Democratizing Software Development: A Systematic Multivocal Literature Review and Research Agenda on Citizen Development

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Abstract. While the ongoing digital transformation is boosting the demand for digital solutions and digital skills, organizations worldwide experience a shortage of IT professionals and particularly software developers. At the same time, the increasing prevalence of low-code development platforms (LCDP) allows organizations to introduce citizen development initiatives to promote and accelerate their digital transformations. Citizen development represents a novel software engineering paradigm which enables and supports the development of software by non-IT professionals, consequently referred to as 'citizen developers'. While there is a vivid discourse on citizen development in the practice community, research on this phenomenon is still scarce. We conducted a systematic multivocal literature review including research and practice publications, and identified six key themes: 1) definition and characteristics of citizen development, 2) enablers and expected benefits of citizen development, 3) challenges of and criticism towards citizen development, 4) citizen development strategy and implementation, 5) citizen development governance, and 6) citizen developers' profiles and skills. Moreover, we propose a research agenda for future work on citizen development. Our research contribution is to synthesize the existing knowledge on citizen development and to point out future avenues to propel research on this emerging and contemporary phenomenon.

Keywords: Citizen development · Citizen developer · Technology democratization · Low-code development platforms · Multivocal literature review

1 Introduction

The digital transformation is boosting the demand for digital solutions and digital talent [1, 2]. While an organization's workforce is considered a key factor in succeeding with digital transformation initiatives [3, 4], most firms struggle to adequately fill their vacancies in IT jobs. For instance, the German industry association Bitkom reports that roughly 96,000 IT positions were vacant in Germany in 2021, which represents an increase of around 123% compared to 2015, and where software developers and architects are in biggest demand [5]. This IT talent gap is widening globally and is expected

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to intensify in near future [e.g., 6, 7]. In effect, a growing backlog is arising on central IT units' sides [1]. Many IT units are unable to meet the demand resulting in delays, longer waiting times and frustrated business unit stakeholders [8–10]. This lack of IT responsiveness has been found as one of the major reasons for the preference of business units to act autonomously and the occurrence of the phenomenon of 'shadow IT' [11] and its associated risks [12].

To overcome the dilemma between the IT talent shortage and increasing demands on IT units, the concept of *citizen development* has gained increasing attention in practice. The term has (presumably) been coined by market research firm Gartner [13] and refers to the empowerment of employees in non-IT functions (*citizen developers*) to create own software applications based on IT-tools that are provided, recommended, or at least tolerated by IT units [14]. Of central relevance to the concept are low-code development platforms[1] (LCDPs) such as Microsoft PowerApps, OutSystems, or Mendix [15]. LCDPs represent cloud-based environments that use advanced graphical user interfaces, visual representations, drag-and-drop facilities, and reusable components to enable a simplified and rapid process for developing lightweight software solutions [15]. The high level of abstraction of LCDPs leads to enhanced ease of use allowing employees with minimal or even without any programming skills and knowledge to create their own software applications [16, 17].

According to industry forecasts, 70% of all new software applications in organizations will be based on LCDP tools by 2025 [18]. Even more, LCDPs are expected to enable the large-scale development of over 500 million new digital solutions between 2020 and 2025, which is equivalent to the total amount of software applications developed in the last 40 years [19]. Indeed, companies such as Shell [20] or H&M [21] already jumped on the citizen development bandwagon. Shell, for instance, launched its "do it yourself" program to foster a cultural shift towards the democratization of digital skills [20]. Within one year, the program resulted in more than 1,000 citizen developers and more than 75 citizen-developed applications [20]. In addition, further studies indicate that empowering citizen developers leads to higher firm innovation [22].

While there is a vivid discourse on citizen development in the practice community, only few research articles deal with this novel phenomenon [1, 23]. The recent literature review on LCDPs by Prinz et al. [24] further supports this by highlighting that the existing literature focuses mainly on technological characteristics of LCDPs and thus largely neglects aspects such as behavior, communication, or governance of LCDP use. The authors propose a closer investigation of citizen development to obtain a social and technical perspective on this emerging phenomenon. While some recent academic papers raise the awareness for citizen development [1, 10, 25], an overview of this emerging stream of research is yet missing. Given that research on citizen development is currently in its infancy, we strive to establish a first foundation by posing the following research questions:

RQ1: *What are themes in current publications on citizen development?*
RQ2: *What are potential future avenues for research on citizen development?*

[1] In line with Di Ruscio et al. [15], we consider LCDPs and so-called no-code development platforms interchangeably and refer only to the term LCDP in this study.

Given that research on citizen development is still emerging, we deliberately refrained from incorporating a theoretical background section and approached our review as open as possible. The next section describes our literature review research methodology. Section 3 presents our results in the form of six themes related to citizen development. In Sect. 4, we discuss our findings and propose a research agenda. After discussing the limitations of our research in Sect. 5, Sect. 6 concludes our study.

2 Review Method

Identifying, reviewing and evaluating prior literature is a crucial task in research and 'an essential feature of any academic project' [26]. A literature review furthermore constitutes a key contribution for advancing the knowledge in a particular field of research as it represents an indispensable source of information for researchers and practitioners [27]. Consequently, literature review outcomes may serve as theoretical foundation for future research, and also help to identify research problems that require more research attention [26–28]. Given the novelty of the citizen development phenomenon and the fact that the concept is discussed mainly in practice, we saw the need to recognize grey literature in addition to academic literature. Analyzing grey literature bears great potential value for understanding a research phenomenon [29, 30], especially for an emerging topic [30]. Some scholars even believe that the inclusion of grey literature has significantly improved their findings [30].

To consider both, academic and grey literature, we conducted a structured multivocal literature review (MLR). MLRs represent an established research methodology in disciplines such as education or health sciences, and they recently started to become more popular in software engineering [30]. Conducting an MLR is regarded as suitable method that provides a more complete picture by emphasizing state-of-the-art and state-of-the-practice in a given field, thus closing the gap between academia and practice [30]. Since our research objective is to shed light on the current understanding of citizen development, this study can be categorized as a descriptive review that strives to reveal interpretable patterns and trends [27]. Our review approach attempts to be as comprehensive and complete as possible in order to satisfy the levels of methodological rigor and reproducibility that is regularly demanded for literature reviews [31].

Figure 1 illustrates our two-fold approach for collecting relevant literature. In the first phase, we reviewed five scientific databases. In the second phase, we systematically searched the web using Google. We report both phases separately in the following. In total, our data set encompasses 79 articles[2] consisting of 9 conference proceedings, 3 working papers (i.e., research-in-progress or workshop papers), 8 research-related publications (e.g., viewpoint, opinion), 14 white papers, 18 news or magazine articles, 23 blog posts, and 4 practice-driven research reports. Regarding the publication period, the articles were published between 2014 and 2022 with a first rising trend of 10 publications in 2020 (7 of practice origin and 3 of academic origin), and followed by a maximum of 31 publications in 2021 (21 of practice origin and 10 of academic origin).

[2] [32] provide an extended and more detailed overview of these 79 articles.

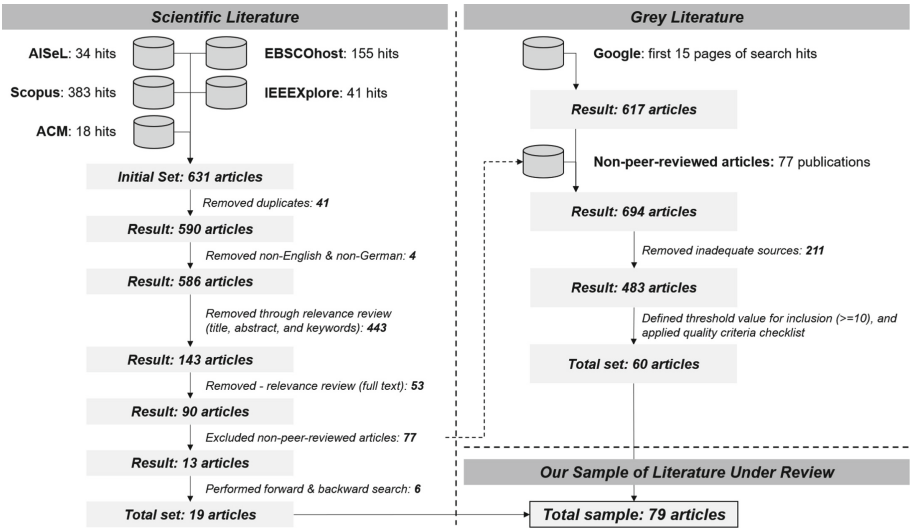

Fig. 1. Data collection process.

2.1 Data Collection Strategy for Academic Research Literature

We followed the instructions of Webster & Watson [26] for collecting relevant academic literature. We conducted a structured literature search in five high-quality information systems, computer science, and business-related research databases (i.e., AIS Electronic Library (AISeL), EBSCOhost Web, ACM Digital Library, IEEEXplore, and Scopus). Our search was performed in May 2022 by querying the search string "citizen develop*"[3] in the aforementioned research databases. We employed a full-text search and limited our search only to articles that were written either in English or German (the first language of the authors). No other filters have been applied in order to identify all relevant publications. This strategy yielded in 631 hits. We removed 41 duplicates and 4 publications not written in English or German. To assess the relevance of each publication, we thoroughly reviewed the title, abstract, and keywords to check if the publication deals with the phenomenon of citizen development in accordance to our understanding and research background. In unclear cases, we additionally assessed the full text. As a result, we removed 443 articles due to different research foci and contexts (e.g., citizen development in the context of education, public health, or politics; such as citizens develop opinions or voices). Furthermore, reviewing the full text revealed that 53 publications referred to 'citizen developer' only as term without further specification or explanation (i.e., as buzzword). Similarly, other articles used the term solely for introducing the concept of LCDP. As these publications did not offer valuable insights for our endeavor, we decided to exclude them. In the next step, we temporarily omitted 77 non-peer-reviewed articles from our data set. However, as some of these articles could have been potentially promising for our research, we decided to reconsider them in our data collection of grey

[3] In ACM Digital Library we used a non-wildcard search string: *[All: "citizen development"] OR [All: "citizen developer"] OR [All: "citizen developers"].*

literature (see Sect. 2.2). Table 1 summarizes our inclusion and exclusion criteria for the surveyed academic research literature.

Table 1. Inclusion and exclusion criteria for surveyed academic literature.

Criteria for inclusion	Criteria for exclusion
• Publication is peer-reviewed • Publication focuses on citizen development as research phenomenon, **or** • Publication focuses primarily on related concept (e.g., LCDP), but extensively examines and refers to key aspects and issues of citizen development	• Publication is duplicate • Publication is written not in English or German • Publication utilizes terms such as 'citizen developer' or 'citizen development' without specification or further explanation (i.e., catchword or buzzword usage) • Publication refers to citizen development solely as introduction to LCDP

Our strategy for searching literature from academic databases resulted in an initial set of 13 relevant articles. Consequently, we performed a forward and backward search for each of them. Searching forward was executed by browsing Google Scholar. To be considered relevant, articles had to equally fulfill all inclusion criteria (see Table 1). This step was iteratively done for each article added. In sum, this process allowed us to add 6 further studies to our data set, thus it totals up to 19 scientific publications.

2.2 Data Collection Strategy for Grey Literature

To identify and collect relevant grey literature, we conducted a systematic search in Google by querying the search strings individually and in quotation marks. Table 2 provides an overview of the applied search strings, -hits, and -stopping criteria.

Table 2. Overview of grey literature search strings, search hits, and search stopping criteria.

Search string	Source	Search hits	Search stop criteria
"Citizen development"	Google	~307,000	Theoretical saturation & effort bounded (first 15 pages)
"Citizen developer"	Google	~196,000	
"Citizen developers"	Google	~148,000	

The first 15 pages of hits have been reviewed in order to explore and check whether the source was appropriate and the concept of citizen development was sufficiently addressed. A threshold of 15 pages was chosen because of two reasons. First, at around the 15th page, a substantial portion of the listed hits did not provide any novel insight to our research thus assuming a certain degree of theoretical saturation [30, 33]. Second, given the large number of search hits, we had to limit our search to a specific boundary.

Adding to this, our limit of 15 pages has been rather extensive in comparison to similar MLR studies [e.g., [33]]. At the beginning, we initially pre-screened all titles of the search hits for relevance and only included those whose titles thematically matched our research background. This resulted in 617 potentially relevant sources. In addition, we considered 77 grey literature articles which have been found during the academic database search (see Sect. 2.1), thus it sums up to 694 sources.

Following the initial collection, we applied specified quality criteria for the inclusion of grey literature. Here, we adjusted the guidelines by Garousi et al. [30] according to our research and subsequently established our quality criteria checklist as presented in Table 3. We used a 3-point scale (yes = 1, partly = 0.5, and no = 0) for evaluating each quality criteria leading in the assignment of a specific score per grey literature source.

Table 3. Quality criteria for grey literature.

Category	Criteria
Authority of the producer	• The publishing organization is reputable, or (at least) one author is associated with a reputable organization • The author has published other work in the field • The author has expertise in the area (e.g., job title)
Methodology	• The work has a clearly stated aim • The work has a clearly stated methodology • Limits are clearly stated • The work covers a specific question • The work refers to a particular population or case
Objectivity ofthe publication	• The statements are objective, clear, and plausible • The work seems to be balanced (i.e., neutral stance) • The work seems to be independent and credible • There are no vested interests
Positioning & Impact	• The work is supported by authoritative, documented references (i.e., citations and backlinks that substantiate the arguments) • Key related sources have been linked and/or discussed • The work provides state-of-the-practice advice or insight (e.g., best practices, challenges, or implications)
Date	• The work has a clearly stated date
Novelty	• The work enriches or adds something unique • The work strengthens or refutes a current position
Outlet type	• 1st tier (score = 1): High outlet control & credibility: magazines, white paper • 2nd tier (score = 0.5): Moderate outlet control & credibility: reports, news, presentations • 3rd tier (score = 0): Low outlet control & credibility: blogs, posts, emails, tweets

Overall, sources could achieve a maximum score of 19. In line with previous studies, sources had to satisfy a threshold value of 10 to be included [30]. In accordance with the academic search, we only considered sources written in English or German. Moreover, purely promotional, inaccessible, and off-topic sources, as well as podcasts and videos were filtered out and omitted from our research. Same applied to duplicates and irrelevant sources (e.g., webinar registration forms). As a result, we excluded 211 sources. Applying the quality criteria to our set of 483 sources resulted in 60 sources that reached the threshold value of 10. Consequently, we merged the scientific and grey literature sources into one sample as the literature under review. Thus, our total sample consists of 79 articles.

3 Results and Findings

We analyzed our data set according to the recommendations of Webster and Watson [26] and vom Brocke et al. [31]. We initially captured all 79 articles of our sample into a table.[4] For literature analysis and synthesis, we pursued a two-step approach. In a first step, the first author carefully read and analyzed each article by identifying and systematically extracting the topics and underlying rationales that surfaced in the respective article. Hence, our process of topic extraction is interpretive in nature. To obtain a comprehensive perspective on the citizen development phenomenon, the first author subsequently searched for interrelationships among these topics in a second step. Identical and interrelated topics were grouped together, leading to the formulation of six key themes. In cases of unclear group assignments, doubts were clarified in discussion with the second author. Figure 2 illustrates the six key themes that emerged from our analysis. In the following, we present our findings by delineating and outlining each theme.

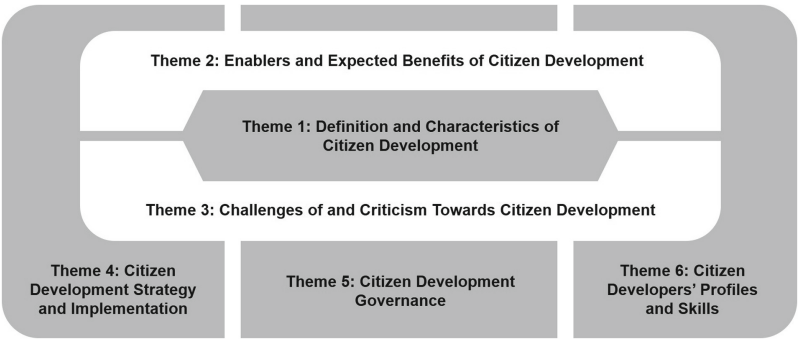

Fig. 2. Conceptual model of current literature themes on citizen development.

[4] We used MS Excel for literature analysis and the follow-up theme synthesis procedure.

3.1 Theme 1: Definition and Characteristics of Citizen Development

The vast majority of articles describe the concept of citizen development as novel software engineering paradigm that strives to empower non-IT employees to design, build, and deploy their own software applications without the direct involvement of the centralized IT units. Hence, a repeatedly used key term across the literature is technology democratization [e.g., 20, 34, 35] referring to the decentralization of IT competencies to enable collective and firm-wide digital innovation. These empowered non-IT employees are then called citizen developers. Of decisive importance is that citizen developers leverage only IT-authorized tools, which largely prevents the creation of shadow IT [e.g., 36, 37]. Regularly quoted key resources in the field have been published by market research firms Gartner and Forrester Research. Even more, Gartner is credited with coining the phrase in 2009 [13, 38] and is thus inextricably linked to the concept.

Given their background, citizen developers are assumed to be mainly equipped for creating applications of low complexity [9, 34] that can range from simple solutions for personal use to organization-wide ones for consumption by others [1, 39]. According to Gartner, a citizen developer is neither a title nor a targeted role, but represents a person that is legally employed by an organization [14]. However, studies also regularly refer to citizen developers in non-organizational contexts [40] and introduce terms such as 'citizen integrator'. This highlights that the term is not always used consistently.

Apart from software applications development, literature also refers to an increased workflow automation that can be achieved through citizen developers [e.g., 10, 23, 41]. In addition, it is noteworthy that almost all articles link the emergence of the citizen development phenomenon with the growing rise of advanced LCDP technologies and its propagated reduction of software development complexity. Thus, 44 articles in our data set explicitly emphasize that citizen developers have little to no coding knowledge.

3.2 Theme 2: Enablers and Expected Benefits of Citizen Development

A second frequently addressed topic in the literature deals with the organizational enablers and the expected benefits of citizen development. Literature already identified an increase in the number of citizen developers [42] and indicates that firms of all sizes are interested in implementing citizen development strategies [10]. In this context, authors argue that several reasons cause its emergence. Most cited are the rising demands for digital solutions in the context of digital transformation, the increased need for faster adaptations to a fast-changing business environment, and the shortage of skilled IT resources resulting in bottlenecks and a widening gap between IT demand and supply [e.g., 1, 10, 36]. On a technology level, modern LCDPs with their easy-to-use graphical interface capabilities and pre-built components are also recognized as a crucial enabler and facilitator of the citizen development phenomenon [e.g., 42–44].

Considering the expected benefits, most organizations strive to establish an environment where citizen developers can realize a multitude of advantages. The first and foremost stated promise is that citizen developers are empowered to cut down routine work and tackle frequent pain points of daily work [35, 38]. In this context, it is believed that citizen developers can achieve a faster and more efficient development process as requirements do not need to be fully aligned and translated between business and IT

[8]. Hence, organizations can increase their overall capacity to develop digital solutions. Instead of waiting for available IT department resources, several studies report that citizen developers can build customized solutions within weeks or days [e.g., 38, 45–47] leading to time and cost savings, more efficient business processes, and less frustrated business stakeholders [e.g., 9, 38, 46].

Another frequently mentioned facet emphasizes the importance of collectivity as citizen development significantly broadens the number of people who can assist with their creativity and competence in an organization's digital transformation [44, 45, 48]. Leveraging the ideas that are already existing within organizations offers the potential to unlock a new source of intrapreneurial business innovation [48]. Moreover, citizen development can potentially benefit central IT teams. If more citizen developers take on active roles in IT-related areas, core IT resources could be freed up, allowing IT professionals to focus on more complex and strategically important projects [8, 49].

3.3 Theme 3: Challenges and Criticism Towards Citizen Development

While the literature predominantly focuses on the potential benefits of citizen development, we also identified a small set of works that discuss challenges and express critique towards the concept. Much of the challenges address the limitations of contemporary LCDPs or question the abilities of citizen developers. Interestingly, and contrary to the statements of most LCDP vendors, firms perceive application development on LCDPs still as complex task that requires specialized skills [1]. Other studies point out to integration limitations [39] and quality concerns caused by improper testing [23, 50]. Similarly, articles refer to risks due to security concerns [23, 42] and citizen developers' unawareness for governance practices or other accepted standards [1, 36, 51].

Apart from the challenges above, one article explicitly expresses critique [52]. The author is skeptical and argues that concepts such as 4th generation programming language technologies have made similar promises to LCDPs and citizen development, but have largely failed to realize these promises [52].

3.4 Theme 4: Citizen Development Strategy and Implementation

The fourth theme discusses strategic decision-making and how organizations can implement citizen development in practice. In this regard, Hoogsteen and Borgman [1] investigated factors that determine a firm's decision to adopt citizen development. Active top management support, centralized IT governance, and external partner involvement have been found to positively affect citizen development adoption [1]. Organizations should proactively drive change management and inform their employees about the arising possibilities and how they can participate [53]. One major component of this is to foster a culture in which the workforce is encouraged to recognize and realize that digital innovation could happen on all levels of an organization [20]. To achieve this, organizations must provide the necessary tools and equip their citizen developers with the required skills and mindset. Some articles emphasize the importance of education and guidance when implementing citizen development and suggest establishing training programs [8, 53] and setting up structures such as a center of excellence or a community

of practice [35, 37]. To identify suitable citizen developers, the literature suggests holding hackathons or looking for jobs with problem-solving activities [54] such as business analysts [55]. More general, people, processes and technology are regularly highlighted as core elements of a citizen development program [9, 41].

However, studies also recognize that there is no one-size-fits-all approach and point out that the implementation can happen top down and bottom up [1]. Moreover, different implementation strategies arise from an organization's individual context (e.g., it might be beneficial to introduce technology from vendors that are already contracted instead of building on so far unknown vendors) [1]. In addition, firms should introduce citizen development first within single departments and then scale to further [37].

With regards to processes, as citizen development promotes a collaborative and more rapid prototyping of innovative ideas, some authors link the concept to an agile mindset and agile methodologies [35, 45, 53], as well as to Scrum and DevOps [37, 56].

3.5 Theme 5: Citizen Development Governance

This theme particularly highlights a new way of collaboration between business and IT units. A large number of articles advocate for bringing citizen development programs under centralized IT governance structures in order to ensure security, compliance, data integrity, and efficiency [1]. Thus, due to the rise of empowered citizen developers, the IT department is given the new function of citizen development governance, which encompasses the provision of the LCDP infrastructure and defining guardrails for citizen developers [1, 37, 53]. However, as reported by Bevans [57], the degree of IT unit's responsibility varies in practice-applied citizen development governance models.

Authors also regularly emphasize that the IT department should seek to closely collaborate, support, and partner with citizen developers, instead of acting as a gatekeeper [e.g., 9, 37, 53, 58]. Collaboration efforts can thereby be achieved through interaction and knowledge exchange in established communities [9, 37] or the setup of cross-functional teams [44, 53]. Likewise, some articles endorse integrative models in which citizen developers create prototypes and professionals later take over finalization [44, 59], implying a shift of work from IT unit to business units [44]. Of importance is that citizen developers are aware of the IT-defined guidelines and standards. For such a citizen development strategy to work and be successfully implemented, firms must have tools and mechanisms in place to monitor and keep the control of citizen-created applications [36]. To avoid duplicate efforts, firms should also strive to establish enterprise-wide directories or app stores in which all employees can look for already available solutions and share their self-developed solutions with others [46].

3.6 Theme 6: Citizen Developers' Profiles and Skills

The sixth and last identified theme in the literature deals with the profile and skills of the individual citizen developer. A number of articles address the question of what exactly constitutes a citizen developer in terms of personality and required skills [38, 46]. Citizen developers are typically characterized as non-IT employees who have no formal IT education, but possess great business expertise and in-depth knowledge of business processes [23, 55]. However, they are also regularly portrayed as tech-savvy

or tech-excited [13, 35, 53]. Other characteristics include curiosity, a desire for change, and a natural motivation for continuous learning and upskilling [13, 35, 53]. Due to their deep and first-hand business expertise, citizen developers are attributed with a thorough understanding of day-to-day business needs and existing operational inefficiencies. Unlike professional developers who often lack deep business insight, citizen developers are thus deemed the perfect candidates for developing custom digital solutions that solve operational pain points [8]. In this context, problem-solving skills are often considered a key competence of citizen developers [8, 41, 47].

Another aspect driving the rise of citizen developers are digital natives now entering business units. Having grown up with technology in their personal lives, the digital natives tend to feel more confident and comfortable using the technological toolset that organizations equip them with [38].

4 Discussion and Research Agenda

Although the term 'citizen development' has been around for over a decade, it has just recently started to gain momentum in academia. In the last few years, the idea has received strong support among practitioners. Despite its attention, literature highlights that there is so far no uniform definition [1]. Some scholars view the concept merely as an extension of end-user development [1, 60]. Indeed, both concepts share similarities, but there are also important conceptual differences. While end-user development goes back to the 1970s and is often linked to single power users who create, modify, or extend specific software artifacts such as spreadsheets [61], citizen development builds on cloud-enabled and advanced LCDP tools that foster collaboration and allow the large-scale deployment of citizen-developed solutions across an organization [60]. Furthermore, while end-user development is often acknowledged a bottom-up approach [62], citizen development is considered more a top-down strategy often initiated by management [1].

Our multivocal literature review results suggest that there is a lot of traction and discussion on citizen development in practice. This opens up numerous research opportunities on multiple levels, as listed in Table 4.

Starting with the *individual level*, scholars should explore the citizen developer role more deeply. So far, the literature portrays citizen developers with varying attributes and skills. Thus, scholars can examine whether there are different types of citizen developers and develop appropriate typologies. Second, research could strive to understand how citizen developers perceive and feel about their role. Having more insights might be important to ensure a lasting success and anticipate workforce resistance. Third, we propose to investigate the motivating factors of citizen developers to take on a new and time-consuming role alongside their regular work.

On *team level*, practitioners sometimes refer to cross-functional teams as appropriate approach for implementing citizen development [44]. This raises several questions with regards to the integration, organization, collaboration, and management of work distribution. For example, it seems essential to understand how citizen developers can benefit teams and team performance. Similarly, it is largely unknown how citizen development practices diffuse within organizations. However, having a clear grasp on this is crucial for the adoption and acceptance of citizen development within and across teams.

Table 4. Research agenda for potential future research on citizen development.

Level of analysis	Exemplary research questions for future research avenues
Individual	• Which types of citizen developers exist, and how can they be classified? • How do citizen developers perceive and feel about their role? • What motivates citizen developers, and how do they approach tasks?
Team	• How do citizen developers integrate themselves into cross-functional teams? • How do citizen development practices diffuse within and across teams? • How can teams and team performance benefit from citizen developers?
Organizational	• How do firms implement citizen development strategies? • How can citizen development training and upskilling be organized? • How should the ownership of support and maintenance for citizen-developed digital solutions be managed? • How can firms measure organization-wide citizen development success?
Ecosystem	• How do citizen development strategies differ across ecosystems? • What are market opportunities for third-party providers? • How does citizen development differ between private and public firms?

There are also research opportunities at the *organizational level*. While no standard implementation approach exists, the literature indicates that citizen development can be driven in two ways, top-down and bottom-up [1]. Future research may longitudinally accompany and observe firms on their citizen development journey to better understand the underlying dependencies and dynamics. This includes numerous aspects such as training, or exploring in which types of departments citizen developers primarily emerge. With so many individuals deploying self-developed digital solutions, also questions around the ownership of support and maintenance arise. Moreover, while many sources report that citizen development yields multiple benefits, research should strive to prove the business value of pursuing such a strategy by adequate measures [1].

Lastly, exploring citizen development on *ecosystem levels* seems to be a worthwhile undertaking. To date, it is unclear whether citizen development is applicable to all industry environments and sectors. For example, there might be fundamental differences in how public sector and private companies might implement and leverage citizen development. In a similar vein, citizen development might require established IT vendors and other third-party providers to rethink their solution portfolio in order for them to realize new market opportunities given that citizen developers will demand a capability to extend their solutions with little or no coding efforts. Our analysis reveals the need for such research as only few of the articles analyzed address these questions.

5 Limitations

No work is without limitation. We performed an MLR using academic databases and the search engine Google, whose ranking algorithm is not transparent. Arguably, this limits the traceability of our results. Second, as the citizen development concept is driven by

practice, researchers may have addressed it under related terms such as 'end-user development'. Hence, we may have missed potentially relevant works that do not explicitly use the term citizen development. A third limitation originates from our interpretational work and the derivation of our research agenda. Other researchers might identify different or additional themes and future research avenues. Finally, a further aspect of validity threat may occur from the data collection and data extraction as both processes were mostly conducted by the same one researcher. Those might be concerns for the reliability and reproducibility of our study results [63].

6 Conclusion

'Software is eating the world', as Marc Andreessen's oft-quoted conjecture goes [64]. With the increasing launch of citizen development initiatives across all industries, it seems that this statement is truer than ever. However, it must be clear that citizen developers cannot replace professional software development [65], but rather extend and increase an firm's overall software development capacity. With our MLR, we placed emphasis on the emerging phenomenon of citizen development and sought to manifest it in research by examining and synthesizing the existing knowledge of academia and practice. We contribute to research by outlining six citizen development key themes: 1) definition and characteristics of citizen development, 2) enablers and expected benefits of citizen development, 3) challenges of and criticism towards citizen development, 4) citizen development strategy and implementation, 5) citizen development governance, and 6) citizen developers' profiles and skills. Moreover, we propose a research agenda which may serve as a point of orientation for future research on citizen development at different levels of analysis (individual-, team-, organizational-, and ecosystem-level).

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