unanticipated shock to the system. Beyond better, cheaper, and faster, the technology-enhanced mantra Industry 5.0 promises to lead the next generation into a balance of decisions that support smarter, cleaner, and more resilient industries.

Here are some potential future scopes and implications of Industry 5.0:

1.Human-Machine Collaboration: Industry 5.0 envisions a future where humans and machines work closely together, each complementing the strengths of the other. This could lead to the creation of safer, more efficient work environments where humans and robots collaborate on tasks that play to their respective strengths.

2.Customization and Flexibility: With advanced robotics and AI, manufacturing processes can become more flexible and adaptable to changes in demand. Industry 5.0 could facilitate mass customization, where products are tailored to individual customer preferences without sacrificing efficiency or economies of scale.

3.Enhanced Training and Skill Development: As automation takes over repetitive tasks, human workers will increasingly focus on higher-level skills such as problem-solving, creativity, and decision-making. Industry 5.0 could lead to the development of new training programs and educational pathways to equip workers with the skills they need for this evolving industrial landscape.

4.Ethical and Social Considerations: As machines become more integrated into the workplace, there will be ethical and social considerations to address, such as job displacement, privacy concerns, and the impact on communities. Industry 5.0 will require careful consideration of these issues and the development of policies and regulations to ensure that technology benefits society as a whole.

5.Resilience and Sustainability: Industry 5.0 could enable more sustainable and resilient industrial systems by optimizing resource utilization, reducing waste, and minimizing environmental impact. Advanced technologies like AI and IoT can help companies monitor and optimize their processes in real-time to achieve these goals.

6.Global Collaboration and Connectivity: Industry 5.0 will further enhance global connectivity and collaboration, allowing companies to leverage expertise and resources from around the world. This could lead to new forms of

cooperation between industries, governments, and academic institutions to tackle complex challenges and drive innovation.

7.New Business Models: The shift towards Industry 5.0 may give rise to new business models based on shared resources, pay-per-use services, and collaborative partnerships between companies. This could democratize access to technology and create new opportunities for startups and small businesses to compete in the global marketplace.

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