



Course #3: Smart Operations Management

Module 1: Advance science for industrial process

Session 1: Operation management strategy in industry 4.0 context















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What is industry 4.0?















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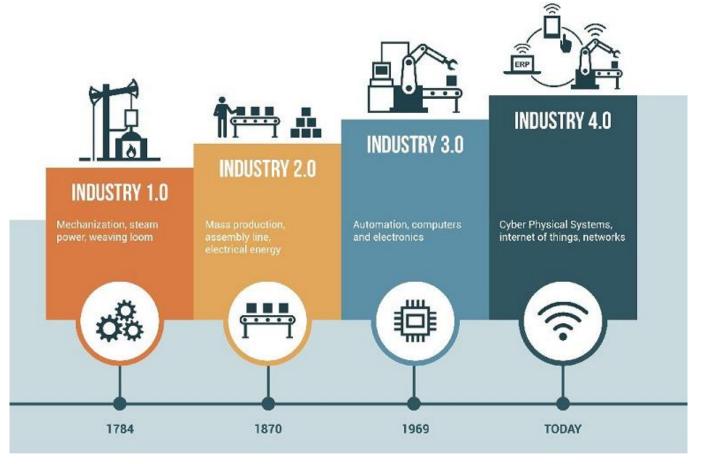
Different names of industry 4.0

- Smart Manufacturing
- Factories of the Future (FoF)
- Industry 4.0
- Industrial Value Chain Initiatives (IVI)
- Manufacturing Innovation 3.0
- Made in China 2025: A New Era for Chinese Manufacturing
- Productivities 4.0

https://www.nstda.or.th/th/nstda-knowledge/11529-industry-4-0



What is industry 4.0 ?



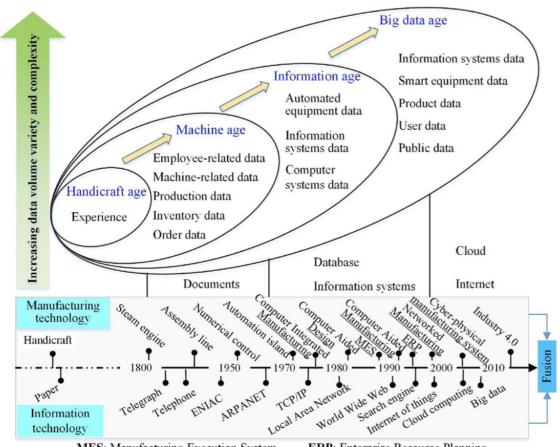
Co-funded by the Erasmus+ Programme of the European Union



Source: https://hammelscale.com/industry-4-0/



Evolution of data in manufacturing



MES: Manufacturing Execution System

ERP: Enterprise Resource Planning

Discussion 1



Define current status of industry 4.0 from your organization

Source: Tao, F., Qi, Q., Liu, A., & Kusiak, A. (2018). Data-driven smart manufacturing. Journal of Manufacturing Systems, 48, 157-169.







Comparison of manufacturing data in different manufacturing ages

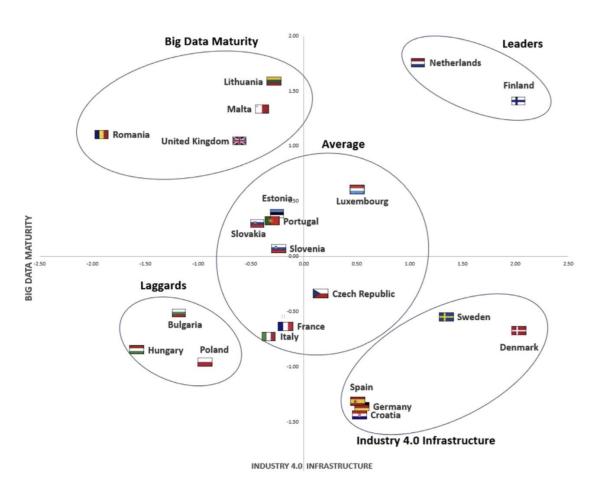
	Data Source	Data Collection	Data Storage	Data Analysis	Data Transfer	Data Management
Handicraft Age	Human experience	Manual collection	Human memory	Arbitrary	Verbal communication	N/A
Machine Age	Human and machines	Manual collection	Written documents	Systematic	Written documents	Human operators
Information Age	Human, machines, information and computer systems	Semi- automated collection	Databases	Conventional algorithms	Data files	Information systems
Big Data Age	Machines, product, user, information systems, public data	Automated collection	Cloud services	Big data algorithms	Digital files	Cloud and AI

Source: Tao, F., Qi, Q., Liu, A., & Kusiak, A. (2018). Data-driven smart manufacturing. Journal of Manufacturing Systems, 48, 157-169.





Industry 4.0 clusters by country







Where do you think Thailand fit in?

Source: Castelo-Branco, I., Cruz-Jesus, F., & Oliveira, T. (2019). Assessing Industry 4.0 readiness in manufacturing: Evidence for the European Union. *Computers in Industry,* 107, 22-32.







Industry 4.0 technologies











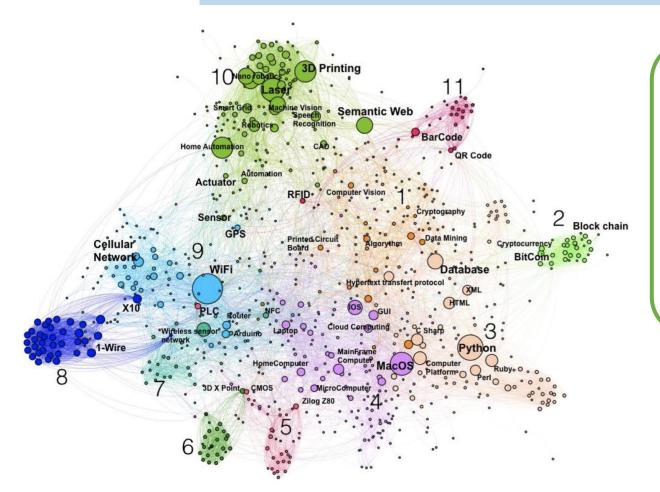




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Representation of the graph of 4.0 technologies







What are the industry 4.0 technologies that you are already familiar with?

Source: Chiarello, F., Trivelli, L., Bonaccorsi, A., & Fantoni, G. (2018). Extracting and mapping industry 4.0 technologies using wikipedia. *Computers in Industry, 100*, 244-257.





9 pillars of industry 4.0









Industry 4.0 framework













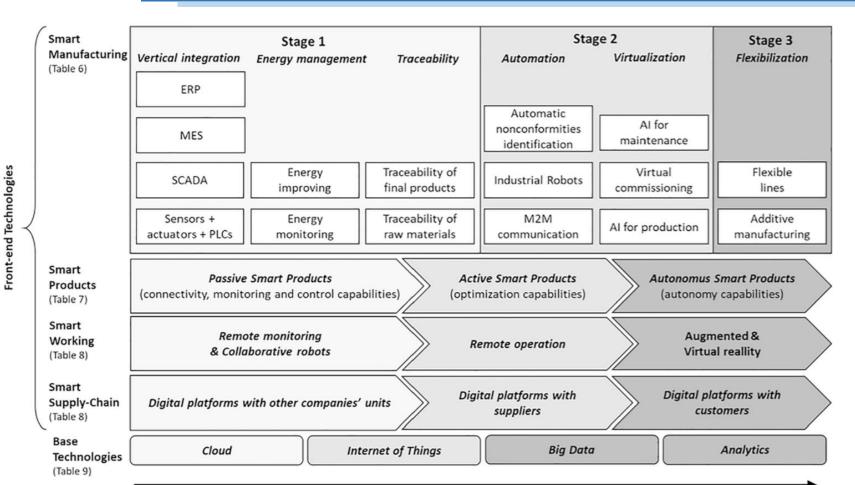


Curriculum Development

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Framework of industry 4.0 adoption patterns



Frank, A. G., Dalenogare, L. S., & Ayala, N. F. (2019). Industry 4.0 technologies: Implementation patterns in manufacturing companies. *International Journal of Production Economics*, 210, 15-26.

Complexity level of implementation of Industry 4.0 technologies





A Porter-like Value chain framework for industry 4.0

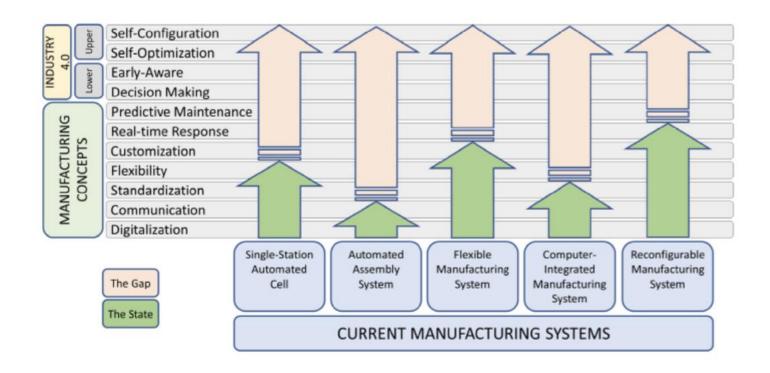
PRODUCTION	INTERNAL	PROCUREMENT	A MAINTENANCE	EXTERNAL	DISTRIBUTION	AFTER-SALES
robot cobot rfid/nfc microcontrollers sensors cloud processors plc	drones agv gps indoor rfid visualization devices cloud auto-unloading	rfid sensors block chain auto-unloading		drones block chain rfid sensors cloud gps	sensori cloud microcontrollori data minig microprocessori	SERVICES web platforms automatic diagnostic systems
RESOUR	CES	sensors - micropro	cessors - microcont	trollers - actuators		
⇔ CONNEC	TIVITY w	i-fi - bluetooth - 30	G - 4G - rfid/nfc -	5G - Ipwan - zigbe	e	
CYBER SECURIT	Υ	firewall - cry	ptography systems -	block chain		
BIG DAT		fog - data mir	nig - artificial intellig	rence - cloud		
SIMULA	TION	agent based -	system dynamics -	discrete events		

Source: Chiarello, F., Trivelli, L., Bonaccorsi, A., & Fantoni, G. (2018). Extracting and mapping industry 4.0 technologies using wikipedia. *Computers in Industry*, 100, 244-257.





Research gap between current manufacturing systems and I4.0



Source: Alcácer, V., & Cruz-Machado, V. (2019). Scanning the Industry 4.0: A Literature Review on Technologies for Manufacturing Systems. Engineering Science and Technology, an International Journal, 22(3), 899-919.









Thank You

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