

PROGRESS TOWARDS INDUSTRY 4.0 – A MANAGEMENT TOOLS PERSPECTIVE

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Abstract The main aim of this draft paper is to discuss the progress towards Industry 4.0 in organizations, through the lenses of management tools utilization. Our discussion is based on the cognitions that management tools support organizational working under Industry 4.0 circumstances. According to the management tools utilization we argue about the level of Industry 4.0 implementation in organizations. Based on the current level of management tools utilization, it is evident that in the forefront are management tools, which are not tightly associated with supporting organizational working under Industry 4.0 circumstances, like outsourcing, benchmarking, knowledge management, etc, while commonly emphasized management tools for supporting organizational working under Industry 4.0 circumstances, are not in the forefront of use, like lean production, RFID, six-sigma, etc. Results allow us to argue that organizations are at the early stages of Industry 4.0 implementation in organizations. The paper offers some possible reasons for such state. This paper should also trigger questions, how to increase the level of Industry 4.0 implementation in organizations.

Keywords:
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level,
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1 Introduction

In management literature, the terms digitalization, internet of things, smart organization, and Industry 4.0 has been increasing appearing over last few years. The new imperative of nowadays business environment, especially for manufacturing organizations, is the phenomena of digitalization, usually conceptualized as Industry 4.0. The issues of increased digitalization and implementation of principles of Industry 4.0 in organizational practice, have been recently much discussed (Lu, 2017; Potočan, Mulej, & Nedelko, 2020; Roblek, Meško, & Krapež, 2016; Zezulka, Marcon, Vesely, & Sajdl, 2016).

From the beginning of the emergence of Industry 4.0 phenomena, the focus was on general debates about conceptualization of Industry 4.0 and its possible applications in organizations. The main body of the literature deals with the implementation of Industry 4.0 principles in organizations, where the focus is on technical aspect of digitalization by focusing on issues related with implementation of IT solutions, changes due to the new technologies, reporting good practices of implementation (Mrugalska & Wyrwicka, 2017; Otles & Sakalli, 2019), etc. More softer aspects of Industry 4.0 implementation in organizations, like managerial perspective, needed new personal and professional competences, management tools that support working under Industry 4.0 circumstances, are given less attention, although their importance increased steadily over last few years (Črešnar & Nedelko, 2020; Ghobakhloo, 2018; Schneider, 2018).

An important stream of research in context of Industry 4.0 is also focusing on assessing the readiness of organizations for Industry 4.0 implementation. There has been an ongoing debate for some years how to assess readiness for Industry 4.0 and level of Industry 4.0 implementation in organizations. Most commonly are outlined models from Warwick University (Agca et al., 2017) and Acateh model (Schuh, Anderl, Gausemeier, ten Hompel, & Wahlster, 2017) to assess the readiness of organizations for Industry 4.0. There is also an alternative way, to assess level of Industry 4.0 implementation based on usage of management tools (Črešnar, Potočan, & Nedelko, 2020). The latest way is more comprehensive, as it emphasizes how management tools, which are commonly used in organizations, support organizational working and how management tools contribute to the increasing level of Industry 4.0 implementation in organizations. Following this, the paper

offers some insights how organizations are progressing towards Industry 4.0 implementation.

The structure of the paper is as follows. First, we provide a short theoretical insight what is Industry 4.0 and what are management tools. Next, we emphasize current state of management tools usage in organizations to get an insight into Industry 4.0 implementation level, through the prism of management tools utilization. Finally, we discuss the reasons for current level of Industry 4.0 implementation, while also consider the impact of COVID 19 circumstances. We conclude the paper with some thought about future research directions.

2 Theoretical background

Management tools can be seen as a set of ideas and concepts to support organizational working and behavior, across various functional areas, organizational processes, and different hierarchical levels in organizations (Dabic, Potocan, Nedelko, & Morgan, 2013; Potocan, Nedelko, & Mulej, 2012; D. Rigby, 2001).

Industry 4.0 can be most simply defined as a set of permanent connections between all objects (e.g. machines, equipment) and subjects (i.e. people) in organization and beyond the organization (i.e. customers and suppliers) (Dombrowski, Richter, & Krenkel, 2017; Wagner, Herrmann, & Thiede, 2017; Zezulka et al., 2016).

The linkages between utilization of management tools and Industry 4.0 have been addressed in the literature. Most commonly is emphasized lean production, which is considered as foundation for Industry 4.0 implementation in organizations (Mrugalska & Wyrwicka, 2017; Rossini, Costa, Tortorella, & Portioli-Staudacher, 2019; Wagner et al., 2017). Looking through the prism of “content of management tools” also other tools are closely related to the digitalization of organizations, like six sigma (Jayaram, 2016), radio-frequency identification (Mladineo et al., 2019), strategic planning (Butt, 2020), and others.

In a comprehensive study of management tools under Industry 4.0 circumstances, Črešnar et al. (2020) revealed following management tools, which are supporting organizational working under Industry 4.0 circumstances, namely, (1) digital transformation, (2) balanced scorecard, (3) rapid prototyping, (4) radio-frequency

identification, (5) six sigma, (6) mission and vision statement, (7) customer segmentation, and (8) total quality management.

Thus, the level of management tools utilization may serve us as an indicator of organizational readiness for implementing industry 4.0 and the progress towards implementation of Industry 4.0 principles in organizations. Accordingly, based on the associations between management tools and working under Industry 4.0 circumstances, it can be speculated that relatively lower utilization of management tools aimed on supporting organizational working under Industry 4.0 circumstances, emphasize lower readiness of organizations, comparing to the organizations having higher level of utilization of management tools, considered to support organizational working under Industry 4.0 circumstances.

3 Management tools utilization in organizations in Central Europe

In this section we outline current level of management tools utilization in organizations in Central Europe. Based on prior studies of management tools and list of tools in this studies (Dabic et al., 2013; Z. Nedelko, Potocan, & Dabić, 2015; Z. Nedelko & Potočan, 2016; D. K. Rigby & Bilodeau, 2015), for the purpose our discussion about the level of Industry 4.0 adoption in organizations, we adopt mean values about usage of management tools, from the study examining usage of management tools in organizations in Central Europe (Treven, Uršič, & Rashad, 2019). The mean values about most commonly used management tools in organizations in Central Europe are outline in Table 1.

Table 1: Management tools usage in Central Europe^a

Management tool	Mean	SD
Outsourcing	1.52	.666
Benchmarking	1.57	.671
Total quality management	1.68	.688
Knowledge management	1.72	.744
Core competencies	1.75	.821
Strategic planning	1.77	.624
Customer relationship management	1.89	.725
Business process reengineering	1.90	.771
Mission and vision statements	1.94	.795
Balanced scorecard	1.97	.866
Mergers and acquisitions	2.03	.649
Customer segmentation	2.07	.717
Loyalty management	2.15	.701
Strategic alliances	2.17	.696
Scenario planning	2.18	.786
Corporate blogs	2.18	.809
Growth strategic tools	2.29	.709
Collaborative innovation	2.32	.696
Lean production	2.39	.618
Six sigma	2.40	.712
Consumer ethnography	2.47	.666
Shared service centers	2.48	.620
Radio frequency identification	2.53	.666
Off-shoring	2.55	.626

^a N = 184-198 (due to the missing values). Respondents indicated their utilization of single management tool with help of a Likert-type scale ranging from “I know and use the tool” (1) to “I don’t know and don’t use the tool” (3).

4 Discussion and conclusions

The outlined results show, that in considered Central Europe organizations are in the forefront management tool aimed on optimization of organizational processes, increasing quality and improving knowledge and competencies of employees (Z. Nedelko & Potočan, 2016).

Looking through the prism of Slovenian context, it is very interesting, that even though that Slovenia’s largest export partner is Germany, where the Industry 4.0 was established and that Germany organizations are on the higher level of Industry 4.0 adoption in organizations, Slovenia is not at the high level of Industry 4.0 implementation (Zlatko Nedelko & Potocan, 2018).

As many Slovenian organizations are acting as sub-contractors in large supply chain, it seems logical that there will be much pressure from the focal organizations to follow the practices of focal organization, in order that sub-contractors will be compatible with focal organization. We may argue that this is still not at the forefront of the interest, rather is still in most important assuring high level of quality, as Slovenian sub-contractors are reliable and are achieving high quality standards. It seems that achieving quality is still most important feature, comparing to the putting in the at the first-place concern for Industry 4.0.

Certainly, Slovenian organizations have already implemented and are still implementing many elements of Industry 4.0 principles adoption in order to become and stay competitive in the market. Thus, we have many examples, where lean principles were implemented to support achieving better quality, faster production cycle and overall optimization of the processes. Although, it would be worth to consider the low level of lean principles/manufacturing usage, as some authors claimed that lean principles are key foundation for Industry 4.0 (Mayr et al., 2018; Xu & Ta, 2018), while some claim that lean principles are not associated with Industry 4.0 implementation (Črešnar et al., 2020).

Interesting is that in Slovenian organizations is most commonly used outsourcing. This is a logic consequence of the fact, that in Slovenia are more than 90 percent of organization with less than 50 employees, therefore considered as micro and small enterprises. Thus, it would be irrational to expect that they first goal will be to implement Industry 4.0 principles, which aims to connect all aspects of organization together. What is more, outsourcing has negative impact on organizational implementation of Industry 4.0 principles in organizations (Črešnar et al., 2020). This support the speculation, that Industry 4.0 is hard and very expensive to implement in smaller organizations, and it is not in line with the policy of “outsourcing” in organizations.

To sum up, looking on the organizational readiness for Industry 4.0, through the prism of management tools utilization, we may argue that the current pattern and level of management tools usage suggest, that the organizations in Central Europe are at the beginning of their journey towards Industry 4.0 implementation. These findings are in line with findings about early stages of Industry 4.0 implementation

in organizations (Horvat, Kroll, & Jäger, 2019; Hubert Backhaus & Nadarajah, 2019).

When the phenomena of Industry 4.0 become relatively well-known, a general enthusiasm may be noticed and an independent observer may get feeling that Industry 4.0 has become a new “must have in organizations”. Looking from today’s perspective, few years later since the Industry 4.0 emerged, we can observe that the initial enthusiasm has vanished. We may argue that this due to the complexity of the implementation of principles and especially technologies associated with Industry 4.0. Next, huge costs associated with new technologies, adaptation of older equipment and possible incompatibilities, also reduced the pace of Industry 4.0 principles adoption. Another reason may lie in the so called “dependence on technology”, where organization do not want to implement costly technologies, which makes them depended on regular maintenance, adoptions, etc.

Additionally, in light of current economic circumstances, caused by COVID 19, we may argue, that the process of moving toward higher levels of Industry 4.0 implementation in organizations, is hindered due to these circumstances, created by COVID 19 crisis. COVID 19 may also be considered, either as either as facilitator or impediment (Acioli, Scavarda, & Reis, 2021; Czifra & Molnár, 2020) for Industry 4.0 implementation. Industry 4.0 therefore may be seen as a way to help organization to cope with negative consequences of COVID 19. Although, more realistic is that COVID 19 will acts as a barrier towards Industry 4.0 implementation. When considering COVID 19 as barrier, we may argue that organizations in crisis circumstances put more focus on organizational survival, not so much on “developing new projects” (Lauesen, 2013; Soulsby, Hollinshead, & Steger, 2017), among which is also Industry 4.0 implementation.

In terms of paper implications, the findings suggest, that Slovenian organizations are at the initial level of Industry 4.0 implementation. Managers should recognize the importance of management tools usage for fostering implementation of Industry 4.0 principles in organizations. Thus, managers should re-thing current usage of certain management tools in organizations, and try to boost usage of tools, which may speed up implementation of Industry 4.0 principles. For instance, outsourcing is negatively related with implementation of Industry 4.0 practices. This is of significant importance, as in Slovenia outsourcing has been most commonly used, or at least

among top three management tools. This implies, that this may importantly impede implementation of Industry 4.0 principles in Slovenian organizations.

Therefore, above cognitions call for deeper research about the role of certain management tools in context of Industry 4.0 implementation, like outsourcing and lean production. Adding new management tools, especially the tools associated with digitalization, which are currently not listed, like digital transformation (Črešnar et al., 2020), will sharpen the picture about the role of management tools for Industry 4.0 implementation. Beneficial will be also to distinguish between countries having different economic, cultural and social settings, to verify the pattern of the results beyond the Slovenian context, emphasized in this paper.

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