Preface

INTRODUCTION

About the Subject

Nowadays, almost everything turns around internet. New technologies and novel electronic devices surprise us each moment. Their processing capacity and interoperability goes further increasingly, and information systems are forced to align with that. The required foundations for an innovative internet environment, where all participating “things” can be easily connected and interoperable, and new services can emerge on top of that, are in plain sight. Industrial engineering and manufacturing areas are evidences of this. The planning, management and decision capacity, the control and monitorization of current production states, the capacity: i) to quickly reconfigure in an effort to correct or prevent defects and; ii) to realign to ever more global, distinct and dynamic requirements and stakeholders, are goals that interest to be continuously and jointly rethought and redefined, towards more competitive results. This scenario represents the framework of the Industry 4.0.

The Industry 4.0 has been announced as the next relevant milestone in continuous industrial transformation: 1) water and steam power production mechanization; 2) mass electric power production; 3) automation and computers; and 4) global industrial digitalization. Furthermore, if the previous took several years to make a relevant geo-localized impact, this one has come so fast and with so large a scope of impact, that industries, processes and humans, are not sufficiently prepared to deal with and get the most of it.

The short and dynamic product life cycle, the continuous technology progress, the aging work force, the shortage and heterogeneity of resources, the individualized product requirements, and high level of quality competition, are handicaps that hinders the required conversion of existent industries towards smart industries, the ones that fit Industry 4.0 paradigm.

The capacity to have production processes with: 1) interacting physical elements, processes and its controlling computational systems; 2) immediate data processing and analysis and, if required; 3) settings adjustment, to prevent or correct problems, substantiating a cyber-physical system, is the essence to the successful deployment of Industry 4.0.
Information and communications technology (ICT) is the key to the coming Industry 4.0 challenges. Artificial and augmented intelligence, advanced analytics, and predictive learning are relevant buzzwords that represent advanced processes for data mitigation and knowledge generation. Innovative products, processes and services should be on top of those processes, as well as on new and emerging technologies.

The expected uncertainty can be analyzed to help create processes based on effective collaboration and cooperation services. This human-centered behavior allows people work that only people can do, with automation responsible for the remaining processes. Thus, innovation can be turned to a competitive advantage.

The Mission

The mission of this book is to present the main issues, challenges, opportunities and trends related to the explosive range of new developments and applications of Industry 4.0, which has caused a permanent evolution, and impacts every organization and society as a whole.

The overall objectives are: to discuss the importance of this concept and their supporting technologies; to present recent developments; to introduce the state-of-the-art technologies; to discuss organizational preparedness; and to analyze the impact on society and on people.

This book is intended to support a professional audience of top managers and IT professionals and an academic audience (teachers, researchers and students, mainly of post-graduate studies).

ORGANIZATION OF THE BOOK

This book is organized in 15 chapters, co-authored by 55 contributors belonging to 27 different organizations ranging from the academia to different private sectors including industry and services.

The first chapter, “Teamwork Behavior: A Review to Interconnect Industry 4.0 Entities,” focuses on the integration of teamwork into existing models by providing a review identifying key factors that affect teamwork behavior to both human and agent-based models.

In Chapter 2, “Digital transformation Towards a New Context of Labor: Enterprise 4.0,” the authors present a comprehensive view on a new context of labour through the adoption of new technology enablers to improve organizational processes and Information Systems.

In Chapter 3, “The Role of Universities in Industry 4.0 Era: Entrepreneurship and Innovation Perspectives,” the authors take a focus on the relation between universities and industry, through the review of the entrepreneurial and research models applied in several countries.

In Chapter 4, “Technologies for Industry 4.0 Data Solutions,” the authors overview the requirements necessary to build an integrated data solution using existing isolated technologies like Industrial Control System and Information and Communication Technology, including work force without specific ICT background.
In Chapter 5, “Smart DC Microgrid: A Cyber-Physical System Perspective,” the authors present a cyber-physical system example of microgrid technologies, where producers can be at the same time consumers, discussing the relation between the physical domain, governed by the laws of physics, and the cyber domain, where computers run algorithms and make control decisions by communicating with actuators.

In Chapter 6, “Cyber-Physical Systems Framework for Smart Built-Environments,” the authors tackle the gap between digital building model (BIM) and automated data capturing (ADC) to promote the collaboration among the multiple dimensions of construction entities, creating a new cyber-physical system that while integrating the construction and logistic processes, manages the progress of construction site activities in close to real time.

In Chapter 7, “Smart Gateways for IOT-Factory Integration: Trends and Use Case,” the authors explore the integration of cyber-physical systems with industrial internet of things, presenting a case study developing smart gateways for different shop floor equipment. Furthermore, the authors also propose the tight collaboration between industry, university and startups to foster SME development.

In Chapter 8, “Cloud-Based Manufacturing (CBM) Interoperability in Industry 4.0,” the authors present the interoperability challenges between cyber-physical systems and cloud computing based services, presenting frameworks for IT model integration in industrial environment like IIRA and RAMI 4.0.

In Chapter 9, “Towards Industry 4.0: Efficient and Sustainable Manufacturing Leveraging MTEF – MTEF-MAESTRI Total Efficiency Framework,” the authors present an overview of the collaborative project MAESTRI that provides a total efficiency framework to advance the sustainability of the manufacturing industries based on four pillars: effective management, efficiency assessment tools, industrial symbiosis paradigm from energy and waste exchange, and an IOT infrastructure.

In Chapter 10, “A Practical Approach to Manufacturing Execution Systems at Bosch AvP: Scope, Structure, and Implementation,” the authors discuss the use of Manufacturing Execution Systems to maintain competitiveness and present a transition between the theoretical concept and a practical applied system controlling the shop floor operations.

In Chapter 11 “The Logistic Model Based on Positions (LoMoBaP [MoLoBaC]) and Industry 4.0,” the authors study the impact of a logistics model based on positions, which is globally applicable to any organization, when adapted to the Industry 4.0 business approach.

In Chapter 12, “Ceramic Industry 4.0: Paths of Revolution in Traditional Products,” the authors present the case study of a traditional industrial sector, the Portuguese ceramic industry, which is typically not related with high-tech. This study shows a pathway for traditional industries to assess, plan and lead the Industry 4.0 adoption.

In Chapter 13, “Digital Transformation in the Utilities Industry: Industry 4.0 and the Smart Network Water,” the authors propose a proof of concept platform for the water resources. This platform will achieve a more efficient management of related resources by improving existing processes through the application of digital transformation.
In Chapter 14, “Industry 4.0 from the Supply Chain Perspective: Case Study in the Food Sector,” the authors present a case study in the food sector from the point of view of the supply chain perspective, using a classification scheme of technologies, features and extensions.

In Chapter 15, “Enterprise Integration With the Structural Services Architectural Style,” the author presents a comparison of two architectures for enterprise application integration, SOA and REST, observing that the architectures are either state or behavior oriented. A new architecture style and service-oriented programming language are proposed to combine the best features of both architectures.

We hope you find it useful. Enjoy your reading.

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