

Abstract

The literature identifies critical shortcomings of Industry 4.0 in the path toward sustainability. Additionally, technology-centered Industry 4.0 continues contributing to further automation and fails to place the human at the center of industry as well as society. In 2018, the term "Industry 5.0" was coined as a continuation of Industry 4.0, but authors now also consider deeper changes in the industrial economic models, in accordance with innovative European Commission programs. This literature review aims to underline the main interests and issues of this current problematic, highlighting the principal challenges and opportunities through an interdisciplinary collaboration.

Engineering education [6]

Expected common requirements:

- ▶ Lifelong transdisciplinary learning
- ▶ Understanding the impact of IA on society
- ▶ Integrating sustainability in design projects
- ▶ Basics of human-agent communication

Industry 5.0 to supplant 4.0

Shortcomings of Industry 4.0

- ▶ Industry 4.0 fails to meet increasingly pressing issues of resilience, sustainability in the context of climate change [11], in spite of its initial goals [5].
- ▶ Industry 4.0 is centered around technology for enhanced productivity, but fails to enhance the human place in industry. [11]
- ▶ Industry 4.0 raises social issues due to its enhancing automation by design. [9]

Characteristics of Industry 5.0 [5] [11]

- ▶ Centered on sustainability
- ▶ Enables workers in a human-centric approach
- ▶ Is probably incompatible with neo-liberal understanding of capitalism
- ▶ Encompasses, includes Industry 4.0
- ▶ Will increase prosperity of workers, consumers, investors and the environment

Experts needed!



The subject of Industry 5.0 and more generally Society 5.0 is by nature multidisciplinary. If you feel like this subject:

- ▶ interests you
- ▶ overlaps your research area
- ▶ is either entirely wrong, or absolutely necessary



Wait no longer: reach out to us and let us know. We realize that much of this subject is out of our area of expertise. Maybe it falls within yours.

A broader scope: Society 5.0 [7] [10]

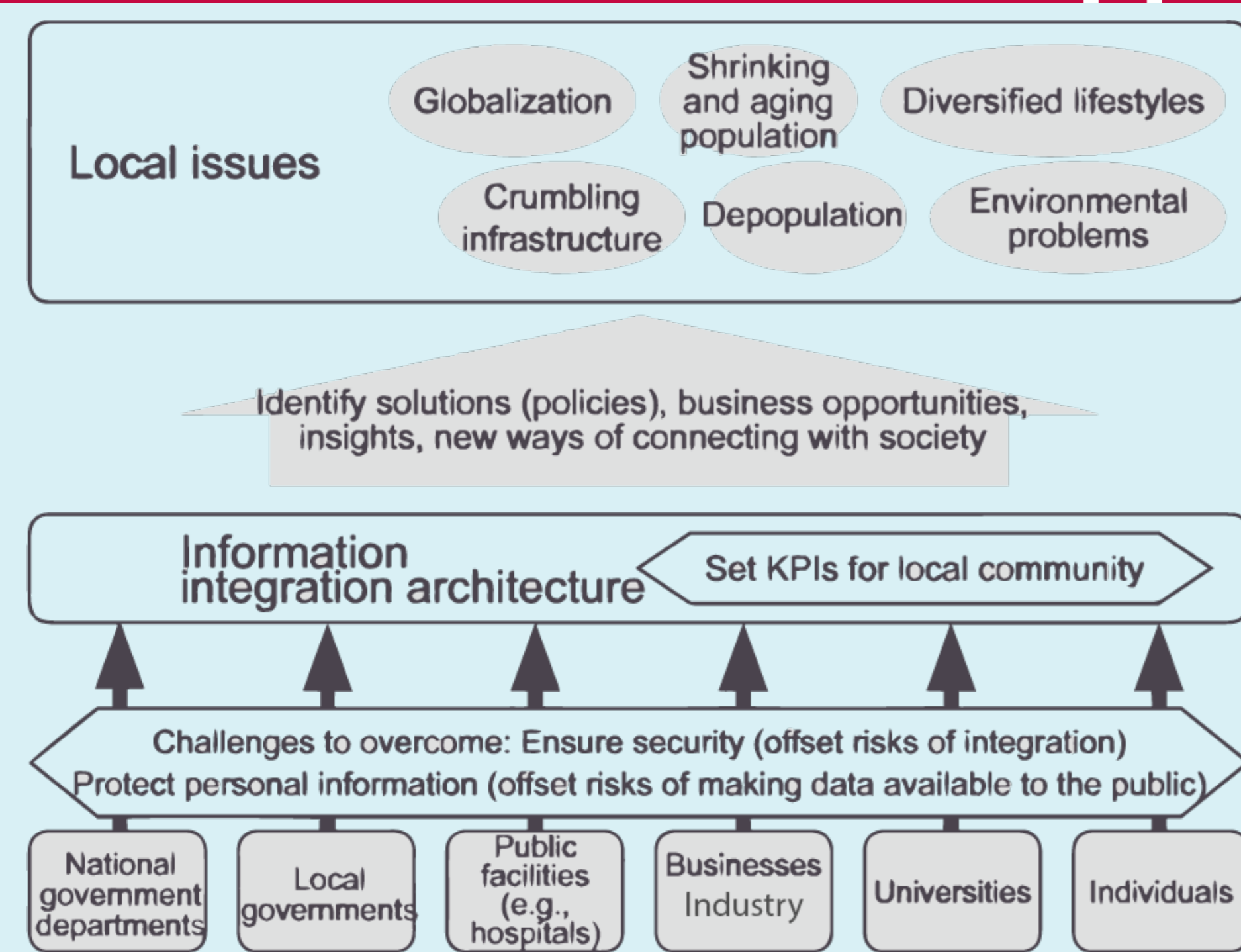
Society 5.0 is a concept created in 2016 by the Japanese Government. Society 5.0:

- ▶ is human-centric: the objective is not profit, nor data, nor technology: it is to allow human beings to live comfortably in all aspects of life
- ▶ makes use of Internet of Things (IoT), Artificial Intelligence (AI) to make cyber-physical systems (CPS) at the scale of cities and communities
- ▶ balances individual needs and community needs, for example in order to meet climate objectives in the spirit of sustainability
- ▶ moves toward a nonmonetary society by going cashless, and by enhancing the sharing economy based on collaborative commons instead of private ownership

Implications in robotics

Proposition in robotics revolve around cobots, which interfere less with human-centric views and preservation of employment than full automation. These cobots are expected to be autonomous thanks to AI [9]. The human-robot co-working raises a number of issues at several levels: social, psychological, organizational, ethical [2]. The choice of values that will direct Industry 5.0 is sensitive matter, based on sociocultural norms that are to be elected [8].

Stakeholders for Industry 5.0 [7]



Implications in risks analysis

It is expected that a human-centered industry will include specific human values and ethical developments [8] and need more diversified criteria in risk analysis and maintenance fields. Risks analysis methods such as FMECA can accommodate additional criteria, other than the usual severity, occurrence, and detection [3]. They can also be modified with weighing coefficients that better represent the values-driven priorities and their hierarchy.

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Conclusions and Perspectives

Conclusions

- ▶ Bibliometric analysis shows how recent the concept of Industry 5.0 is [1].
- ▶ The most central subjects in the current literature are related to artificial intelligence [1].
- ▶ The decisive criteria for the future of industry and society will stem from ethics and investment in human capital [4].
- ▶ Industry 5.0 is cross-disciplinary.

Perspectives

- ▶ A novel discipline merging engineering, human sciences and ethics is to emerge.
- ▶ Standards of sustainability are to be widely adopted across industrial practice.
- ▶ Aspects of Society 5.0 and Industry 5.0 might reduce solastalgia and improve mental health.
- ▶ Basic education on sustainability across the population might be key to support of policy changes.