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Digital leadership in education: a systematic review

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ABSTRACT

Digital leadership in educational settings has gained substantial attention in recent years. However, still lacks of a comprehensive understanding of digital leadership. Therefore, this systematic review presents the analysis on three key areas: defining digital leadership, understanding its effect, and analyzing what factors influence digital leadership practice. It aims to reveal the overlooked aspects of digital leadership. Methods involved conducting a systematic review of studies from the Scopus, Web of Science, and EBSCO databases, complemented by searches of citing articles and reference lists. The data gathered were analyzed to identify patterns and gaps in the current literature. As a result, this review suggest that digital leadership should be defined dynamically, taking into account the evolving nature of technology and its integration into education. The effects of digital leadership should focus more on promoting lifelong learning and ensuring digital safety. Future research should delve deeper into the factors influencing digital leadership to provide a more nuanced understanding of its practice. This literature review contributes to a comprehensive understanding of digital leadership by uncovering previously overlooked dimensions and proposing directions for future research.

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1. INTRODUCTION

As the educational institutions become increasingly infused with technology, education is undergoing a profound transformation. Making the role of effective digital leadership has already become a focus of research. Given this reality, effectively implementing digital leadership is no longer a choice but a necessity [1]. However, digital leadership in education remains in a complex and multifaceted situation, leaving unseen dimensions unexplored. Moreover, the research on digital leadership is relatively scarce. Therefore, there is a need for a comprehensive and in-depth understanding of digital leadership in education [2].

The definition of digital leadership has evolved from digital transformation in the 21st century with e-leadership, internet and communication technology (ICT) leadership and technology leadership [3]. An increasing number of researchers have proven the importance of leadership practice in the process of digital transformation within various types of organizations [4]. Therefore, digital leaders must first understand the meaning of digital leadership, possess competence in using the technology for administration and cultivate an environment that inspires all the stakeholders, including teachers and students to use technology in teaching, learning, and the management process [5].

Clearly, defining digital leadership is challenging because educational institutions are complex and dynamic organizations. Moreover, educational technology is continuously updated. Thus, digital leadership in

education should also evolve alongside technology, organizational changes, and environmental factors. In analyzing the concept of digital leadership, various terms such as e-leadership, virtual leadership, technology leadership, and ICT leadership frequently appear in the literature. Researchers have suggested that defining digital leadership should consider these related concepts, making the concept broader [6]. However, a satisfactory definition of digital leadership in the educational context has not been identified at present. This indicates a need for a comprehensive definition of digital leadership in this field [7].

Furthermore, the increasing global demand for digital transformation in education has sparked interest in examining the potential effects of digital leadership. Previous studies have backed up the beneficial impact of digital leadership on teachers' behavior and students' outcomes, and subsequently advancing the digital transformation process. However, the actual impact of digital leadership extends beyond these aspects. Therefore, considering the rapid development of technology, it is necessary to continuously update and evaluate the latest contributions of digital leadership. Additionally, researchers have primarily focused on how digital leadership influences the educational sector, with less emphasis on a clear understanding of digital leadership and its influencing factors.

In fact, clarifying digital leadership and exploring its influencing factors can enhance its effective role in educational context. Additionally, systematic reviews of the previous literature on digital leadership in education are in short supply. By addressing these gaps, this study aims to look deep into digital leadership and discover the unseen part for the future study through a systematic literature review (SLR). Extensive research should be conducted to answer the following questions to guide this literature review.

- RQ1. How is digital leadership currently defined in the educational sector?
- RQ2. What is the effect of digital leadership in the educational sector?
- RQ3. What factors influence the development and implementation of digital leadership?

2. METHOD

The current study is a SLR conducted following the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines. This approach is characterized by being repeatable, scientific, and transparent [8]. The SLR procedure involved three stages: i) data collection, ii) data analysis, and iii) synthesis [9]. To provide a comprehensive review of the topic, a two-stage search approach was adopted, incorporating both database searches and citation searches. The collection process was from November 9th, 2023 to November 12th, 2023. In the first stage, this study searched the Scopus, Web of Science, and EBSCO databases, using the basic keywords, which were used as a selection criterion for the topic (title, keywords, or abstract). The keywords were "leadership" AND "digital" OR "technology" OR "e-leadership" AND "education". And then, proceed with a qualitative selection of publications. The search initially identified 2761 publications from the three databases. After limiting the language to English, 2214 publications remained. Following the papers' abstract selection process, 163 publications remained. Publications that were not directly relevant to the research topic were excluded, even if they met the specified keyword criteria and discussed digital leadership challenges as a secondary subject. For example, non-academic books and articles related to specific domains (such as business and health) were excluded. Additionally, literature reviews, book chapters, and overview articles were excluded to prevent the duplication of research. Empirical publications presenting quantitative, qualitative, or mixed research were retained, resulting in a final set of 33 articles.

In the second stage, citation searching was conducted to further enrich the research review. This involved tracking the references of the selected literature to identify and include additional significant studies related to digital leadership in education. References from the 33 articles identified in the first stage were retrieved and screened to ensure their relevance to the research topic. The screening process from the first stage was repeated, resulting in the inclusion of 6 additional articles. Figure 1 displays the number of papers identified, screened, and ultimately included. After the procedure of search approach, the final total comprised 39 articles. These articles are detailed in Table 1 (see in Appendix) [10]–[48], which contains the authors and titles of these 39 articles, along with the countries where the research conducted.

3. RESULTS AND DISCUSSION

3.1. Definition of digital leadership

Leadership is considered as an interactive process with followers in which the leader needs to have ability to motivate and influence the followers to achieve desired goals. Therefore, leadership element contains interaction, process, ability, follower, and goals. Digital leadership should combine the leadership elements and the characteristics of the TOE. Therefore, based on these elements, the literature review found that definitions of digital leadership are unseen to varying aspects. Only 11 out of 39 literatures provided a definition which are shown in Table 2.

There are three papers focused on technology leadership. They emphasized that digital leadership is the integration of technology into various forms of transformational leadership to achieve diverse educational goals [11], argued that technology leaders require high ICT competence to influence followers effectively [14], focus on planning, providing guidance, and encouraging employees to perform tasks based on the use of ICT [15]. These definitions enhance our understanding of leader competencies and follower impacts but neglect the interactive nature of digital leadership as a dynamic process and follower's roles. Additionally, they do not consider the specific educational and digital context. Researchers use the term e-leadership in their papers, describing digital leadership as a process [12], [18], [20]. These definitions broadly consider technology, including ICT, social networking tools, and advanced information technology (AIT). But they ignore the elements: leaders' competence, digital environment, the roles of followers, and educational goals, which making their definitions incomplete.

Other researchers use the term digital leadership in their papers [13], [16], [17], [19], [21]. Some of them overly emphasize technology integration while neglecting the pivotal role of leaders in the process and their impact on followers [13], [16], [17]. Another one view digital leadership as transformational, focusing on building digital culture and achieving organizational goals through influencing followers with digital tools [19]. This definition is comprehensive but lacks educational organizational characteristics. Therefore, Luo *et al.* [21] propose a more comprehensive definition, emphasizing digital leadership as an evolutionary process to adapt to the changing digital social environment. It involves a gradual process of leaders developing attitudes, perceptions, and competencies in the digital age to guide faculty in enhancing their digital attitudes, digital perceptions, and digital competencies.

Previous studies suggested that digital leadership is an evolving definition based on technology [21]. Because digital leaders need to constantly learn and update their knowledge due to the constant evolution of technology. However, it is not only the technology that is changing, but also the changing digital environment and organizational structure, that is what the most definitions have missed. In fact, with rapid technological advances and societal changes, digital leadership also needs to be more dynamic, adaptive, and in sync. Therefore, this study suggests that a technology organization environment driven digital leadership model should be constructed. Through this perspective, emphasizes leaders' understanding, application, and innovation of emerging technologies, and the reshape of organizations and environments for digital leadership. Therefore, the future direction of digital leadership research could be centered around a more flexible and evolving definition.

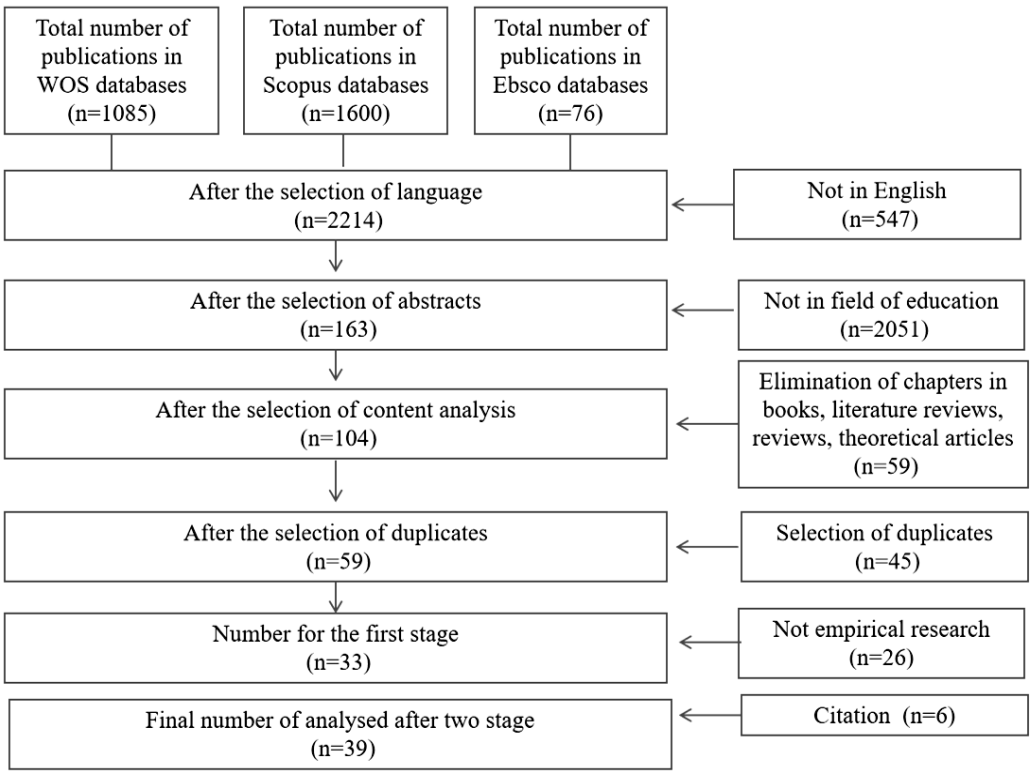

Figure 1. The procedure of search approach

Table 2. Definition of digital leadership

Author	Item	Definition	Unseen element			
			Leadership element	Tec.	Org.	Env.
[11]	Technology leadership	Integration of technology into a variety of transformational leadership to achieve a variety of educational goals.	×Interaction ×ability ×follower	√	√	×
[12]	E-leadership	The process of social influence that produces behavioral and performance changes in individuals and groups in an organization using ICT as a medium.	×ability	√	×	×
[13]	Digital leadership	Integration of a set of technologies, such as: social media, Artificial Intelligence, Big Data, Machine Learning and so on.	×Interaction ×ability ×follower ×goals	√	×	×
[14]	Technology leadership	Leaders with technology leadership should have a high level of ICT competence, develop the potential of ICT in the organization and influence employees to use ICT more effectively.	×Interaction	√	×	×
[15]	Technology leadership	Plan, provide guidance and encourage employees to perform their tasks, with a greater focus on educational institution management and administrative methods based on ICT usage.	×Interaction	√	×	×
[16]	Digital leadership	Characterized by transformational leadership, with a focus on changes by digital technology usage in the field of educational management.	×Interaction ×ability ×follower ×goals	√	√	×
[17]	Digital leadership	The implementation and use of leadership practices that are in keeping with the requirement in digital age, relying on modern technology devices.	×Interaction ×ability ×follower ×goals	√	×	√
[18]	E-leadership	The ability to influence subordinates using social networking tools in daily interactions in educational institutions, which may be at home or in the workplace.	×process	√	√	×
[19]	Digital leadership	An evolved form of transformational leadership, essentially the characteristics and competencies demonstrated when assuming a leadership position, influencing subordinates to utilize digital devices to build an organization's digital culture and achieve organizational goals.	×process	√	×	√
[20]	E-leadership	A social influence process, mediated by AIT, at the level of the individual, the group, and the organization.	×ability ×follower ×goals	√	×	×
[21]	Digital leadership	A gradual evolutionary process to face the changing digital social environment. The process involves the gradual development of the director's attitudes, perceptions, and competencies in the digital domain to guide the faculty and staff in enhancing their digital attitudes, digital perceptions, and digital competencies.	×goals	√	√	√

Tec.--technology; Org.--organization; Env.--environment

3.2. The effect of digital leadership

Because understanding the role of digital leadership in guiding and implementing digitization in schools is relatively more urgent and challenging. Therefore, the effect of digital leadership is mentioned in 28 papers of 39 which covered multiple levels, including students, teachers, and schools. These studies reveal the multifaceted impact of digital leadership on the entire education ecosystem.

According to Table 3, only one paper discussed the impact of digital leadership at the student level, 19 papers discussed the impact at the teacher level, and nine discussed the impact at the school level. At the student level, research on digital leadership focuses on academic achievement [33]. Effective implementation of digital leadership can provide students with a higher quality and personalized educational experience, therefore positively impacting academic performance. However, the impact on promoting student creativity and digital literacy is not well-documented.

At the teacher level, 11 papers concentrated on technology integration, indicating a strong consensus among scholars on the importance of digital leadership in facilitating this process. Although Raman and Thannimalai [27] noted that there is no relationship between digital leadership and teacher technology integration, other eight studies suggested a significant effect of digital leadership on teacher technology integration. These findings conclude that a primary role of digital leadership is to guide and facilitate the effective integration of technology to enhance teaching and learning. Additionally, several studies focusing on teachers' professional development [24], instructional reflection [49], and job engagement [29] which reveal the important impact of digital leadership in stimulating teachers' innovative thinking and improving job satisfaction [37].

Table 3. The effect of digital leadership

Author	The role of digital leadership		
	Students	Teachers	Schools
[11]			School administrative effectiveness
[12]			Raise the quality of teaching and learning
[14]		Technology integration	
[15]		ICT self-efficacy	
[16]		Digital teaching	
[17]		Technology integration	
[18]		Teacher behavior	
[20]		Attitudes in using virtual learning environments	
[22]		Technology integration	
[23]		ICT self-efficacy	
[24]		Development using ICT	
[25]		Technology integration.	
[26]			ICT implementation strategies, ICT transformation
[27]		Technology integration (no relationship)	
[28]		Technology integration	
[29]		Reflective practice work engagement	
[30]			(1) digital transformation, (2) technology-based professional development, and (3) digital learning culture
[31]		Personal and professional lives, such as increased timetables and greater autonomy, learning	
[32]		Technology integration	
[33]	Students' academic performance	Effective ICT use	
[34]		ICT competency	
[35]			Implementation of the distance education
[36]		ICT usage, ICT competence	
[37]		Job satisfaction, explained the role of digital leadership in inspiring employees to innovate and defend their ideas, making them feel satisfied in their job.	Digital culture
[38]		Technology integration	
[39]			Information system success model. System quality, information quality, and service quality
[40]		Technology adoption	Digital smart organization
[41]			Managing school virtual spaces
[42]		Digital education resource use	
[43]			Digital environment and culture
[44]			High quality of education

At the school level, the effect of digital leadership is displayed in management [11], pedagogical, and environment [41]. Through digital management tools, schools can better organize resources, optimize decision-making processes, and improve administrative efficiency [44]. Meanwhile, digital leadership supports the improvement of teaching quality [12] and technology-based professional development [30]. Furthermore, digital leadership also impacts on ICT transformation [26], digital transformation [30], and building a digital learning culture [37], [43]. These papers show that digital leadership helps to build a digital culture and drives the school towards digitization and innovation.

Existing research has focused more on the effect of digital leadership on teachers' behaviors and very little about the impact on students. Therefore, future research could focus on how digital leadership can reshape students' behaviors, especially on the lifelong learning skills. Because in changing technologies, organizations and environments, the acquisition of learning skills is considered to be more important than the mere accumulation of knowledge [45], as it enables individuals to adapt to the development of society. Moreover, in the digital age, lifelong learning is seen as an indispensable skill [10]. Furthermore, previous studies have ignored the effect of digital leadership on digital security. In fact, the importance of digital security cannot be ignored as the widespread use of digital technologies in education exposes schools, students and educational institutions to a variety of potential digital security threats [50]. This includes how leaders advocate and implement digital security strategies and their contributions in building organizational security culture, training employees to be aware and managing digital risks.

3.3. The influencing factor of digital leadership

Only 10 out of the 39 papers provide an in-depth analysis of the factors influencing digital leadership, reflecting the relative scarcity of research in this area. The findings categorize influencing factors into two main groups: internal and external factors, as shown in Table 4, offering a clearer understanding of the multifaceted factors that contribute to the formation and development of digital leadership.

The internal factors can be further categorized into three main areas: individual characteristics, professional experience, and digital literacy. Individual characteristics includes factors such as age, gender, and frequency of computer and internet use [46], which directly influence an individual's acceptance and application of digital technology and shape their digital leadership style. Professional experience covers administrative experience [10], positional status [10], professional qualifications, and participation in IT service projects [45], which have a significant impact on leaders' role-playing and decision-making in digital environments. Digital literacy, which refers to a leader's level of computer literacy, change management skills [12], and perceptions of technology acceptance and self-efficacy [23], has a direct impact on a leader's ability to adapt to the digital age and successfully meet challenges.

Table 4. The influencing factor of digital leadership

Author	Influencing factor	
	Internal	External
[12]	Knowledge of computer,	Infrastructure.
	A change management ability	Conducive e-leadership culture
[22]		School culture
[23]	Technology acceptance and self-efficacy	
[26]		ICT policy
[36]		Technology leadership training
[37]		COVID-19 pandemic; training programs
[45]	Professional seniority, participation in IT service program	
[10]	Administration experience.	
	Status pose	
[46]	Age, gender,	Infrastructure.
	Frequency of computer and internet use	Teachers' perception on school digital culture
[47]		Regular training technical supervision

External factors cover infrastructure [12], school culture [22], technical supervision [47], policies [26], COVID-19 pandemic, and regular training programs [37]. These factors directly influence the organizational environment in which digital leaders operate. Adequate infrastructure is essential for the successful implementation of digital strategies by digital leaders [48]. And school's positive, innovative culture help leaders inspire teamwork and innovation in the digital environment. Regular training and technology oversight are crucial for continuously enhancing leaders' technological competencies [47]. Policies [26], training programs [37], and external factors such as COVID-19 enable digital leaders to better respond to emergencies and challenges, demonstrating leaders' resilience and leadership skills in times of crisis. These externalizations form an important part of the environment in which digital leaders work and provide strong support and assurance to digital leaders.

However, in actual implementation, these factors are intertwined and influence each other. In addition, it should be noted that although existing research has achieved some results in digital leadership, research on the influencing factors is still relatively limited. Therefore, future research directions should focus more on the influencing factors of digital leadership to deeply understand and clarify these factors, so as to improve the actual utility of digital leadership. Moreover, the existing studies have ignored that leadership is the interaction process between leaders and followers. Future research could focus on the extent to which followers are involved in digital decision-making and how their attitudes affect leadership behaviors. Also, researchers should focus on the practice of digital leadership in multicultural digital teams. This approach can help to better understand the differences in leadership across cultures and how to achieve leadership alignment and synergy in such multicultural contexts.

4. CONCLUSION

This study redefines digital leadership in educational settings, explores its role and influencing factors, and identifies overlooked aspects, providing directions for future research. The findings redefined digital leadership based on TOE. Based on the TOE framework, digital leadership emerges as a dynamic practice integrating technology and shaping a supportive organizational culture for digital innovation. Effective digital leaders exhibit flexible, adaptive behaviors, fostering interaction with followers to drive educational

institutions towards digital transformation. This holistic approach embraces technological advancements while considering internal dynamics and external influences shaping the educational landscape. Meanwhile, existing research predominantly focuses on the functional aspects of digital leadership, with limited exploration of its influencing factors. Enhancing our understanding of these factors is crucial for optimizing digital leadership effectiveness. Future research should emphasize the dynamic nature of digital leadership, its role in lifelong learning and data security, and the impact of followership and organizational culture. Strengthening theoretical foundations in these areas will advance digital leadership to higher levels in academia and practice.

APPENDIX

Table 1. Details of final literature

No.	Author	Title	Country
1	[10]	Technology leadership and its relationship with school-Malaysia standard of education quality (school-MSEQ)	Malaysia
2	[11]	The relationship between technology leadership strategies and effectiveness of school administration: an empirical study	Taiwan
3	[12]	How are e-leadership practices in implementing a school virtual learning environment enhanced? A grounded model study	Malaysia
4	[13]	Leadership types and digital leadership in higher education: behavioral data analysis from University of Patras in Greece	Greece
5	[14]	Mobile technology integration in the 2020s: the impact of technology leadership in the Malaysian context	Malaysia
6	[15]	Empowering teacher self-efficacy on ICT: how does technology leadership play a role?	Malaysia
7	[16]	The effects of principals' digital leadership on teachers' digital teaching during the COVID-19 pandemic in Malaysia	Malaysia
8	[17]	The impact of digital leadership on teachers' technology integration during the COVID-19 pandemic in Kuwait	Kuwait
9	[18]	E-leadership of the school principals in implementing online learning during COVID-19 pandemic at public senior high schools	Indonesia
10	[19]	A typology for digital leadership in higher education: the case of a large-scale mobile technology initiative (using tablets)	Arab
11	[20]	E-leadership, technology acceptance and technological self-efficacy: its effect on teacher attitudes in using virtual learning environments	Indonesia
12	[21]	Chinese model of digital leadership in early childhood settings: a grounded theory study	China
13	[22]	The impact of school culture, technology leadership, and support services on teachers' technology integration: a structural equation modeling	Turkey
14	[23]	An examination of open and technology leadership in managerial practices of education system	Cyprus
15	[24]	E-leadership and teacher development using ICT	USA
16	[25]	The influence of principals' technology leadership and professional development on teachers' technology integration in secondary schools	Malaysia
17	[26]	How does principal e-leadership affect ICT transformation across different school stages in K-12 education: perspectives from teachers in Shanghai	China
18	[27]	Importance of technology leadership for technology integration: gender and professional development perspective	Malaysia
19	[28]	Principals' technology leadership and its effect on teachers' technology integration in 21st century classrooms	Malaysia
20	[29]	Influence of the principal's digital leadership on the reflective practices of vocational teachers mediated by trust, self efficacy, and work engagement	Indonesia
21	[30]	Examining teachers' perspectives on school principals' digital leadership roles and technology capabilities during the COVID-19 Pandemic	Turkey
22	[31]	E-Leadership analysis during pandemic outbreak to enhanced learning in higher education	Indonesia
23	[32]	Effect of principal's technology leadership on teacher's technology integration	Palestine
24	[33]	Technology leadership in Malaysian schools: the way forward to education 4.0-ICT utilization and digital transformation	Malaysia
25	[34]	The relationship between technology leadership and teacher ICT competency in higher education	China
26	[35]	E-leadership and distance education in Greece during COVID-19 pandemic	Greece
27	[36]	Technology leadership perceptions of Utah, elementary school principals	Utah
28	[37]	Digital leadership of school heads and job satisfaction of teachers in the Philippines during the pandemic	Philippines
29	[38]	Principal's leadership and technology leadership practices and its relationship with integration of technology in teachers' teaching at school	Malaysia
30	[39]	The role of digital leadership, system of information, and service quality on e-learning satisfaction	Indonesia
31	[40]	Measuring the effectiveness of smart digital organizations on digital technology adoption: an empirical study of educational organizations in Indonesia	Indonesia
32	[41]	Digital leadership: managing schools' virtual spaces in times of crisis	Israel

Table 1. Details of final literature (continu)

No.	Author	Title	Country
33	[42]	When the push and pull factors in digital educational resources backfire: the role of digital leaders in digital educational resources usage	Ghana
34	[43]	Teacher views on school administrators' technology leadership competencies	Istanbul
35	[44]	Digital leadership competencies to improve the quality of high schools in Tasikmalaya city in the post-pandemic COVID-19	Indonesia
36	[45]	An examination of school administrators' technology leadership self-efficacy	Turkey
37	[46]	Investigation of principals' technology leadership profiles in the context of schools' learning organization culture and ICT infrastructure	Turkey
38	[47]	Technology leadership in Saudi schools	Saudi Arabia
39	[48]	School technology leadership in a Spanish secondary school: the TEI model	Spain

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