Competências multiníveis dos líderes para transformação digital – uma revisão sistemática da literatura

Multilevel competencies of leaders for digital transformation – a systematic literature review

Competencias multinivel de los líderes para la transformación digital – una revisión sistemática de la literatura

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PALAVRAS-CHAVE
Competências multiníveis. Lider digital. Transformação digital.

Resumo: A transformação digital (TD) substitui as formas de gestão e operação tradicionais das organizações pela adesão de novas tecnologias digitais com enfoque no pensamento estratégico voltado a adaptação das empresas aos novos paradigmas digitais. A TD exige dos líderes competências que promovam um movimento multinível de interdependência e que agreguem valor econômico e social. Assim, o objetivo deste artigo consiste em identificar na literatura as competências dos líderes para a TD das indústrias em nível organizacional, de equipe e individual e caracterizar as publicações sobre a temática. Trata-se de uma pesquisa com abordagem qualitativa focada na revisão sistemática da literatura (RSL) de 44 artigos nacionais e internacionais que resultou na identificação de nove competências para promover a TD nas indústrias. No âmbito organizacional, destacam-se: a capacidade de alinhar-se com as estratégias da empresa, a habilidade de integrar, reavaliar e fomentar o desenvolvimento das competências digitais, e a aptidão para promover a mudança na cultura organizacional. No nível da equipe, as competências compreendem a capacidade

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

170

de influenciar, liderar e motivar pessoas, bem como a habilidade de impulsionar iniciativas digitais ao formar equipes multidisciplinares e multifuncionais. No nível individual, as competências identificadas incluem a necessidade de uma adaptação constante na maneira de liderar, a promoção de habilidades multidisciplinares, a capacidade de comunicação clara e objetiva, e a fluência digital. A identificação destas competências desempenha um papel importante ao auxiliar as organizações no processo de autodiagnóstico de competências em múltiplos níveis e de desenvolvimento de seus líderes, para impulsionar a transformação digital.

Abstract: Digital Transformation (DT) replaces traditional forms of management and operation of organizations with the adoption of new digital technologies focused on strategic thinking aimed at adapting companies to new digital paradigms. DT requires leaders to have skills that promote a multilevel movement of interdependence and add economic and social value. Therefore, the objective of this article is to identify in the literature the competencies of leaders for DT in industries at an organizational, team, and individual level and to characterize publications on the subject. This research has a qualitative approach focused on the systematic literature review (SLR) of 44 national and international articles that resulted in the identification of nine skills to promote DT in industries. At the organizational level, the following stand out: the ability to align with the company's strategies, the ability to integrate, reevaluate, and encourage the development of digital skills, and the ability to promote change in organizational culture. At the team level, competencies include the ability to influence, lead, and motivate people, as well as the ability to drive digital initiatives by forming multidisciplinary and cross-functional teams. At the individual level, the competencies identified include the need for constant adaptation in the way of leading, the promotion of multidisciplinary skills, the ability to communicate clearly and objectively, and digital fluency. The identification of these competencies plays an essential role in helping organizations in the process of self-diagnosing competencies at multiple levels and developing their leaders to drive digital transformation.

Resumen: La transformación digital (TD) reemplaza las formas tradicionales de gestión y operación en las organizaciones mediante la adopción de nuevas tecnologías digitales, con un enfoque en el pensamiento estratégico dirigido a la adaptación de las empresas a los nuevos paradigmas digitales. La TD requiere que los líderes posean competencias que promuevan un movimiento multinivel de interdependencia y que agreguen valor económico y social. Por lo tanto, el objetivo de este artículo es identificar en la literatura las competencias de los líderes para la TD en las industrias a nivel organizacional, de equipo e individual, y caracterizar las publicaciones sobre el tema. Este es un estudio de investigación cualitativa centrado en una revisión sistemática de la literatura (RSL) de 44 artículos nacionales e internacionales que resultó en la identificación de nueve competencias para promover la TD en las industrias. A nivel organizacional, destacan las siguientes competencias: la capacidad para alinearse con las estrategias de la empresa, la habilidad para integrar, reevaluar y fomentar el desarrollo de competencias digitales, y la aptitud para promover el cambio en la cultura organizacional. A nivel de equipo, las competencias incluyen la capacidad para influir, liderar y motivar a las personas, así como la habilidad para impulsar iniciativas digitales mediante la formación de equipos multidisciplinarios y multifuncionales. A nivel individual, las competencias identificadas incluyen la necesidad de una adaptación constante en el estilo de liderazgo, la promoción de habilidades multidisciplinarias, la capacidad de comunicación clara y objetiva, y la fluidez digital. La identificación de estas competencias desempeña un papel importante al ayudar a las organizaciones en el proceso de autoevaluación de competencias en múltiples niveles y en el desarrollo de sus líderes para impulsar la transformación digital.

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

171

Introduction

Digital transformation (DT) is described as an evolutionary process that takes advantage of digital capabilities and technology to generate value for organizations (Rodriguez & Bribiesca, 2021). According to the conceptualization of Saarikko *et al*. (2020), DT is considered a sociocultural process (not just focused on technology) of adapting companies to the new forms and sets of skills necessary for the organization to remain viable and relevant in a digital scenario.

In this sense, DT has required organizations to restructure their strategies, reevaluate technological leverage capabilities, and develop leadership and management skills, whose factors are perceived as one of the main challenges of contemporary times (Rodríguez & Bribiesca, 2021; Saarikko *et al*., 2020).

The topic of leaders' skills for DT was addressed with more emphasis in the literature from 2011 onwards due to the need for leaders to adapt quickly to follow this movement (Hansen *et al*., 2011). The fact is that leading for DT has become essential for creating strategies that aim to digitally boost business, as well as encourage the development of new skills (Bharadwaj *et al*., 2013; Kane *et al*., 2015).

The new skills for leading in the context of DT suggest that in addition to influencing people to achieve specific objectives (Hansen *et al*., 2011; Oberer & Erkollar, 2018), leaders also start to adopt other behaviors and attitudes, apply technologies and develop a digital mindset in their employees (Brock & Von Wangenheim, 2019; Jayawardena *et al*., 2020; Kappelman *et al*., 2019).

To meet these demands, leaders need to develop individual, team, and organizational multilevel competencies (Henriette *et al*., 2015; Nylén & Holmström, 2015; Rodríguez & Bribiesca, 2021; Vial, 2019). In this sense, individual multilevel competencies give rise to and support organizational competencies, which, at the same time, are influenced by the team and organizational level (Brandão & Guimarães, 2001; Kozlowski & Klein, 2000); that is, the skills at one level influence the other and vice versa (Kozlowski & Klein, 2000).

The research limited the study to the business area and the industrial sector, which underwent several adaptations in its production process with the disruption of theoretical and structural paradigms (Anand *et al*., 2020) that were gradually adapting to new forms of management. In this sense, the new cycle focused on DT requires the industrial sector to implement planning that incorporates strategic, tactical, and operational issues and that follows the speed of DT in the market in which it operates (Heavin & Power, 2018). Therefore, this study proposes the following research question: "What are the multilevel competencies of leaders for the digital transformation of industries?".

This study aims to identify the multilevel competencies of leaders for the digital transformation of industries through a systematic literature review (SLR). The results of this research will help management identify whether multilevel skills are present or not in their leaders to promote the leverage of DT in organizations.

Theoretical elements of the research

DT is one of the main challenges faced by contemporary companies, given the need to leverage digital technology in the development of their businesses, forcing companies to reevaluate their capabilities, structures, and culture, which makes DT a strategic priority for senior management (Rodríguez & Bribiesca, 2021). It is considered a "sociocultural process of adapting companies to new forms and sets of skills necessary to remain viable and relevant in a digital scenario" (Saarikko *et al*., 2020, p. 836).

For DT to propagate in organizations, digital leadership must integrate digital, market, and business skills (they comprehend

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

172

the product and the customer) and strategic leadership (intrapersonal and interpersonal skills to create business value through driving actions, strategic mindset, and decision-making) to drive DT (Hüsing *et al*., 2015).

The studies by Saarikko *et al*. (2020) reveal a series of challenges related to business strategy involving DT, such as the lack of clear vision with technologies introduced without a long-term strategy or due to external pressure to meet customer expectations; actors reluctant to promote transformative changes due to uncertainty regarding results; lack of familiarity with the innovation; mismatch between what technology allows us to do and the ability to understand its consequences; and issues related to cultural inertia.

To face such challenges, it is up to organizations to develop digital and multilevel skills in their leaders. Digital competencies are considered a set of knowledge, skills, attitudes, strategies, and awareness that are necessary when using ICTs (information and communication technologies) and digital media to carry out tasks, solve problems, communicate, manage information, collaborate, create and share content, and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, and reflectively for work, leisure, participation, learning, socialization, consumption, and empowerment (Ferrari, 2012).

Multilevel competencies are processes through which the expression of competencies at work spreads from the person to the higher levels of the organization (team, production unit, and organization as a whole), but also in which the "characteristics of these higher levels influence the competence or the person's performance, on an individual level" (Brandão *et al*., 2008, p. 12).

These competencies cover three levels: organizational, team, and individual. Competencies at the organizational level refer to the organization's attributes for achieving its strategic objectives (Prahalad & Hamel,

2003); team or collective competencies deal with the interaction processes of competency attributes to generate superior performance (Silva & Ruas, 2016); and individual competency can be defined as specific behaviors of people to achieve results and superior performance in a position or specific job function (Bartram, 2005; Chouhan & Srivastava, 2014).

Multilevel phenomena are cyclical and can manifest themselves from bottom to top based on psychological characteristics, perceptions, and interactions between (emerging) individuals and are considered a fundamental dynamic process in multilevel theory (Kozlowski *et al*., 2016; Kozlowski & Klein, 2000). Team processes are represented as collective constructions that originate from individual cognition (models), motivation (collective efficacy), affect (group mood), and behavior (coordination) (Marks *et al*., 2001). However, most of the research is focused on contextual effects; that is, attention is focused on processes that shape and constrain lower-level phenomena embedded in the higher-level context (Kozlowski *et al*., 2016).

Kozlowski and Klein (2000) emphasize that the ideal is to seek the potential for the evolution of the emerging phenomenon as it manifests itself across the entire range of the organization. To the authors, multilevel research must begin with theory and with caution in identifying and defining key constructs. For this reason, it is considered complex and challenging, as it requires detailed theory with careful and rigorous operationalization capable of capturing such complexity that involves the real life of the organization.

The need for involvement and dissemination of knowledge between levels makes it possible to leverage the organization's DT. In this sense, companies adapted to DT requirements become holders of crucial information, knowledge, and learning resources (Vial, 2019).

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

173

Methodological elements of the research

The research method adopted in the development of this study includes a qualitative approach with the carrying out of an SLR with the objective of presenting publications that address the topic of leader competencies for DT and identifying the multilevel competencies of these leaders for DT in industries.

SLR is a method that seeks to bring together similar studies on a topic to ensure a better level of evidence for decision-making on research questions and reduce bias through a comprehensive, transparent, and replicable investigation (Donato & Donato, 2019).

Scopus databases (considered one of the

Figure 1

Systematic literature review methodology
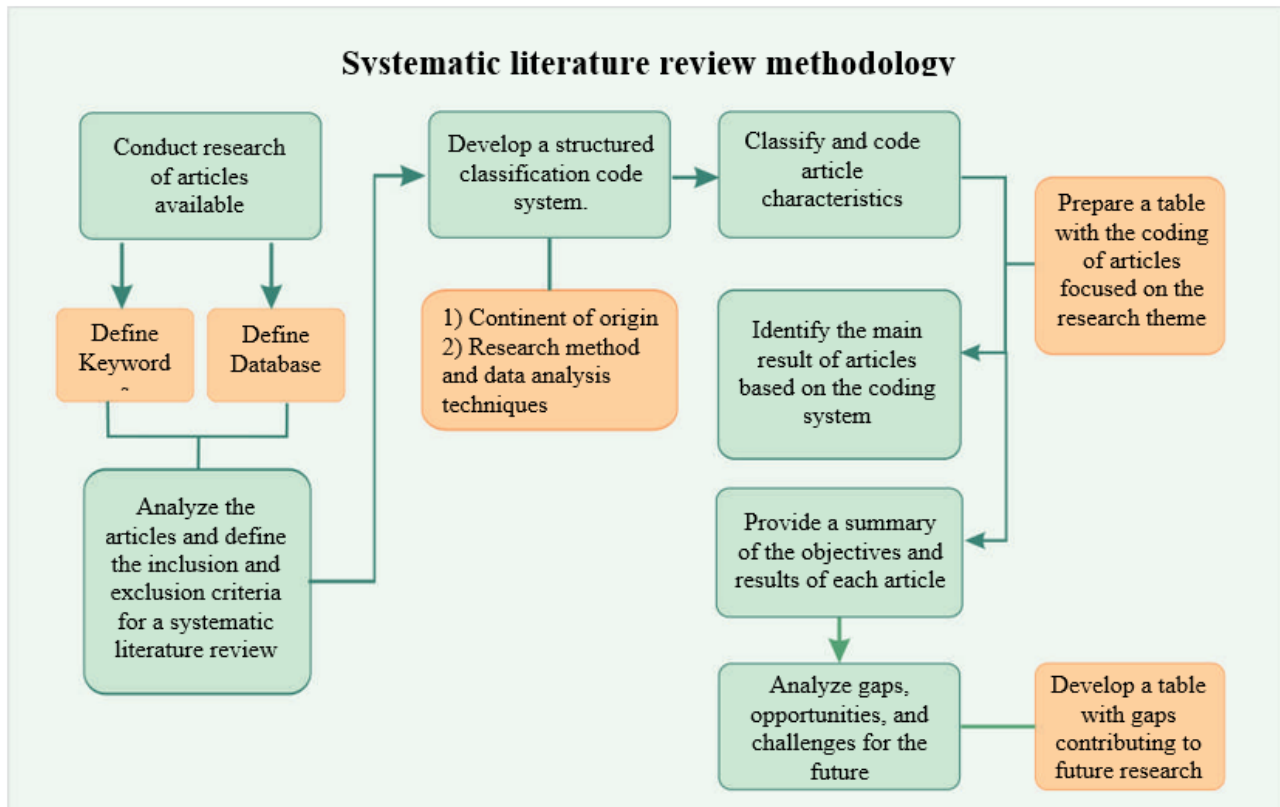
most essential bibliographic databases among journal classification systems) and the Web of Science (Wang & Waltmann, 2016) were used to extract the contributions of scientific articles published in relation to the topic of the multilevel skills of the leaders involved in the industries' DT process. Figure 1 describes the steps that guided the development of this SLR.

As an initial stage of the SLR, we sought to identify the most considerable number of studies related to the competencies of leaders involved in DT. The following keywords were used as search criteria in the databases, considering the filter for titles, abstract, and keywords (TITLE-ABS-KEY): "leader* profile" OR "leader* abilit*" OR "leader* skill*" OR "leader* characteristic*" OR "leader* competence*" OR "leader* capabilit*" OR "leader* behavior" OR "digital leader*" AND "digital".

Considering the secondary stage of the SLR of defining the research criteria, searches were carried out on the topic in the Scopus and Web of Science (WoS) databases. In Figure 2, the search terms are visualized, and the results of this selection and the inclusion and

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

174

exclusion criteria carried out for the SLR are reported.

The initial searches carried out at the beginning of May 2022 identified 867 results (819 from the Scopus database and 48 from the Web Of Science) that refer to the skills of leaders in the digital environment. Based on these results, the research inclusion and exclusion criteria were defined. The type of document only considered article and journal publications, excluding 271 results (remaining 596). Next, the language criteria of the periodicals were defined, limiting the searches only to articles in English and Portuguese. With this definition, 27 publications were excluded, followed by 569 publications.

Type of source was another defined criterion, considering only "journal" publications. Thus, 528 results were obtained (516 by Scopus and 12 by WoS). Another exclusion criterion adopted in the research was the publication phase as "final" (PUBSTAGE, "final"), which represents the publication phase of a record. It removed 35 articles from the Scopus database, resulting in 493 articles.

Figure 2

Inclusion and exclusion criteria for systematic literature review
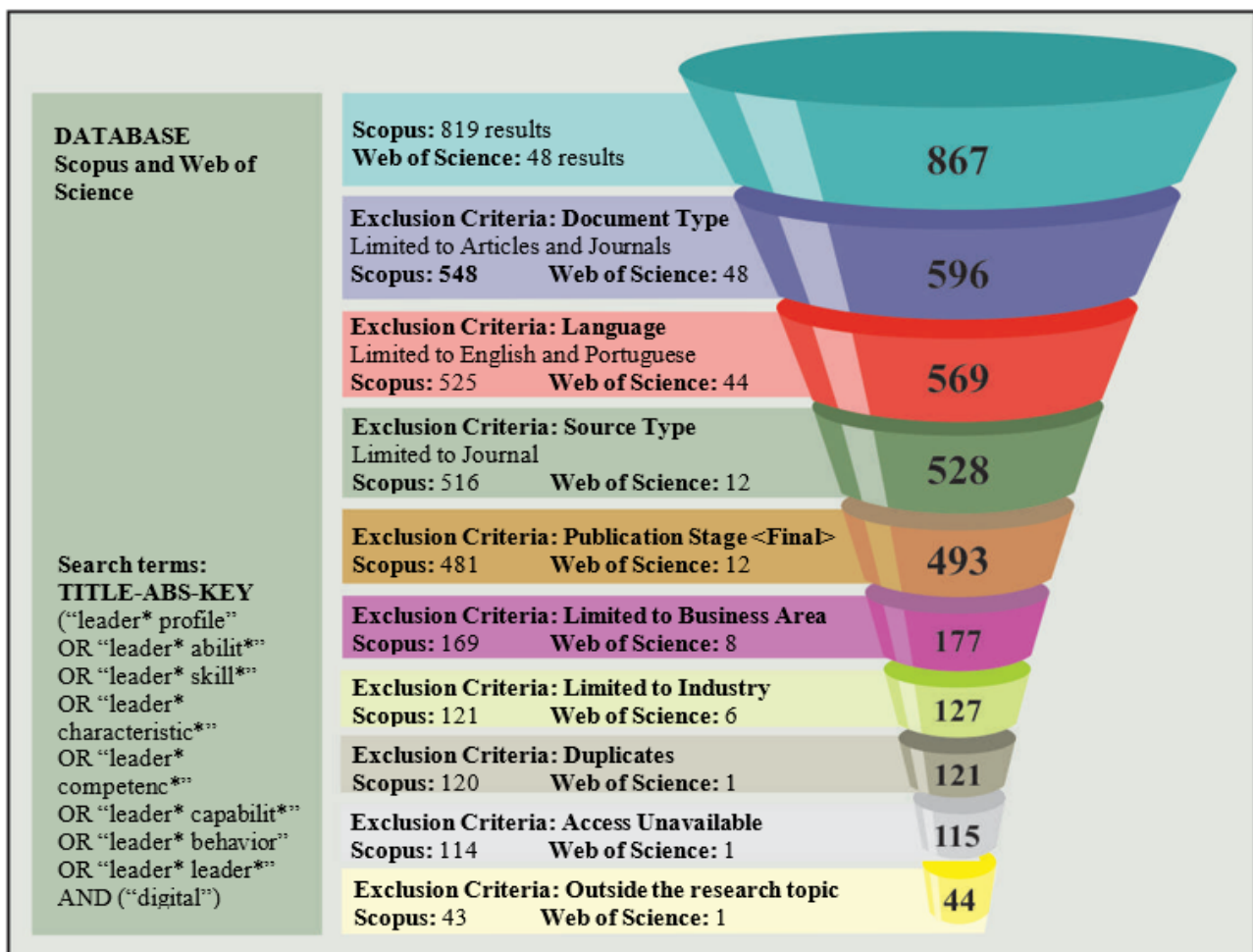
Source: Prepared by the authors (2023)

The following limitation referred to the business area adopted due to the research theme being related to leaders (business managers), which eliminated a total of 316 articles and resulted in 177 publications to continue the research.

Considering the universe and focus area defined in the study, the following filter removed publications that were not related to the industry from the SLR, totaling 127

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

175

publications. Furthermore, six publications were removed due to duplication between the bases, leaving 121 results. The following exclusion criterion was access to the publication, which limits the ability to obtain the text (six publications were not available).

Finally, of the 115 filtered results, the last exclusion criterion comprised the research theme, which concerns the skills of leaders for DT in industries. In this criterion, 71 articles were excluded because they covered other sectors. The excluded publications addressed the topic in different areas, such as education and information technology (14 publications each), public management (7 publications), healthcare and services (4 publications each), tourism (2 publications), and other areas, such as architecture, entertainment, and psychology.

In conclusion, after selecting the criteria for evaluation, the research followed the studies with the aim of identifying the competencies of leaders in the industrial environment with the theoretical deepening of 44 articles.

It is worth noting that based on the Publication Stage (final) criterion, limitations to the business area and industry, as well as the research theme, the selections for the WoS database were made from reading the articles, as the database does not have a filter for these exclusions.

The sequence of studies included obtaining additional information related to the topic, the research design, study methodologies, and the geographic location of the publications (Donato & Donato, 2019). To this end, a coding system for these topics was detailed and served as a reference for analyzing the data from this SLR (Amui *et al.*, 2017; Mayring, 2020).

The dimensions created to classify the articles were as follows:
a. Continent of origin of the study, enabling the visualization of the study fronts on the topic as well as the perception of the development of these

studies in Brazil, encoded as:

- CNT-AME = America;
- CNT-EUR = Europe;
- CNT-ASI = Asia;
- CNT-AFR = Africa;
- CNT-OCE = Oceania.
b. Research method and data analysis techniques with the aim of guiding this and other research in relation to the methods studied in this theme, coded as:

- MT-MIX = Mixed;
- MT-QTI = Quantitative;
- MT-QUL = Qualitative;
- MT-EMP = Empirical;
- MT-THE = Theoretical;
- MT-INT = Interviews;
- MT-SUR = Survey.

In addition to the categorizations, information on the year and journal of publication, number of citations, and the continent of origin of the primary author of the research were included.

Presentation and discussion of results

The first classifications aimed to present the year of publication, the journal in which it was published, the number of citations, and the continent of origin of the teaching entity of the primary author of the research. Afterward, the research methods and analysis techniques applied were coded. Table 1 shows the data from the 44 articles analyzed by SLR, classified first by the recency criterion (most recent to oldest year).

Figure SEQ Figura * ARABIC 3 – Year of publications
Source: Scopus (2022)

Regarding the year of publications of the selected journals, the rise of research in relation to the theme of leaders' competencies

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

176

for DT occurred from 2016, with two publications, rising to five publications in 2019, eight in 2020, and 14 publications in 2021. In 2022, there are seen articles published by April. Figure 3 demonstrates this temporal evolution extracted from the Scopus database; that is, the data includes the final forty-three articles analyzed from this database and does not include the only article analyzed from the WoS database.

Figure 3
Year of publications

Source: Scopus (2022)

European continent covers 43% of publications, that is, 19 articles published, boosted by Germany (five articles), the United Kingdom (three articles), and Norway, Portugal, and Switzerland (with two articles each). Finland, France, the Netherlands, Iceland, and Italy have one publication. Next is the Asian continent (32%), with the collaboration of 14 articles on this topic. China and Indonesia have the most publications (three articles each), and India contributes two articles. The remaining countries (Korea, Iran, Malaysia, Singapore, Taiwan, and Turkey) have published one article.

The American continent holds 18% of publications (eight articles). The United States leads in the number of publications (five), followed by Brazil, Mexico, and Peru with one publication each. The African continent contributes 7% of publications (three), all originating from South Africa. The continent of Oceania did not participate.

When considering the periodical data of
Classification and coding of article characteristics

these publications, three of them deserve to be highlighted because they contain two publications: 1) *Gruppe. Interaction. Organization. Zeitschrift fur Angewandte Organizationspsychologie*; 2) Information and Management, and 3) Journal of Management Development. The other journals in Table 1 had one publication.

The two most cited articles among those selected were authored by Wegge *et al*. (2011), with the approach to work motivation with employee involvement in organizational leadership (Promoting work motivation in organizations: Should employee involvement in organizational leadership become a new tool in the organizational psychologist's kit?), with 56 citations, and Chen, Lee (2007), with an article on the performance evaluation model for project managers (Performance evaluation model for project managers using managerial practices), with 45 citations.

The research method with a qualitative approach was predominant (41% - 18 articles) among the selected articles, followed by the mixed approach, with 36% (16 articles), and the quantitative method, present in 23% of publications (10 articles). For data collection, the survey was used in 52% of publications (23 publications); in 25%, data collection was carried out via interviews (11 articles) and, in 23%, other techniques were used. Regarding the classification of theoretical or empirical research, we found that 20% of the articles are theoretical (nine articles), and 80% are empirical (35 articles).

The identification of leaders' competencies was carried out by reading in full the 44 final articles of the SLR, and the extraction of competencies was carried out, considering whether the leaders' competencies mentioned were focused on the concept of DT and the process of promoting DT in industries.

Several leadership skills were listed in this context. However, many refer to personal
Table 1

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

177

Authors	Continent	Journal	Citations	Method		
Benitez *et al.* (2022)	CNT-EUR	Information and Management	0	MT-MIX	MT-INT	MT-EMP
Borah, Iqbal, Akhtar (2022)	CNT-ASI	Technology in Society	1	MT-MIX	MT-SUR	MT-EMP
De Albuquerque *et al.* (2022)	CNT-AME	Brazilian Journal of Operations and Production Management	0	MT-QTI	MT-SUR	MT-EMP
Karippur, Balaramachandran (2022)	CNT-ASI	Australasian Journal of Information Systems	0	MT-MIX	MT-SUR	MT-EMP
Lianto, Dachyar, Soemardi (2022)	CNT-ASI	Journal of Modelling in Management	2	MT-MIX	MT-SUR	MT-EMP
Ljubica *et al.* (2022)	CNT-EUR	Cross Cultural and Strategic Management	0	MT-QUL		MT-THE
Tsai *et al.* (2022)	CNT-AME	Leadership Quarterly	0	MT-QUL		MT-THE
Bell, Hofmeyr (2021)	CNT-AFR	South African Journal of Business Management	0	MT-QUL	MT-INT	MT-EMP
Brown, Hill, Lorinkova (2021)	CNT-AME	European Journal of Work and Organizational Psychology	1	MT-MIX		MT-THE
Dehghanan *et al.* (2021)	CNT-ASI	International Journal of Innovation and Technology Management	0	MT-QUL		MT-EMP
H van Dun, Wilderom (2021)	CNT-EUR	International Journal of Operations and Production Management	4	MT-MIX	MT-INT	MT-EMP
Imran *et al.* (2021)	CNT-EUR	Journal of Change Management	3	MT-QUL	MT-INT	MT-EMP
Kannan, Garad (2021)	CNT-EUR	International Journal of Quality and Reliability Management	16	MT-QUL	MT-INT	MT-EMP
Klus, Müller (2021)	CNT-EUR	Journal of Business Economics	3	MT-MIX	MT-SUR	MT-EMP
Mey, Poisat, Stindt (2021)	CNT-AFR	SA Journal of Human Resource Management	3	MT-QTI	MT-SUR	MT-EMP
Motiani, Kulkarni (2021)	CNT-ASI	International Journal of Innovation Science	0	MT-QLI	MT-INT	MT-EMP
Ngayo Fotso (2021)	CNT-EUR	European Journal of Training and Development	1	MT-QLI		MT-THE
Ötting, Masjutin, Maier (2021)	CNT-EUR	*Gruppe. Interaktion. Organisation. Zeitschrift fur Angewandte Organisationspsychologie*	0	MT-QLI	MT-INT	MT-EMP
Park (2021)	CNT-ASI	Journal of Distribution Science	1	MT-MIX	MT-SUR	MT-EMP
Porfírio *et al.* (2021)	CNT-EUR	Journal of Business Research	15	MT-MIX	MT-SUR	MT-EMP
Zulu, Khosrowshahi (2021)	CNT-EUR	Construction Management and Economics	1	MT-QTI	MT-SUR	MT-EMP
Chinakidzwa, Phiri (2020)	CNT-AFR	Business: Theory and Practice	5	MT-MIX	MT-SUR	MT-EMP
Jäckli, Meier (2020)	CNT-EUR	International Journal of Management and Enterprise Development	1	MT-QUL	MT-INT	MT-EMP
Magno, Cassia (2020)	CNT-EUR	Journal of Business and Industrial Marketing	12	MT-MIS	MT-SUR	MT-EMP
Morais-Storz, Nguyen, Sætre (2020)	CNT-EUR	Journal of Product Innovation Management	2	MT-QLI	MT-ENT	MT-EMP
Nasution *et al.* (2020)	CNT-ASI	Journal of Management Development	1	MT-MIS	MT-SUR	MT-EMP

Authors	Continent	Journal	Citations	Method		

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

178

Patro (2020)	CNT-ASI	International Journal of Knowledge Management	0	MT-QTI	MT-SUR	MT-EMP
Prommer, Tiberius, Kraus (2020)	CNT-EUR	Journal of Business Venturing Insights	8	MT-QUL	MT-INT	MT-EMP
Reitz *et al.* (2020)	CNT-EUR	Journal of Management Development	8	MT-MIX	MT-SUR	MT-EMP
Brown, Paz-Aparicio, Revilla (2019)	CNT-AME	Leadership and Organization Development Journal	16	MT-MIX	MT-SUR	MT-EMP
Lange, Rowold (2019)	CNT-EUR	*Gruppe. Interaktion. Organisation. Zeitschrift fur Angewandte Organisationspsychologie*	3	MT-QTI	MT-SUR	MT-EMP
Pan, Lin (2019)	CNT-ASI	Journal of Business Economics and Management	1	MT-QUL		MT-THE
Sasmoko *et al.* (2019)	CNT-ASI	Management Science Letters	4	MT-QTI	MT-SUR	MT-EMP
Shao (2019)	CNT-ASI	International Journal of Information Management	34	MT-MIX	MT-SUR	MT-EMP
Oberer, Erkollar (2018)	CNT-ASI	International Journal of Organizational Leadership	15	MT-QUL		MT-THE
Sousa (2018)	CNT-EUR	Administrative Sciences	16	MT-MIX	MT-SUR	MT-EMP
Varela Medina, González Macías (2018)	CNT-AME	*Espacios*	1	MT-QUL		MT-THE
Dodge *et al.* (2017)	CNT-AME	Research Technology Management	8	MT-QTI	MT-SUR	MT-EMP
Andersen (2016)	CNT-EUR	Systemic Practice and Action Research	5	MT-QUL	MT-INT	MT-EMP
Gerth, Peppard (2016)	CNT-AME	Business Horizons	40	MT-QUL		MT-THE
Wegge *et al.* (2011)	CNT-EUR	Journal of Personnel Psychology	56	MT-QUL		MT-THE
Idris, Ali (2008)	CNT-ASI	Total Quality Management and Business Excellence	28	MT-QTI	MT-SUR	MT-EMP
Chen, Lee (2007)	CNT-ASI	International Journal of Project Management	45	MT-QTI	MT-SUR	MT-EMP
Sutcliffe (1999)	CNT-AME	Information and Management	45	MT-QTI	MT-SUR	MT-EMP

Source: Prepared by the authors (2023)

skills and abilities considered necessary for the entire leader profile. Individual characteristics (charisma, attention, creativity, humility, ethics, empathy, calm, self-awareness, agility, and proactivity are some examples) and relationships with the team, team members, and interested parties were not considered as they were not focused on DT skills.

The identified competencies were tabulated and subsequently grouped by similarity or because they were involved in the same context. Nine competencies of leaders for industries' DT were identified, and the context brought by the literature was the criterion used to identify the level of involvement of competencies and allocation at multilevels, such as organizational, team, or individual.

Competencies at the organizational level are represented by the capabilities of the organization and its leaders to mobilize, integrate, and develop the organization's people. According to Prahalad and Hamel (2003), essential competencies for the organization generate new perceptions for customers and provide a competitive advantage. One of the strategic objectives of leaders at the organizational level is to ensure that technology alignment is met and that there is a balanced integration of old skills with new ones focused on DT (Brock & Von Wangenheim, 2019; Rodríguez & Bribiesca, 2021; Vial, 2019).

SLR identified three necessary

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

179

competencies for industry leaders at the organizational level, which are described in Table 2.

1) Be aligned with the organization's strategies, which consists of seeking best practices to strategically achieve management objectives, including infrastructure and technology issues (Idris & Ali, 2008), facilitating tasks (Sutcliffe, 1999), and redistributing authorities in the decision-making process (Ljubica et al., 2021). This alignment requires leaders to formulate concrete goals and objectives and share them with interested parties (Jäckli & Meier, 2020), promoting participation, collaboration, and commitment to the organization's objective (Wegge et al., 2011).

The participation of leaders and alignment with management strategies were identified as the leader's responsibilities to promote DT (Nasution et al., 2020), seeking to satisfy the organization's objectives (Imran et al., 2021). The purpose of analytical strategic thinking lies in problem-solving skills (Lianto et al., 2020) and decision-making (planning, organizing, consulting, and delegating) about business activities (Chen & Lee, 2007). A leader with strategic thinking responds quickly to customer and market opportunities (Lianto et al., 2020) and can process, filter, and control a flow of information to use in decision-making (Reitz et al., 2020).

In this context, the leader focuses on short-term planning (Morais-Storz et al., 2020) and, to this end, defines strategic priorities related to marketing and investments to be made (Karippur & Balaramachandran, 2022). Uncertainties about the future require leaders to develop strategic thinking and the ability to manage businesses and strategic alliances to solve problems (Sousa, 2018).

The digital strategic vision is considered the starting point of DT. It indicates a company's ability to have perception, vision, and objectives to stand out in the digital world (Nasution et al., 2020). It is a vision focused on innovation opportunities and capabilities (Borah et al., 2022) with a focus on the customer. In this approach, leaders must work to provide solutions for their customers and generate value for them (Imran et al., 2021), considered as a strong ability to think and act in an entrepreneurial way (Klus & Müller, 2021), with a vision focused on digital strategic decision-making for new business models (Fotso, 2021). The digital vision requires regulation, management supervision, and strategic decision-making (circulation of information flow, physical distribution, technology flow, and capital flow) (Pan & Lin, 2019).

2) The ability to integrate, reevaluate, and promote the development of digital skills, considering existing and current ones in the organization, is reported by several authors. This competence involves the need to develop the knowledge and application of DT in organizations, thinking and taking advantage of existing knowledge to generate motivation and drive other employees to transform the organization. The focus for DT is to utilize digital technology to the fullest and make full use of new resources (Nasution et al., 2020).

In this sense, Andersen (2016) cited the need to identify (digital and non-digital) skills of old employees along with the acquisition and implementation of new technological capabilities (Karippur & Balaramachandran, 2022; Nasution et al., 2020; Porfírio et al., 2021), providing support and acting as trainers and guides (Borah et al., 2022; Van Dun & Wilderom, 2021) and also develop the self-leadership of all agents involved (Wegge et al., 2011).

Therefore, the leadership style influences

Table 2

Multilevel skills of leaders for digital transformation of industries

Multilevel competence of leaders	Competency description
Competence of leaders at the organizational level	

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

180

Alignment of Organization to Strategy (AOS)	Being aligned with the organization's strategies is a leader's competence that aims to seek best practices to promote digital transformation and satisfy the organization's objectives (Imran *et al.*, 2021) through strategic thinking and vision, including infrastructure issues, technologies (Idris & Ali, 2008), facilitating tasks (Sutcliffe, 1999), and redistributing authorities in the decision-making process (Ljubica *et al.*, 2021).
Integrate, reassess and promote digital skills development (IRD)	Integrating, reassessing and promoting the development of digital skills involves the need to develop knowledge and application of the digital transformation of organizations by leveraging and identifying existing knowledge (Nasution *et al.*, 2020; Benitez *et al.*, 2022), implementing and developing new technological capabilities (Karippur & Balaramachandran, 2022; Porfírio *et al.*, 2021).
Promote change in organizational culture (PMC)	Promote a collaborative environment in the organization (Imran *et al.*, 2021), creating a roadmap for change (Motiani & Kulkarni, 2021) and management and monitoring (Ötting *et al.*, 2021), developing knowledge and a unified mindset of digital transformation for all (Nasution *et al.*, 2020).
Competence of leadership at team level	
Influence, lead and motivate people (ILM)	Influencing, leading and motivating people (ILM) includes motivation as a central theme and other skills in this context, such as supporting team members (Lorinkova, 2021), influencing people (Motiani & Kulkarni, 2021), involving and encouraging employees to take the initiative (Karippur & Balaramachandran, 2022; Ljubica *et al.*, 2021), guiding, expanding, and elevating the team's interests (Medina & Macías, 2018).
Promote digital initiatives (PID) by forming multidisciplinary and multifunctional teams	Promote digital initiatives by forming multidisciplinary and multifunctional teams (PID) with a focus on relationships and tasks for performance in virtual teams (Brown *et al.* (2021), with incentives and support for the work group (Dodge *et al.*, 2017), rewarding initiatives (Idris & Ali, 2008) and encouraging the autonomy of teams and individuals in the organization (Jäckli & Meier, 2020).
Competence of leaders at the individual level	
Constant adaptation in the way of leading (AWL)	Adapt or change the way they conduct their activities (behaviors) and adapt their leadership style, depending on the situation or environmental demands (Dehghanan *et al.*, 2021; Imran *et al.*, 2021; Karippur & Balaramachandran, 2022).
Multidisciplinary capabilities (MDC)	Multidisciplinary capabilities involve the need to be aware of the multifunctional developments that digital transformation requires in relation to products and services, requiring new leadership practices and close integration of IT with business processes (Bharadwaj *et al.*, 2013; Karippur & Balaramachandran, 2022).
Clear and objective communication (COC)	Clear and objective communication, knowing how to read and communicate visual content combined with vocal and digital stimuli (Fotso, 2021) in an open and transparent way, maintaining good communication between managers, employees and stakeholders (Idris & Ali, 2008; Ötting *et al.*, 2021).
Digital fluency (DGF)	Digital fluency is digital capabilities of knowledge about products, marketing channels and essential customer requirements, implementing technology, automating interfaces and integrating real-world objects into business processes (Nasution *et al.*, 2020, p. 362). It requires proficiency with digital tools for data analysis, communication, virtual collaboration, task automation and improved operations (Fotso, 2021).

Source: Prepared by the authors (2023)

the development of innovation capacity (Lianto *et al.*, 2020). In the context of DT, it is necessary to take risks to experiment and discover new ideas and alternatives, seek new opportunities, and adopt innovation (Karippur & Balaramachandran, 2022).

The leader must be equipped with capabilities that aim to integrate and develop internal and external competencies to face rapid changes (Lianto *et al.*, 2020) and leverage the skills of their employees (Patro, 2020). Noteworthy, in this context, is to evaluate and promote the continuous updating of this competence (Idris & Ali, 2008), retaining tacit and explicit knowledge and promoting relevant digital content through social media.

3) Promoting change in organizational culture is inherent to the DT process. It requires leaders to promote a collaborative environment in the organization (Imran *et al.*, 2021) and the creation of a change roadmap

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

REUNIr
revista

181

(Motiani & Kulkarni, 2021) as well as management and monitoring (Ötting *et al.*, 2021). The adoption of new technologies for organizational change (Sousa, 2018) changes the organization's culture and breaks paradigms, requiring the creation of an organizational culture focused on continuous learning (Patro, 2020).

Either team or collective competencies result from the group's social interactions, representing more than the sum of individual competencies (Silva & Ruas, 2016). One of the skills of leaders for DT in industries focused on the team level is to keep everyone involved moving in the right direction (driving) with the task of converting the team into believers in the digital future, extending this belief to the organization (Horlacher *et al.*, 2016; Lucas Jr. & Goh, 2009; Matt *et al.*, 2015; Westerman *et al.*, 2016). This competence also requires that DT leaders accompany employees in this extended transition beyond the domain of human resources (Karimi & Walter, 2015; Vial, 2019).

For this level of team, the competencies expected of leaders consist of "helping subordinates develop cognitions that respond to a new direction for the company, [...] teaching the organization about its vision for the company, and making employees learn the new business model and what it involves" (Lucas Jr. & Goh, 2009, p.48). The leader at this level needs to understand the desire of all employees (a feeling that extends to all age groups) to work for companies committed to digital progress and seek to attract and retain the best talent. It should be noted that reducing the risk of losing them is as essential as developing talents (Kane *et al.*, 2015).

Promoting internal and external engagement is also part of leaders' skills. One of the ways to obtain this engagement is through the creation of a separate unit with independence in relation to the rest of the organization, and the other way is to create multifunctional teams (formation of multidisciplinary competence networks),

which remain within the current organization and that break down functional silos by focusing on cross-functional collaboration (Kane *et al.*, 2017; Maedche, 2016).

In the sense of cross-functional collaboration, team leaders need to recognize the spontaneous initiatives of organizational members and identify talent in improvising with digital technologies, as well as combining skills in each digital project to ensure sustainable digital innovation. The involvement of teams in learning for DT is continuous and includes the exploration of new digital technologies that are fundamental for companies and leaders (Nylén & Holmström, 2015). The literature highlights cross-functional collaboration as an essential element of DT and reveals that organizations that mature digitally are much more likely to use cross-functional teams to implement digital initiatives (Kane *et al.*, 2015; Kane *et al.*, 2017).

The team-level leader must be integral, that is, ensure employee involvement and a supportive culture, given that a qualified team engaged in an empowering culture helps to overcome internal resistance and a lack of skills and knowledge (Brock & Von Wangenheim, 2019). The leader must "show support for teams and help them understand how their work fits into the overall context of the business plan" (Kane *et al.*, 2015, p.15).

Team leaders are change brokers who help understand top-down management mandates while coordinating bottom-up performance improvement initiatives (Van Dun & Wilderom, 2021). The skills of these leaders, brought by Fotso (2021), consist of abilities to monitor, coordinate, train, communicate, and develop other skills, as well as demonstrate motivational skills and management of emotions and conflicts within the team.

When it comes to the competencies of leaders for DT in industries at the team level, as shown in Table 2, (1) influencing, leading, and motivating people - the cited authors point to motivation as a central theme (Morais-Storz

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

182

et al., 2020; Patro, 2020; Porfírio *et al.*, 2021). They also include other skills in this context, such as supporting team members (Brown *et al.*, 2021; Sutcliffe, 1999), influencing people (Chen & Lee, 2007; Motiani & Kulkarni, 2021; Shao, 2019), involving and encouraging employees to take the initiative (Karippur & Balaramachandran, 2022; Ljubica *et al.*, 2021; Pan & Lin. 2019), encouraging participation (Klus & Müller, 2021; Mey *et al.*, 2021), promoting self-efficacy, optimism, resilience and hope (Park, 2021), guiding, expanding, and elevating the team's interests, encouraging and motivating, generating intellectual stimulation (Medina & Macías, 2018).

Another competence of leaders at the team level refers to (2) promoting digital initiatives by forming multidisciplinary and multifunctional teams. The authors' reports indicate leadership focused on relationships and performance in virtual teams (Brown *et al.*, 2021), with due incentives and support for the workgroup (Dodge *et al.*, 2017), rewarding initiatives (Idris & Ali, 2008) and encouraging the autonomy of teams and individuals in the organization (Jäckli & Meier, 2020). When there is sufficient autonomy for employees, teams, and individuals in the organization act flexibly and feel adaptable and fast in the dynamic environment that is DT (Jäckli & Meier, 2020).

The reason for establishing digital teams is to promote digital innovation (Karippur & Balaramachandran, 2022; Pan & Lin, 2019) and enable collaboration (Reitz *et al.*, 2020), stimulating the individual desire to be part (Wegge *et al.*, 2011), implement new digital solutions/tools (Klus & Müller, 2021), encourage overcoming and confronting resistance (Morais-Storz *et al.*, 2020) and develop a multifunctional development strategy (Porfírio *et al.*, 2021).

Competence at the individual level has underlying characteristics that induce individuals to demonstrate their behaviors (Chouhan & Srivastava, 2014) through their knowledge, skills, and attitude (Fleury &

Fleury, 2001; Silva, 2021). Individual competencies refer to leaders' needs to learn new technologies and develop knowledge that change is necessary; that is, "leaders must lead the change effort" (Lucas Jr. & Goh, 2019). The need for leaders to learn, emphasizing that it is necessary to truly understand the power of digital technologies to drive the organization's change to digital, has already been brought up by Kane *et al.* (2015) and Westerman *et al.* (2016).

Table 2 shows the four competencies of leaders at the individual level to promote DT in industries as perceived by the authors of the articles analyzed in SLR, which are:

1) Constant adaptation in the way of leading: it indicates changes in behaviors and styles (Dehghanan *et al.*, 2021; Imran *et al.*, 2021; Karippur & Balaramachandran, 2022), depending on the situation or the demand viewed, depending on the context (Reitz *et al.*, 2020), the type of organization (Sousa, 2018), the environment (virtual or in-person, local or distance) (Klus & Müller, 2021; Medina & Macías, 2018), the organizational levels (individual or multilevel) (Tsai *et al.*, 2022) and the need for available information technologies.

DT requires a leader to develop a vision for the digital experience only after exploring business issues and challenges and after understanding how technology can create improvements in problem-solving. The digital experience must adapt "content and functionality" to "current needs" (Earley, 2014). The technical part of the digital leader's work is becoming less and less important, and the critical part is reaching new digitally enabled businesses.

2) The multidisciplinary capabilities competence is exemplified in several ways. However, the concept of Benitez *et al.* (2022) is a mix of digital, market, business, and strategic leadership skills. The authors relate this competence to the terminology of hybrid digital competence, which is when the leader has contact with IT and other areas. DT

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

183

increasingly requires multiple skills from leaders with specific knowledge on the subject (Klus & Müller, 2021).

This competence involves the need to be aware of the multifunctional developments that DT requires in relation to products and services, requiring new leadership practices and close integration of IT with business processes (Bharadwaj *et al*., 2013; Karippur & Balaramachandran, 2022).

Other authors cite the terminology of ambidexterity as leaders' multidisciplinary ability to exploit current resources to improve business operations and simultaneously take risks by exploring new opportunities for the existing business model (Karippur & Balaramachandran, 2022); that is, leaders are capable of operating alternately between the construction and execution disciplines, managing different divisions within the organizational whole and managing the changes to each requirement of these divisions.

3) Clear and objective communication was a skill observed and linked to various terminologies, such as expressiveness, interaction, precision, and questioning (Brown *et al*., 2019). In terms of communication, leaders must have the skills to read and communicate visual content combined with vocal and digital stimuli (Fotso, 2021) openly and transparently, maintaining good communication between managers, employees, and stakeholders (Idris & Ali, 2008; Ötting *et al*., 2021).

4) Digital fluency refers to digital capabilities of "knowledge about products, marketing channels, and essential customer requirements, as well as available implementation technology, automate interfaces and integrate real-world objects directly into business processes" (Nasution *et al*., 2020, p. 362).

Leaders need digital skills that include the competency to leverage big data tools and analytics, cloud computing and virtualization, mobile application design and development,

complex business systems, web development, IT architecture, Enterprise Resource Planning (ERP) systems, social media, security skills (Benitez et al., 2022) and digital marketing (Borah *et al*., 2022; Phiri, 2020). This competency consists of connecting people, technology, and innovation and navigating a digital environment.
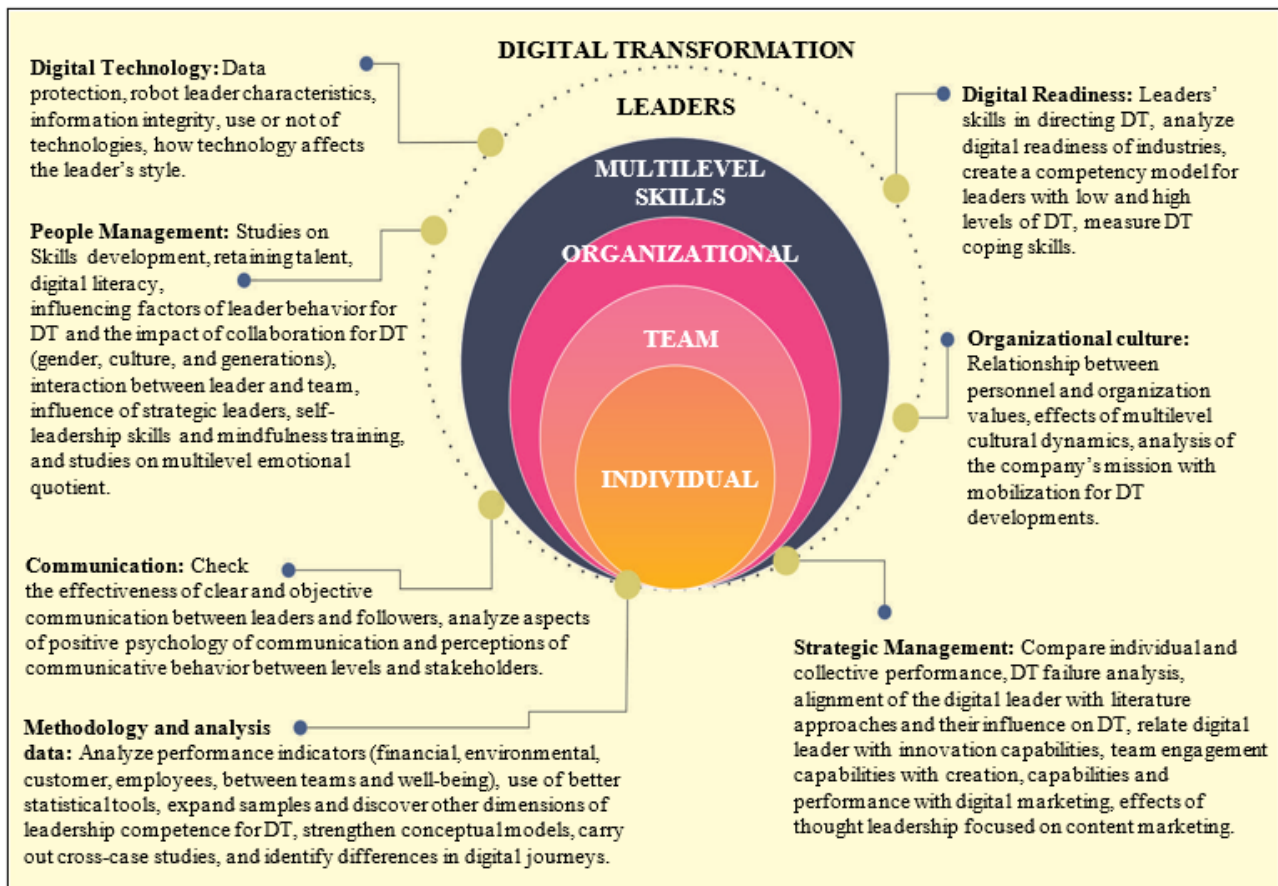
DT requires proficiency with digital tools useful for data analysis, communication, virtual collaboration, task automation, and improved operations (Fotso, 2021). Digital fluency requires a leader who learns and applies new technologies and who knows how to deal with technological complexity. It is on the rise, requiring "the ability to articulate the value of digital technologies and their dynamic role for the future of the organization" (Kane *et al.*, 2015, p. 4).

Analyzing the different interpretations of the concept of competencies in the literature is considered one of the challenges of designing competency models (Montezano & Silva Filho, 2022). Aiming to unify the skills of leaders for DT in industries extracted from the SLR as well as the theoretical framework developed in this research, an analysis of contextual similarity was carried out, and from this analysis emerged these nine dimensions addressed in this research.

The seven topics referring to opportunities and challenges for future studies related to the topic conclude the last stage of the SLR (Figure 4). It is suggested that research be developed involving digital technology on data protection and information integrity (Tsai *et al*., 2022), the use or not of technologies, and how it affects leadership style (Medina & Macías, 2018). When it comes to the area of people management, we suggest studies on skills development (Sousa, 2018), talent retention and digital literacy (Mey *et al*., 2021), the influence of leader behavior (Chen & Lee, 2007), and the impact of team collaboration/interaction on DT (Sasmoko *et al*., 2019).

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

184

Figure 4
Future agenda topics extracted from the systematic literature review

DIGITAL TRANSFORMATION
LEADERS
MULTILEVEL SKILLS
ORGANIZATIONAL
TEAM
INDIVIDUAL

Digital Technology: Data protection, robot leader characteristics, information integrity, use or not of technologies, how technology affects the leader's style.

People Management: Studies on Skills development, retaining talent, digital literacy, influencing factors of leader behavior for DT and the impact of collaboration for DT (gender, culture, and generations), interaction between leader and team, influence of strategic leaders, self-leadership skills and mindfulness training, and studies on multilevel emotional quotient.

Communication: Check the effectiveness of clear and objective communication between leaders and followers, analyze aspects of positive psychology of communication and perceptions of communicative behavior between levels and stakeholders.

Methodology and analysis data: Analyze performance indicators (financial, environmental, customer, employees, between teams and well-being), use of better statistical tools, expand samples and discover other dimensions of leadership competence for DT, strengthen conceptual models, carry out cross-case studies, and identify differences in digital journeys.

Digital Readiness: Leaders' skills in directing DT, analyze digital readiness of industries, create a competency model for leaders with low and high levels of DT, measure DT coping skills.

Organizational culture: Relationship between personnel and organization values, effects of multilevel cultural dynamics, analysis of the company's mission with mobilization for DT developments.

Strategic Management: Compare individual and collective performance, DT failure analysis, alignment of the digital leader with literature approaches and their influence on DT, relate digital leader with innovation capabilities, team engagement capabilities with creation, capabilities and performance with digital marketing, effects of thought leadership focused on content marketing.

Source: Prepared by the authors (2023)

In the aspect of communication, the literature points to studies that verify its effectiveness between leader and followers, with an analysis of positive psychology for DT (Park, 2021) and studies on the perceptions of communicative behavior between levels and interested parties (Brown *et al.*, 2019). The topic of strategic management indicates studies that compare individual and collective performance, analysis of failure in the DT process and innovation capabilities, team engagement, and performance with digital and content marketing (Phiri, 2020).

When it comes to organizational culture, address the relationship between personnel and the organization's values, the effects of multilevel dynamics, and analysis of the company's mission with the mobilization for the development of DT (Ljubica *et al.*, 2022). For digital readiness, research is suggested on analyzing the digital readiness of industries and creating a model and measuring skills for DT (Ötting *et al.*, 2021).

Regarding the methodological aspect, SLR indicates data analysis through DT performance indicators (Patro, 2020) with different statistical techniques adopted in future empirical studies, as well as the elaboration of the multilevel model of competencies of leaders for industries' DT.

Final remarks

The objective of identifying in the literature the competencies of leaders for DT in industries at the organizational, team, and individual levels was achieved. Nine competencies were identified in the SLR considered necessary for leaders to be able to leverage DT in organizations, namely: 1) align

Magazine of Administration, Accounting Sciences and Sustainability, 13(5), 2023.
Special Edition: Competencies and Learning in Organizations

185

with the organization's strategies, 2) integrate, reevaluate, and promote the development of digital competencies, 3) promote change in organizational culture at the organizational level, 4) influence, lead and motivate people, 5) promote digital initiatives by forming multidisciplinary and multifunctional teams at the team level, 6) constant adaptation in the way of leading, 7) multidisciplinary capabilities, 8) clear and objective communication, and 9) digital fluency at the individual level.

During the development of this research, relevant contributions emerged for academic purposes, such as the procedures adopted at each stage of SLR execution that could guide future studies that adopt this research method, the conceptual basis of leaders' multilevel competencies for industrial DT extracted from the literature, and concepts related to research that could facilitate the carrying out of new studies.

As a managerial contribution, the study will serve as a basis for analysis regarding self-assessments of the competencies already existing in industry leaders. It will help to identify the needs for developing these competencies at the three levels of the organization (Area-Moreira *et al*., 2020).

Among the aspects that limited the research was the allocation of competencies extracted from SLR into their respective levels, as it depended on the researcher's interpretation of the theory. In this sense, there is the possibility of differences in interpretation between researchers.

Although DT is expanding rapidly, influenced by the market, competitiveness, and sustainability requirements, the research identifies topics on the future agenda, studies aimed at developing a research instrument that makes it possible to identify which multilevel competencies identified in this research are made present in industry leaders and establish a comparison between industrial sectors in relation to the digital skills imbued in the leaders of these organizations.

Studies are suggested on the behavior of leaders among multilevel phenomena and the creation of a multilevel competency model aimed at development and efficiency in management focused on digital leverage. Research focused on this topic must be constantly updated in view of the constant readjustment needs that DT requires.

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186

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REUNIR
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187

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188

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189

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190

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191