

LEADERSHIP COMPETENCY FRAMEWORK FOR INDUSTRY 4.0 IN THE POST-COVID-19 SCENARIO

JULITA MAJCZYK

University of Warsaw, Faculty of Management, Warsaw, Poland
jmajczyk@uw.edu.pl

Abstract There is no single and ultimate leadership competencies framework, although expectations are evolving for such a framework, as can be observed in both scientific articles and reports on competencies for Industry 4.0 (I4.0). The aim of this study is to identify the leadership skills perceived as essential for I4.0 and describe the changes in the leadership skills curriculum caused by the spread of SARS-CoV-2. The author collected data from purposely drawn samples of nurturing leader process owners using in-depth individual interviews. A total of 26 programme owners from 22 large economic entities, in which the leadership development programmes (LDPs) operate, participated in the research. Qualitative data analysis was used to establish the effect of COVID-19 on the competencies for I4.0. Data indicate that the design of LDPs did not pay attention to the determinants of the economic environment known as I4.0, however, the LDP curriculum reflects the concepts and theories considered contemporary. However, the pandemic has affected the perception of a leader's role as a caregiver. Therefore, the competencies added to the curriculum focus on building and maintaining positive relationships. Qualitative research does not allow for broad generalisations. Sample size, context of large companies, and perceptual data are additional limitations.

Keywords:
competences,
leadership
development,
Industry 4.0,
curriculum,
semi-structured
interviews

1 Introduction

There is no single and ultimate leadership competencies (LC) framework. Although expectations for such a framework are evolving over time (Babatunde, 2021), leadership skills are considered necessary, as the Industry 4.0 (I4.0) environment means more responsible tasks and flat structures (Kannan & Garad, 2020). In general, competencies are a combination of knowledge, skills and attributes (Ruel et al., 2021). Hecklau et al. (2016, p.2) defined this as a ‘set of skills, abilities, knowledge, attitude and motivations an individual needs to cope with job-related tasks and challenges effectively.’ Leadership competencies are the knowledge, skills, abilities and attributes that leaders must possess to perform their jobs proficiently (Imran et al., 2020).

There is growing interest in learning the competencies necessary for I4.0 (Chaka, 2020; Hariharasudan & Kot, 2018; Kipper et al., 2021). This is motivated by the need to cope with new technologies and processes for human resource management (Hecklau et al., 2016) and the perception of a managerial role in which the focus is placed on the leadership role (Güteryüz & Duygulud, 2020). Leadership and social influence are considered the sixth out of the 15 top skills for 2025 (WEF, 2020, p.36). These are perceived as emerging skills, i.e. ones in high demand among the companies surveyed from various industries such as Advanced Manufacturing, Agriculture, Food and Beverage, Consumer, Digital Communications and Information Technology, Education, Energy Utilities & Technologies, Financial Services, Government and Public Sector, Health and Healthcare, Manufacturing, Mining and Metals, Oil and Gas, Professional Services, Transportation and Storage. All these industries, as well as the automotive industry, were identified as those in which current skills are the focus of existing reskilling or upskilling programmes.

The objective of this study is to identify clusters of competencies considered crucial to playing a leadership role in the I4.0 environment. The study is the first of its kind to investigate the development of competencies through participation in leadership development programmes in large firms operating in Poland. It utilised traditional subjective research methods, such as interviews conducted in 14 different sectors, to elicit the information required to provide substantive findings that advance understanding of the perceived required skills.

The study contributes to the advancement of research in the field of competencies for I4.0 by providing a perspective of the leader process owner on the development of leadership competencies using the methods of data collection and analysis mentioned above, thus filling gaps in existing literature and research.

2 Theoretical background

To identify research areas, an initial systematic literature review (SLR, Petticrew & Roberts, 2006) was performed in three bibliographic and bibliometric databases for this research proposal. The advantage of the SLR is the reduction of authors' biases related to the presentation of the problem under study, which may not necessarily correspond to the views of the researchers, since the selection of articles is determined by criteria previously selected from the wide range of those offered by bibliographic-bibliometric databases. Additionally, the set of articles that were analysed for the current study can be easily completed at a later date because the selection criteria remain universal across the entire set of databases. The main disadvantage of SLR is that it excludes articles that did not reach certain publications due to the criteria adopted. As such, they were broadly defined to obtain as many studies as possible, tentatively even loosely related to leadership competencies that are expected to be critical for the future. All the results have been limited to peer-reviewed scientific articles written in English. The aim was to deepen and compile knowledge in thematic areas of leadership competencies for the Fourth Industrial Revolution (I4.0).

To embed the selected issue into the leadership area, the initial search was limited to verification of the content of the topic, i.e. title, abstract or keywords, which constitute social sciences in the field of business and management studies and report the results of empirical and theoretical research. To explore the undertaken problem, additional conceptual limitations on the topics are also included. First, synonyms for leadership competencies were used. These include leadership 4.0, digital leadership, and leadership and social influence. Second, synonyms such as Industry 4.0 and the Industrial Internet of Things were employed. Third, to encompass as many results as possible, two terms – competencies or skills – were used to refine the search. The search strings yielded 9 articles in Scopus, 4 articles in Web of Science (Clarivate Analytics publisher server), and 62 articles in EBSCO. These articles provided results from the following research databases: Complementary Index (22), Directory of

Open Access Journals (12), Business Source Ultimate (10), The Belt and Road Initiative Reference Source (9), Academic Search Ultimate (7), ScienceDirect (5), MEDLINE (3), Supplemental Index and Springer Nature Journals (2 in each), and 1 per OpenAIRE, BazEkon and Sociology Source Ultimate. The initial SLR search allowed for the selection of scientific articles corresponding to the research project. These were further selected on the basis of their abstracts, which were the best for the research problem located in the business and management studies. This yielded 38 papers. The final stage of selecting the appropriate literature on the subject was to read each of the selected articles. The enlisted competencies were clustered into authenticity, cognitive skills, communication skills, digital leadership skills, influencing skills and the propensity to take risks.

Authenticity includes self-awareness, transparency and relationship with customers/subordinates (Güleryüz & Duygulud, 2020; Helming et al., 2019; Kwiotkowska et al., 2021; Sousa et al., 2019). Cognitive skills cover critical thinking, identification of downstream consequences, key causes/problems, analysis of operations, problem solving, social perceptiveness, system perception, solution appraisal and system evaluation (Guzmán et al., 2020; Juhro et al., 2019; Mumford et al., 2007). Communication skills include language skills such as active listening, reading comprehension, speaking, and writing (Guzmán et al., 2020; Juhro et al., 2019; Mumford et al., 2007). Digital leadership deals with digital knowledge, the use of digital tools in their function, digital vision and digital communication (Dash et al., 2019; Imran et al., 2020). Influencing skills include negotiation, persuasion, motivation and conscientiousness (Guzmán et al., 2020; Juhro et al., 2019; Kwiotkowska et al., 2021; Mumford et al., 2007). Propensity to take risk refers to the ability to deal with change and includes decision making (Juhro et al., 2019; Sousa et al., 2019). Other personal competencies refer to active learning (Guzmán et al., 2020; Mumford et al., 2007), agility, breakthrough, visionary (Juhro et al., 2019), failing fast (Imran et al., 2020), intuitiveness and sensitivity (Kwiotkowska et al., 2021). The social competencies considered important for I4.0 are emotional intelligence, social intelligence (Juhro et al., 2019), empowerment (Imran et al., 2020), and teamwork (Sousa et al., 2019). Given the fact that the literature query was set in the leadership context, managerial functions also appeared. These include coordination and in general management of customer complaints, financial resources, material resources, personnel resources and diverse teams (Mumford et

al., 2007; Sousa et al., 2019). The need for a proper personal image was also highlighted (Sousa et al., 2019).

In addition to the characteristics specifically mentioned, numerous articles refer to a general concept of leadership. In addition to the term leadership competencies (Shevyakova et al., 2021), conceptual articles employ general terms such as leadership skills, digital leadership skills and disruptive leadership (Dash et al., 2019; Güleriyüz & Duygulud, 2020; Kannan & Garad, 2020; Shet & Pereira, 2021). Additionally, scholars who conducted theoretical research of the competencies considered necessary for I4.0 (Chaka, 2020; Kipper et al., 2021) identified some articles referring to leadership, in which, however, these skills are mentioned as a general concept (Aziz Hussin, 2018; Carter, 2017; Hariharasudan & Kot, 2018; Hecklau et al., 2016; Motyl et al., 2017).

3 Methods

The research project underlying this article is based on interpretative assumptions. The findings are based on data collected during the COVID-19 pandemic in 2020 through individual in-depth interviews with nurturing leader process owners. A total of 26 programme owners from 22 large economic entities, in which the leadership development programmes (LDPs) operate, participated in the research. Qualitative data analysis was performed in five stages: compiling data in a database, open coding, selective coding, interpretation, and conclusion (Yin, 2011). Further details on the adopted methodology can be found in Majczyk (2021).

4 Findings and discussion

To build a silhouette of a leader in a large company, nurturing leader process owners used 107 characteristics. Most of them were applied once. The most cited are shown in this study.

4. Communication skills

In general, the findings of the study support the assumption of the importance of communication skills for future leaders. However, this was narrowed down to active listening and speaking (Guzmán et al., 2020; Juhro et al., 2019; Mumford et al., 2007). The interviewees indicated that a leader would be expected to have the ability to actively listen, formulate and ask questions, define and concretise a goal, and be able to present objectives. In addition to building and giving feedback, constructive criticism and the ability to criticise and praise, one would also be expected to conduct meetings and conversations, including negotiating, evaluating, recruiting, firing and motivating. In addition to one-on-one conversations, these include public speaking. Effective persuasion should also include tailoring messages to appropriate levels, if only when cascading ideas downward. In turn, the ability to communicate in foreign languages is expected to facilitate work in an international environment.

4.2 Openness

Openness is a diverse concept that addresses properties such as the ability to deal with change, active learning and teamwork (Guzmán et al., 2020; Juhro et al., 2019; Mumford et al., 2007; Sousa et al., 2019). In the research, when building the profile of a leader, the following characteristics were pointed out: openness to innovation; thinking outside the box; openness to new trends, opportunities and change; the ability to respond quickly and adapt to the pace of development of the company and the market. The openness to new solutions was also mentioned, because challenges are perceived as opportunities and potential and the world as a source of knowledge. Openness to inclusion and diversity (understood as combining people with different characteristics, competencies and experiences), understanding the other party, other people's ideas and debate, i.e. openness to people, is supposed to facilitate the management of a diverse team. Openness to cooperation and integration in teams should be based on kindness. Openness to feedback, learning from the ecosystem, creating links and sharing learning is supposed to support personal development as well as the development of others around.

4.3 Knowledge

One of the surprising findings of the study was that the interviewees did not consider digital knowledge (Dash et al., 2019; Imran et al., 2020). Although data collection occurred a few months after the declaration of the pandemic, it did not influence social perception. However, this can be interpreted as e-leadership or digital leadership, which did not appear in leadership development programme curriculums managed by the interviewees and/or is not a popular concept in these companies, or the fact that the interviewees did not associate any links between knowledge and digital skills, despite the fact that the digital context was raised by four of the interviewees. They did, however, mention the necessity to possess technical knowledge, expert knowledge and knowledge of the work topic, as well as of the business and solutions of other departments. While a leader is not expected to have ready-made solutions and answers to all the questions, they must ask good questions. At the same time, a leader should have knowledge of managing a team and leading people with expertise.

4.4 Ambition

Challenging the status quo, striving to be better, beating the competition, moving upward and beating the bar are all manifestations of ambition. However, in the literature review, it is not considered as an I4.0 competency. In the eyes of nurturing leader process owners, however, leaders should be known for their determination and the constant search for ways to do better, i.e. their characteristic moderate satisfaction with the results achieved to date. They must fight to the end. However, in the event of failure, which can happen to anyone, they should get up and move on. The need for development refers both to the leader themselves and to the improvement of others. These ambitions should serve both the team and the customer.

4.5 Networking

The next, albeit not the last, competency most often mentioned is relationship building, which is supported in existing literature (Sousa et al., 2019). On the one hand, interdependence and cooperation with the team, other people and stakeholders in the organisation makes it possible to engage others in achieving their

goals, while on the other, it allows the sharing of good practice. Building relationships in business is supposed to be facilitated by the satisfaction of working with others, the trust shown, the appreciation of the employee, and the awareness of the impact on others.

5 Conclusions

The key competencies for leaders operating in the reality of the I4.0 economy are not unified. Sets of propositions often do not even find a common denominator. A study of nurturing leader process owners who are directly responsible for the vision and implementation of leadership development programmes also identified a range of competencies that are both people and business-oriented, those that are personal and social, those that are focused on individual or other development, and those that are performance and organisational climate-oriented. However, the most popular ones, such as communication skills, openness, knowledge and relationship building, are supported in existing literature on leadership competencies for I4.0. The only characteristic that should characterise contemporary leaders working in large companies that has not gained support in existing literature is that of ambition. However, this expectation may be explained by the specifics of the Polish market, as well as the culture, which is characterised by individualism, the focus on achieving fast results and masculinisation.

Although this study extends the understanding of the leadership skills crucial for I4.0, qualitative research does not allow generalisations. The sample size, the context of large companies and the perceptual data are additional limitations. Future research should consider the potential effects of the mentioned competencies. Another important issue to address is the influence of the cultural environment on the effectiveness of a chosen set of leadership competencies.

References

- Aziz Hussin, A. (2018). Education 4.0 Made Simple: Ideas For Teaching. *International Journal of Education and Literacy Studies*, 6(3), 92. <https://doi.org/10.7575/aiac.ijels.v.6n.3p.92>
- Babatunde, O. K. (2021). Mapping the implications and competencies for Industry 4.0 to hard and soft total quality management. *The TQM Journal*, 33(4), 896–914. <https://doi.org/10.1108/TQM-07-2020-0158>
- Carter, D. (2017). Creativity in action – the information professional is poised to exploit the fourth

- industrial revolution. *Business Information Review*, 34(3), 122–137.
<https://doi.org/10.1177/0266382117722440>
- Chaka, C. (2020). Skills, competencies and literacies attributed to 4IR/Industry 4.0: Scoping review. *IFL-A Journal*, 46(4), 369–399. <https://doi.org/10.1177/0340035219896376>
- Dash, D., Farooq, R., Panda, J. S., & Sandhyavani, K. V. (2019). Internet of things (IoT): The new paradigm of HRM and skill development in the fourth industrial revolution (industry 4.0). *The IUP Journal of Information Technology*, 15(4), 7–30.
https://search.proquest.com/docview/2330961303?accountid=26642%250Ahttp://link.periodicos.capes.gov.br/sfxcl41?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=article&sid=ProQ:ProQ%253Ahigh techjournals&title=Internet+of+Things+%2528Io
- Güleryüz, Ö., & Duygulud, E. (2020). Can Managerial Roles and Skills Change? An Exploratory Study in the Context of Industry 4.0. *Manisa Celal Bayar University Journal of Social Sciences*, 18(4), 33–48. <https://doi.org/10.18026/cbayarsos.694644>
- Guzmán, V. E., Muschard, B., Gerolamo, M., Kohl, H., & Rozenfeld, H. (2020). Characteristics and Skills of Leadership in the Context of Industry 4.0. *Procedia Manufacturing*, 43, 543–550. <https://doi.org/10.1016/j.promfg.2020.02.167>
- Hariharasudan, A., & Kot, S. (2018). A Scoping Review on Digital English and Education 4.0 for Industry 4.0. *Social Sciences*, 7(11), 227. <https://doi.org/10.3390/socsci7110227>
- Hecklau, F., Galeitzke, M., Flachs, S., & Kohl, H. (2016). Holistic Approach for Human Resource Management in Industry 4.0. *Procedia CIRP*, 54, 1–6. <https://doi.org/10.1016/j.procir.2016.05.102>
- Helming, S., Ungermann, F., Hierath, N., Stricker, N., & Lanza, G. (2019). Development of a training concept for leadership 4.0 in production environments. *Procedia Manufacturing*, 31, 38–44. <https://doi.org/10.1016/j.promfg.2019.03.007>
- Imran, F., Shahzad, K., Butt, A., & Kantola, J. (2020). Leadership Competencies for Digital Transformation: Evidence from Multiple Cases. In J. Kantola, S. Nazir, & V. Salminen (Eds.), *Advances in Human Factors, Business Management and Leadership. AHFE 2020. Advances in Intelligent Systems and Computing* (Vol. 1209, pp. 81–87). Springer International Publishing. https://doi.org/10.1007/978-3-030-50791-6_11
- Juhro, S. M., Aulia, A. F., Aliandrina, D., Hadiwaluyo, D., & Lavika, E. (2019). The Role of Catalytic Collaboration in Leveraging Transformational Leadership Competencies to Generate Sustainable Innovation. *SSRN Electronic Journal*, 9, 48–66. <https://doi.org/10.2139/ssrn.3786739>
- Kannan, K. S. P. N., & Garad, A. (2020). Competencies of quality professionals in the era of industry 4.0: a case study of electronics manufacturer from Malaysia. *International Journal of Quality & Reliability Management*, 38(3), 839–871. <https://doi.org/10.1108/IJQRM-04-2019-0124>
- Kipper, L. M., Iepsen, S., Dal Forno, A. J., Frozza, R., Furstenau, L., Agnes, J., & Cossul, D. (2021). Scientific mapping to identify competencies required by industry 4.0. *Technology in Society*, 64, 101454. <https://doi.org/10.1016/j.techsoc.2020.101454>
- Kwiotkowska, A., Gajdzik, B., Wolniak, R., Vveinhardt, J., & Gębczyńska, M. (2021). Leadership Competencies in Making Industry 4.0 Effective: The Case of Polish Heat and Power Industry. *Energies*, 14(14), 4338. <https://doi.org/10.3390/en14144338>
- Majczyk, J. (2021). The Impact of Radical Change on Leadership Development in Large Companies. *Problemy Zarządzania (Management Issues)*, 19(2(92)), 9–23. <https://doi.org/10.7172/1644-9584.92.1>
- Motyl, B., Baronio, G., Uberti, S., Speranza, D., & Filippi, S. (2017). How will Change the Future Engineers' Skills in the Industry 4.0 Framework? A Questionnaire Survey. *Procedia Manufacturing*, 11, 1501–1509. <https://doi.org/10.1016/j.promfg.2017.07.282>
- Mumford, T. V., Campion, M. A., & Morgeson, F. P. (2007). The leadership skills strataplex: Leadership skill requirements across organizational levels. *The Leadership Quarterly*, 18(2), 154–166. <https://doi.org/10.1016/j.leaqua.2007.01.005>

- Petticrew, M., & Roberts, H. (2006). Systematic Reviews in the Social Sciences. In M. Petticrew & H. Roberts (Eds.), *Systematic Reviews in the Social Sciences: A Practical Guide*. Blackwell Publishing Ltd. <https://doi.org/10.1002/9780470754887>
- Ruel, H., Rowlands, H., & Njoku, E. (2021). Digital business strategizing: the role of leadership and organizational learning. *Competitiveness Review: An International Business Journal*, 31(1), 145–161. <https://doi.org/10.1108/CR-11-2019-0109>
- Shet, S. V., & Pereira, V. (2021). Proposed managerial competencies for Industry 4.0 – Implications for social sustainability. *Technological Forecasting and Social Change*, 173, 121080. <https://doi.org/10.1016/j.techfore.2021.121080>
- Shevyakova, A., Munsh, E., Arystan, M., & Petrenko, Y. (2021). Competence development for Industry 4.0: Qualification requirements and solutions. *Insights into Regional Development*, 3(1), 124–135. [https://doi.org/10.9770/IRD.2021.3.1\(7\)](https://doi.org/10.9770/IRD.2021.3.1(7))
- Sousa, M. J., Santos, V., Sacavém, A., Reis, I. P. dos, & Sampaio, M. C. (2019). 4.0 Leadership Skills in Hospitality Sector. *Journal of Reviews on Global Economics*, 8, 105–117. <https://doi.org/10.6000/1929-7092.2019.08.11>
- WEF. (2020). The Future of Jobs Report 2020. In *World Economic Forum*. <https://www.weforum.org/reports/the-future-of-jobs-report-2020/digest>
- Yin, R. K. (2011). *Qualitative Research from Start to Finish*. The Guilford Press.