

# Theoretical perspective of interaction between human and machine learning implications on industrial engineering

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## INTRODUCTION

- Industry 4.0, emerged with the arrival of **automation technologies, AI, Big data, IoT and smart factory**. Industry 4.0 offers mass production with little human involvement (Nahavandi, 2019)
- The pandemic has accelerated the rise of **robotics, digitalisation and the onset of Industry 5.0**. (Rymarczyk, 2020)
- The Industry 5.0 is a **new production model where the focus lies on the interaction between humans and machines** (Rymarczyk, 2020)
- Industry 5.0 brings personalization and the human touch back to manufacturing. **Collaborative robots** are well positioned to become Industry 5.0 tools, helping **humans create the personalized products** demanded by consumers. (Nahavandi, 2016)
- Industry 5.0 embodies these systems and incorporates greater human intelligence. (Nahavandi, 2019)
- Industry 5.0 brings benefits for industry, for workers and for society. **It empowers workers, as well as addresses the evolving skills and training needs of employees**. It increases the competitiveness of industry and helps attract the best talents. (Rymarczyk, 2020)

## RESULTS

### Future challenges

#### Economic challenges:

- Sustaining SMES
- Fair competition

#### Technological challenges:

- Combination between (cyber – physical – digital – biological)
- integration between machine learning & robotic engineering
- Advance human machine interaction

#### Societal challenges:

- Human behavioural adaptation
- Recognition & acceptance of machine domination
- Job loses & future job requirements

## METHODOLOGY

For research, previous literatures and has been collected. Scientific databases such as Google Scholar, Emerald, EBSCO & Science Direct has been used for selecting relevant articles.

Methodology of selected literatures (4.0)

Analogies	Google Scholar	Emerald Insight	EBSCO	Science Direct
Industrial revolution 4.0, Smart Factory	22	15	12	21
Human machine interactions, AI, IOT, AR	12	17	18	23

Collection of literatures analysed (4.0)

Literature Review	Case Study	Modelling/Conceptual framework	Test/Exp	Tool/Concept
6	5	9	10	12

Methodology of selected literatures (5.0)

Analogies	Google Scholar	Emerald Insight	EBSCO	Science Direct
Industries 5.0, Automatised factories	21	11	17	18
Big data, autoboots, robots, co-bots	20	15	19	23

Collection of literatures analysed (5.0)

Literature Review	Case Study	Modelling/Conceptual Framework	Test/Exp.	Tool/Concept
13	11	8	14	17

## References

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## CONCLUSION, CONTRIBUTION AND NOVELTY

“Bringing back human workers to the factory floors”

- the Fifth Industrial Revolution will pair **human and machine to further utilize human brainpower and creativity to increase process efficiency** by combining workflows with intelligent systems. (Nahavandi, 2016; Benrick, 2017)
- Industry 5.0 will be a **synergy between humans and autonomous machines**. The autonomous workforce will be **perceptive and informed about human intention** and desire. (Miller, 2017)
- **Human race will work alongside robots**, not only with no fear but also with peace of mind, knowing that their **robotic co-workers ‘Cobots’** adequately understand and have ability to effectively collaborate with them. It will result in an **exceptionally efficient and value-added production process, flourishing trusted autonomy**, and reduced waste and associated costs. (Nahavandi, 2019; Nahavandi, 2016).

