

LETTER TO EDITOR

INTEGRATION HEALTH 4.0 WITH INDUSTRY 4.0

Sevil Alkan ÇEVIKER¹

Bulent AKKAYA²

Dear editor: COVID-19 is a quite new respiratory disease that has widely spread throughout the world (World Health Organization, 2020). The fourth industrial revolution has developed and reshaped many markets around the world at an unprecedented rate. Many new technologies and services improve people's lives to meet their needs and they can implement and manage them remotely. Since the Industry 4.0 has been impacting almost all industries, healthcare managers should prepare their organization very well including to manage covid-19 pandemic. In this context, this research aims to link Industry 4.0 and Health 4.0.

Lasi, Fettke, Kemper, Feld and Hoffmann (2014) described “Industry 4.0” as different IT driven changes which not only have technological but furthermore versatile organizational implications in manufacturing systems. Balasubramanian, Srinivasan, Buonopane, Subathra, Vain and Ramaswamy (2016), Vogel-Heuser, Rösch, Fischer, Simon, Ulewicz, and Folmer (2016) and M. Hermann, T. Pentek and B. Otto (2016) categorized the Industry 4.0 components and design principle as below:

- Additive technologies,
- Internet remote data storage technologies,
- Cyber-physical systems security technologies,
- Set of industrial detectors,
- Augmented/virtual reality technology,
- Internet of things,
- Big data.

Healthcare 4.0 includes nine components. These are IoT, IIoT, healthcare, cognitive computing, artificial intelligence, machine learning, virtual reality, augmented reality and cloud computing. Kumar, Krishnamurthi, Nayyar, Sharma, Grover and Hossain, 2020; Arfi, Nasr, Khvatova and Zaied, 2021) Healthcare 4.0 is one of the main domains of Industry 4.0, using various concepts in healthcare (Kumar et al., 2020). Industry 4.0 is completely revolutionizing e-Health and its whole ecosystem (Aceto, Persico and Pescapé, 2020).

¹ Ass.Prof.Dr. School of Medicine, Infection Diseases and Clinical Microbiology Çanakkale Onsekiz Mart University, Turkey, ORCID: 0000-0003-1944-2477, s-ewil@hotmail.com

² Dr., Department of Office Management and Executive Assistant of Manisa Celal Bayar University, Turkey, ORCID:0000-0003-1252-9334, bulent.akkaya@cbu.edu.tr

Smart Industry 4.0 components are adaptable and assist people and equipment facilitate to execute tasks. These components may, such as virtual reality and cyber-physical system, facilitate aware people assistance and the correct use of machines during their duties in healthcare information systems and practices IT systems. As expertise grows, healthcare will increasingly be structured modularly, and the global healthcare system is progressively moving from a professionally-oriented hospital-based to a dispersed, patient-centered healthcare model (Kagermann, Wahlster and Helbig, 2013). A significant issue, however, is certainly the degree to which this is sensible and necessary. Monitoring and virtualization of specified system parts can be adequate new technologies virtualization to be wider and simpler. From the healthcare domain viewpoint, this is particularly interesting to new strategies for the individualization of awareness of patients during covid-19. The Health 4.0 needs to prioritize virtual reality during covid-19 as a general because in the Industry 4.0. which is a basic requirement that may extend the Industry 4.0 design and pop up criteria to the Health 4.0. Health 4.0 must allow for gradual virtualization to support the healthcare personalization close to real-time for patients, doctors and even workers (Odeyinka, Ajibola and Ndinechi, 2020; Aceto, Persico & Pescapé, 2020).

Many studies have pointed out that technology will improve healthcare quality for patients and their awareness. However, a key factor is how to design such a systems using the virtual reality component of Industry 4.0. Therefore, healthcare organization, private and public medical institutions, and their managers need to discuss and integrate the industry 4.0 components with Health 4.0 systems. Future researches and developments may analyze the solutions how these components can be translated into healthcare organizations.

Increasing patients' awareness about the transmission of Coronavirus, risk factors as well as providing digital transformation or virtual reality for patients may help increase their awareness and therefore reduce their anxiety and worry. It is also recommended that in cities where techno-firms are available, the medical team may be provided how to manage digital transform while maintaining both their and patients' safety.

1. Declarations

1.1. Acknowledgment

None.

1.2. Author's contribution

Both authors made a substantial contribution to writing of the paper draft and met.

1.3. Conflict of interest

None.

1.4. Funding and support

None.

REFERENCES

- Aceto, G., Persico, V., & Pescapé, A. (2020). Industry 4.0 and health: Internet of things, big data, and cloud computing for healthcare 4.0. *Journal of Industrial Information Integration*, 18, 100129.
- Aceto, G., Persico, V., & Pescapé, A. (2020). Industry 4.0 and health: Internet of things, big data, and cloud computing for healthcare 4.0. *Journal of Industrial Information Integration*, 18, 100129.
- Arfi, W. B., Nasr, I. B., Khvatova, T., & Zaied, Y. B. (2021). Understanding acceptance of eHealthcare by IoT natives and IoT immigrants: An integrated model of UTAUT, perceived risk, and financial cost. *Technological Forecasting and Social Change*, 163, 120437.
- Balasubramaniyan, S., Srinivasan, S., Buonopane, F., Subathra, B., Vain, J., & Ramaswamy, S. (2016). Design and verification of Cyber-Physical Systems using TrueTime, evolutionary optimization and UPPAAL. *Microprocessors and microsystems*, 42, 37-48.
- Kagermann, H., Wahlster, W., & Helbig, J. (2013). Recommendations for implementing the strategic initiative Industrie 4.0: Final report of the Industrie 4.0 Working Group. *Forschungsunion: Berlin, Germany*.
- Kumar, A., Krishnamurthi, R., Nayyar, A., Sharma, K., Grover, V., & Hossain, E. (2020). A Novel Smart Healthcare Design, Simulation, and Implementation Using Healthcare 4.0 Processes. *IEEE Access*, 8, 118433-118471.
- Lasi, H., Fettke, P., Kemper, H. G., Feld, T., & Hoffmann, M. (2014). Industry 4.0. *Business & information systems engineering*, 6(4), 239-242.
- M. Hermann, T. Pentek and B. Otto, "Design Principles for Industrie 4.0 Scenarios," 2016 49th Hawaii International Conference on System Sciences (HICSS), Koloa, HI, USA, 2016, pp. 3928-3937, doi: 10.1109/HICSS.2016.488.
- Odeyinka, O. J., Ajibola, O. A., & Ndinechi, M. C. (2020). The Role and Trend of Information and Communications Technology Towards a Pervasive Healthcare System. *International Journal of Information Communication Technologies and Human Development (IJICTHD)*, 12(3), 59-73.
- Organization WH. Novel Coronavirus (2019-nCoV) Situation report-9, 29 January 2020. Geneva, Switzerland.2020.
- Vogel-Heuser, B., Rösch, S., Fischer, J., Simon, T., Ulewicz, S., & Folmer, J. (2016). Fault handling in PLC-based industry 4.0 automated production systems as a basis for restart and self-configuration and its evaluation. *Journal of software engineering and applications*, 9(01), 1-43.