Quality Festival 2019
ISSN 2620-2832

Mirjana Misita[1]
Dragan D. Milanovic

ORGANIZATIONAL AND MANAGEMENT CHANGE IN INDUSTRY 4.0

Abstract: *Key elements of Industry 4.0 are collaborative innovation, comprehensive integration, IoT, data driven and organizational change. This paper focus is analysis organizational change in new business environment. Management system in industry 4.0 can be viewed through three cycles: strategy, element and management cycle. Strategy cycle addresses on developing sustainable competitiveness or new capability. Element cycle is based on data driven - technology, business process and organizational structure. Management cycle is based on leadership role. Element cycle is analyzed, concrete organizational structure transformation to minimum viable organization (MVO) and management support for this process. Steps, phases and concepts for achieving MVO are discussed in this paper.*

Keywords: *Organization, Management, Industry 4.0*

1. Introduction

Industry 4.0 is German high-tech strategy for automation and data exchange in manufacturing technologies. This concept of manufacturing introduce as in environment of smart factory where computers connected and communicate with one another and make decisions without human involvement. This concept enables more efficient and productive way of manufacturing with minimal waste. But this concept demand readiness of companies for digital transformations.

The basic principle in Industry 4.0 are: interconnection, information transparency, technical assistance and decentralized decisions. But first step of measuring readiness of companies for Industry 4.0 is assessment of strategy and organization. It is crucial to access openness toward cultural interaction with Industry 4.0. It means: openness for implementation Industry 4.0 strategy, review corporate strategy, investments in all activity relating to Industry 4.0 and readiness for usage modern technology and innovation management.

2. Organizational change as one of key elements in Industry 4.0

Reference architecture model for Industry 4.0, shown on fig. 1, is well described in literature.

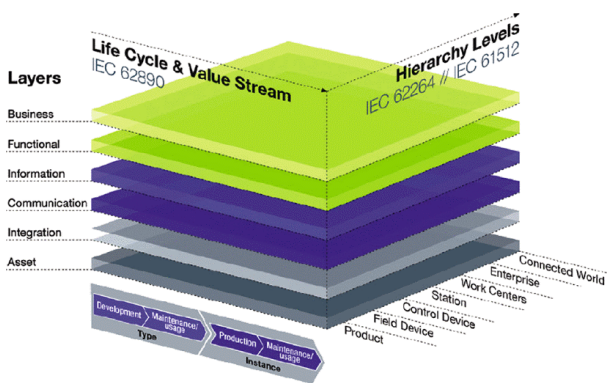

Figure 1. Reference Architecture Model for Industry 4.0

[1] Corresponding author: Mirjana Misita
Email: mmisita@mas.bg.ac.rs

RAMI model is starting point for reviewing corporate strategy and acceptance all activity related to Industry 4.0.

Yin (2016) indices key elements of Industry 4.0 and integration of industrialization and informatization are: collaborative innovation, organizational change, internet of everything and comprehensive integration (fig 2.). Focus of this paper is organizational change as one of key element in Industry 4.0.

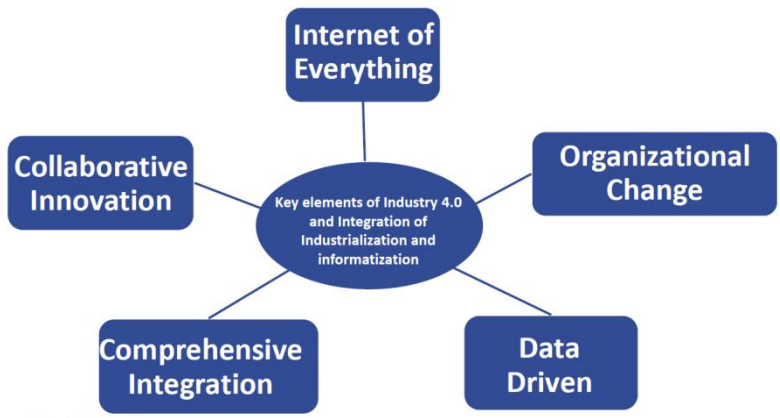

Figure 2. Key elements of Industry 4.0 (Yin, 2016)

Management system in industry 4.0 can be viewed through three cycles: strategy, element and management cycle (fig. 3). Strategy cycle addresses on developing sustainable competitiveness or new capability. Element cycle is based on data driven - technology, business process and organizational structure. Management cycle is based on leadership role. Focus of this paper is element cycle, concrete, organizational structure transformation to minimum viable organization (MVO) and management support for this process.

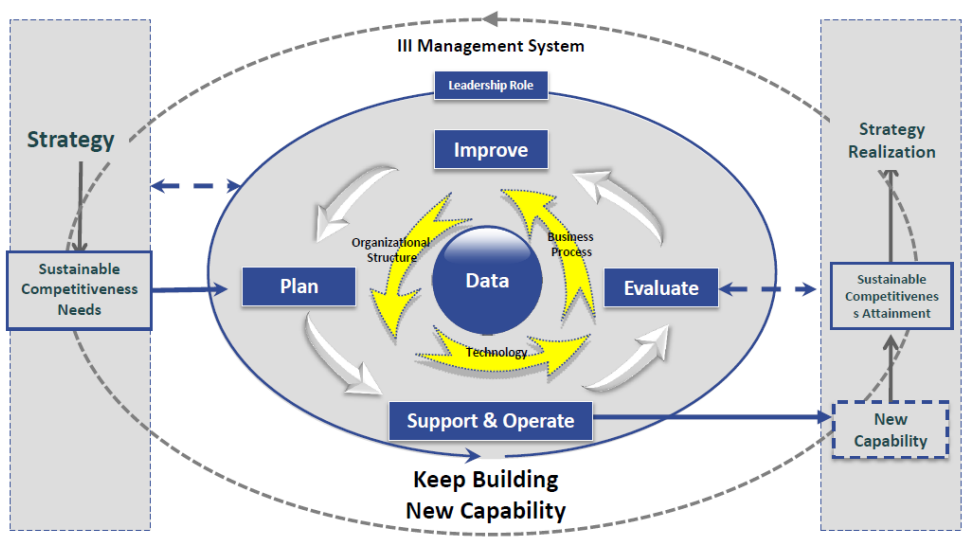

Figure 3. Three Cycles and Four Elements of Management System (Yin, 2016)

This overview of management systems help as to see position of organization structure position in Management system of Industry 4.0

According to Borioli (2017) minimum viable organization (MVO) model offers a novel perspective on the process of organizational change towards a lean production system. Author states that the minimum viable organization model describes the iterative process of evolution of lean production as a viable system.

Heynitz and Brimcker (2016) think that redesign of organizational structures of companies for introducing Industry 4.0 should start with transformation at all levels into a process-oriented structural organization. The introduction of ERP into the company is not only a software solution but a business philosophy. By introducing ERP, the company accepts the organizational culture and structure, and process-oriented organizational structure alowes easily allocate cost center costs to business processes beside calculating conventional cost center accounting capabilities.

Fridman (2016) explain occurence of gap between technology, individuals, company and public policy (fig. 4).

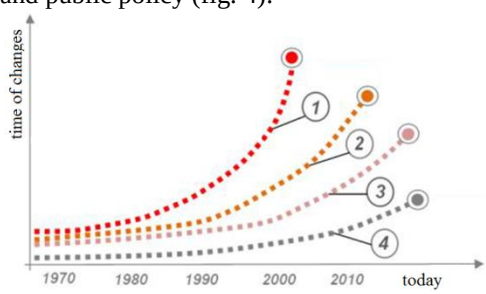

Figure 4.. Gap between technology (1), individual (2), company (3) and public policy (4), (Fredman, 2016)

Fridman (2016) discused that technology development has exponential growth during the time. An individual very fast adopt new technological changes, while company and public policy slowly adopt new technology solutions and that is the reason for the gap occurences.

Schlund and others (2019) conduct research involving 518 German companies in the manufacturing sector, during 2014. Research aim is to investigate impact Industry 4.0 technology on job design and work organization. Structure of analyzed companies was: SME (33%), large companies (60%). Only 6% of those surveyed believe that their company is fully ready for Industry 4.0, 39% of companies believes that they are prepared, while a 55% of companies have yet to begin work to prepare for Industry 4.0. Results of investigation in term of impact on work organization indicate: 51% of surveyed managers say that industry 4.0. reduce amount of simple manual work; contrary of thinking that in future organization structure is going to be flatten, this research shows that introduction of Industry 4.0 will result in level hierarchy (Fig.5. left). Decentralized decision making and self-organization in Industry 4.0. companies will become more important. Only 26% of respondents think that this will affect span of control in expanding, 55% says no change, and 20% thinks that span of control is going to shrink. But 74% of respondents think that organizational hierarchy will not disappear with introduction of industry 4.0.

On figure 5 is shown 5 layer automation architecture where: I/O devices (sensors) sends signals to logical controllers (PCL). SCADA systems perform control tasks, while, management execution systems is for complex tasks like production scheduling. ERP on top level is for management reporting and planning.

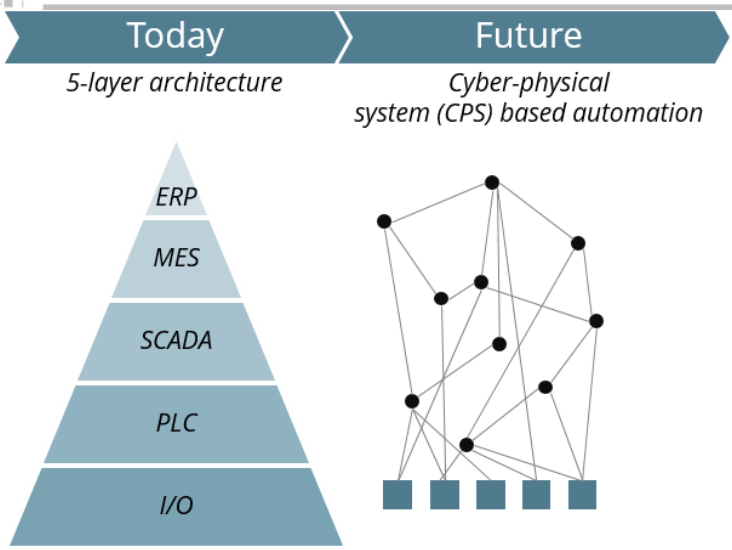

Figure 5. Future distributed Cyber-phisical system (Lueth, 2015)

Today
ERP - Enterprise resource planning level
MES - Plant managemet level
SCADA - Proces control level
PLC - Control Level
I/O - Field level

Future
- I/O devices
- distributed functionality
- service interaction

According to Leuth (2015) future cyber-physical systems will be highly networked system structure compound of humans, IT systems and automation components (fig. 5 left). Every component on fig. 5 (left) could interact with any others components which enable strong horizontal and vertical integration.

VDI/VDE Society for Measurement and Automation presented on Hanover Fair in 2013 viewpoint of successive dissolution classic automation pyramid and replacement by networked, decentrally organized or partially self-organizing (fig. 5). Figure 5 shows the transformation of the hierarchical pyramid (fig. 5, left) to the network structure in (fig. 5, right).

The existing automation pyramid will be gradually dissolved by the introduction of networked decentralized systems, and that the various levels will no longer exist for the structure of hardware and networking as well as for information processing and engineering. Services, data and hardware components can be distributed to any nodes of the emerging network and thus form abstract functional modules that make up the automation system.

The classic automation pyramid (fig. 6,a) shows not only the functional structure of an automation system, but also the compression of data and information in the individual nodes. With CPPS, the automation pyramid is gradually abstracted to its functional structure through the possibility of using and providing decentralized services in the various nodes (fig. 6,b). For the time being, real-time critical controls and regulations will initially remain in the field level close to the process. In the future, owever, it is also conceivable that real-time-relevant requirements can be met by new architectures distributed in the CPPS (fig. 6,c).

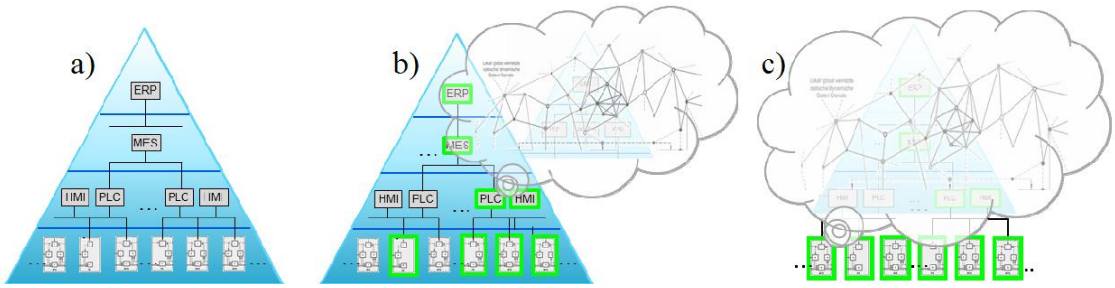

Figure 6. Successive dissolution classic automation pyramid and replacement by networked, decentrally organized or partially self-organizing services (VDI/VDE, 2013)

Extensive survey, carried out by Deloitt company, about global human capital trends. This survey includes more than 10,000 HR and business leaders across 140 countries. Bersin and others (2017), as participants in this survey, conclude from survey results about shifting away from hierarchical organizational structures toward models where work is accomplished in teams (fig.7.). Results indice that leading companies has flexible, team-centric organizational structrue model.

Overall conclusion is that by transitions, companies start with making smaller teams, encourage teams and individuals to share information and move from team to team depending on task/issue. That how is making network of specialist. Sharing information between of network of different spacialities speed up innovations, market share/gowing etc (fig. 7).

The network teams shared values and culture, also has transparent goals and projects. In the network team, peopre is rewarded for their skills and aabilities, not position. Also free flow of information and feedback is crucial for sucess of team network structure.

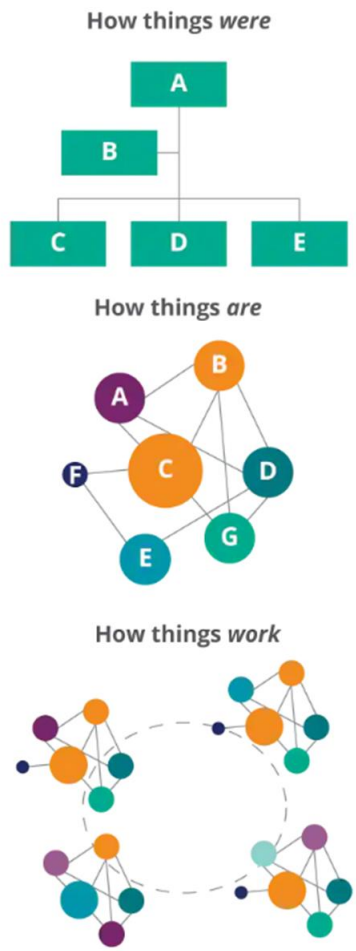

Figure 7. The network of teams (Bersin, 2017)

3. Conclusion

Based on the conducted research and the obtained knowledge, it can be concluded that the first step towards introducing the concept of Industry 4.0 is the openness of the observed company for organizational and technological changes.

Encouraging the development of the manufacturing industry in the direction of implementing the concept of Industry 4.0 by the state government is of key importance. This step is important except for its own development and growth, and for inclusion in global trends and competitive abilities

The next step toward the introduction indsutry 4.0 is the strategic harmonization and organizational transition to a five-layer organizational pyramid with the creation of small teams adaptable to innovative solutions. Decentralized decision-making and self-organization should be a strategic goal for which the reaching strategies to target. In addition to investments in digital equipment, companies should also plan investments in organizational transition, which involves training and education of employees for two reasons: due to the development of their own skills, IT knowledge, etc. and for ensuring the successful implementation of the Industry 4.0 concept.

References:

Lueth, K. L. (2015). Will the industrial Internet disrupt the smart factory of the future? 2015. [Online]. Available: http://iot-analytics.com/industrial-internetdisrupt-smart-factory/.

Heynitz H., Brimcker M. (2016). The Facotry of the Future: Industry 4.0 - The challenges of tomorrow, KPMG.

VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik (2013). Cyber-Physical Systems: Chancen und Nutzen aus Sicht der Automation.

Thomas L. Friedman, *Thank You for Being Late* (Farrar, Straus & Gioux, 2016), pp. 213–219.

Bersin J., McDowell T., Rahnema A., Durme Y. (2017). The organization of the future, Deloitte University Press.

Borioli, S.G; (2017) The Minimum Viable Organization Model: a grounded model of planned transformation to a Lean Production System. Doctoral thesis, UCL (University College London).

Yin L, (2016). Exploration and Practice of Industry 4.0 in China, Electronic Technology Information Research Institute, https://www.plattform-i40.de

Referenzarhitekturmodell Industrie 4.0 (RAMI4.0), (2015). VDI/VDE Gesellschaft Mess- und automatizierungstechnik.

Schlund, S., Hämmerle, M., Strölin, T., Industry 4.0 – a revolution in work organization: How automation and digitization will change production, Ingenics AG , Fraunhofer Institute for Industrial Engineering IAO, Stuttgart, https://www.ingenics.com, accessed on 2019.

Mirjana Misita
University of Belgrade,
Faculty of Mechanical Engineering,
Belgrade,
Serbia
mmisita@mas.bg.ac.rs

Dragan D. Milanovic
University of Belgrade,
Faculty of Mechanical Engineering,
Belgrade,
Serbia
ddmilanovic@mas.bg.ac.rs