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Industry 4.0 to Industry 5.0: Explorations in the Transition from a Techno-economic to a Socio-technical Future. Susu Nousala, Gary Metcalf, David Ing (Eds). Springer 2024

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Abstract. This book analyzes the critical evolution from the Fourth Industrial Revolution (Industry 4.0), which centered on efficiency, productivity, and techno-economic goals, to the emergent Fifth Industrial Revolution (Industry 5.0). Launched around 2020, Industry 5.0 represents a fundamental shift towards a socio-technical future that integrates societal and ecological values. It is primarily characterized by three pillars: sustainability, human-centricity, and resilience. The volume, which incorporates findings from the IN4ACT research project, investigates how industrial paradigms are being reshaped to respect these broader social and ecological concerns. Contributors explore the implications of this transition, including the necessary development of enhanced soft skills in the workplace, and the profound challenges and opportunities presented by technologies like Generative AI and Artificial Semi-General Intelligence (ASGI). The book emphasizes that this shift is not just a linear technological upgrade but a complex institutional and socio-technical development driven by criticism and pressure regarding social and environmental issues, ultimately complementing and extending Industry 4.0's features to achieve a better "win-win" interaction between industry and society.

Keywords. Industry 5.0 / Industrial Paradigm Shift; Human-Centricity / Socio-technical Systems; Sustainability and Resilience; Artificial Intelligence (AI) / Generative AI; Soft Skills / Workforce Transition.

JEL. O33; J24; L60; D63; P18.

Book Review

Industry 4.0 to Industry 5.0, edited by Susu Nousala, Gary Metcalf, and David Ing, is a crucial and timely academic exploration of the next great inflection point in industrial and societal development. The volume addresses the imperative to transcend the purely "techno-economic" focus of Industry 4.0 towards a more comprehensive "socio-technical future". Positioned within the Translational Systems Sciences series, the book serves as a vital bridge between the rapid advancements in digital industrial technology and the lagging imperatives of social and ecological well-being.

The central thesis of the book is that the emergence of Industry 5.0 (I5.0) is not merely a technological upgrade but a paradigm shift driven by external pressures—criticisms about social/environmental shortcomings and global crises like the COVID-19 pandemic and the climate crisis. It argues that for the industrial system to remain relevant and sustainable, it must re-orient itself around three fundamental, value-centric pillars: human-centricity, sustainability, and resilience. This book, which synthesizes research findings and insights leading up to 2024, is essential for scholars, policymakers, and industry leaders seeking to navigate this complex, non-linear transformation.

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Part I: Defining the Shift—From Efficiency to Values

The initial chapters of the volume are dedicated to clearly defining the divergence between I4.0 and I5.0. While Industry 4.0 is acknowledged for its success in driving efficiency and competitiveness through technologies like IoT, Cyber-Physical Systems, and Big Data Analytics, the book argues that this model has reached its conceptual limits by neglecting social and environmental concerns. Industry 5.0, in contrast, emerges as a value-centric paradigm intended to complement and extend I4.0's features by focusing on stakeholder value beyond mere shareholder profit.

This shift necessitates a change in how progress is measured. The discussion moves beyond productivity gains to consider broader metrics like societal well-being, environmental impact, and systemic resilience against global shocks. The book highlights that this re-prioritization aligns I5.0 with concepts like "Society 5.0" (first presented by the Japanese government), which seeks to balance economic development with the resolution of societal and environmental problems. The core message here is that the industrial system must transform from a purely economic engine into a "resilient provider of prosperity".

Part II: The Human and Skills Imperative

A significant and insightful portion of the book focuses on the "human-centric" pillar. The rise of automation, robotics, and, most recently, Generative AI (like ChatGPT) challenges the traditional division of labor and necessitates a reassessment of the workforce's future.

The analysis delves into the required skills transition for the workplace of Industry 5.0. It is suggested that the successful transition to a sustainable, resilient, and human-centered production model will require a new or enhanced set of soft skills. The book investigates the drivers behind this need for soft skills, such as complex issue handling and multi-scale systems thinking. Furthermore, it addresses the potential for sophisticated AI, specifically Artificial Semi-General Intelligence (ASGI), to encroach upon fields traditionally reserved for creative human work, thereby intensifying the need for distinct human skills that complement, rather than compete with, automated systems. By focusing on upskilling and the ethical relationship between human workers and technology (e.g., Cobots/Advanced Robotics), the book provides practical insights for managing the socio-technical integration of human labor into the new industrial ecosystem.

Part III: Systemic Change, Policy, and Institutional Forces

The volume uses a multidisciplinary approach, covering history, economics, social dynamics, ethics, and technology to map the transition. A critical contribution is the argument that the move to I5.0 is not solely technology-driven, but is fundamentally an institutional process. The authors contend that the new paradigm is shaped by institutional pressures, stakeholder interactions, and the shared meanings that emerge from discourse. This analytical lens, which draws on frameworks like the Multiple Level Perspective (MLP), suggests that the transition is a "reconfiguration pattern" of the socio-technical system, requiring the co-evolution of technology with social and institutional systems.

Policy-wise, the book aligns with the European Commission's conceptual report on Industry 5.0, which champions the triple transition: Digital, Green, and Social. This means that the goal of creating a more sustainable built-

infrastructure and achieving "win-win" outcomes requires elevating environmental and social objectives to the same priority level as technological and economic objectives. The book thus provides a robust framework for policymakers to design interventions that facilitate this systemic change, moving beyond purely technical solutions to address the complexity of adapting human behavior and organizational structures.

Conclusion

Industry 4.0 to Industry 5.0 is a profoundly insightful and essential text for understanding the next phase of industrial and economic development. It offers a necessary correction to the techno-optimism of the Fourth Industrial Revolution by firmly re-centering the discussion on human values and planetary boundaries. By providing a multidisciplinary perspective on the role of skills, the rise of powerful AI, and the required institutional reforms, the book succeeds in transforming the vague policy concept of Industry 5.0 into a concrete, actionable roadmap for a more sustainable, resilient, and ultimately more human future. It serves as a comprehensive guide for anyone looking to understand the forces—technological and social—that will shape the global economy for decades to come.