

Citizen Developers: The New Accelerators for Digital Transformation

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In the context of this study, citizen developers are defined as individuals outside formal Information Technology (IT) departments who create applications using low-code/no-code platforms to solve business challenges related to their functional roles and responsibilities. The citizen developer role becomes pivotal as organizations navigate the intricate pathways to address increasing business demands for creating applications as part of their digital transformation journey. The driving force behind this paradigm shift lies in the ever-expanding

appetite for software solutions that often eclipses the resource capacities of traditional IT departments. Consequently, companies are turning their attention toward citizen

developers, entrusting them with crafting solutions. In this paper, we systematically review the existing literature to identify the factors contributing to citizen developers' effectiveness in creating applications. We discovered a

lack of research papers discussing this topic. Our study fills this void and proposes a conceptual model to advance understanding of the factors that influence the effectiveness of citizen developers in creating applications. Organizations can utilize the understanding of the factors that enhance citizen devel-

opers' effectiveness and productivity to create applications to foster citizen development and accelerate digital transformation.

A theoretical model is proposed to explain the characteristics of individuals, organizations, and technology platforms contributing to citizen developers' effectiveness in creating applications using low-code/no-code platforms to drive an organization's digital transformation.

Keywords: Citizen developers, Effectiveness factors, Low-code, No-code, Development platforms, Digital transformation, Productivity model, Effectiveness model

Digital transformation is now a global priority for leadership, and it has become essential for business survival and success, necessitating hyper-agile approaches to keep pace with change (Carroll et al., 2021). The surge of this digital transformation wave has resulted in a notable upswing in the IT department backlogs. IT departments need help managing the escalating backlog of activities related to business innovation driven by digital transformation initiatives (Hoogsteen & Borgman, 2022). Another challenge that IT departments face is the shortage of skilled software developers. Breaux and Moritz (2021) warned us three years ago about the imminent shortage of software developers in the IT industry. Companies facing challenges with expanded IT backlogs and shortages of software developers are increasingly considering low-code development platforms (LCDPs) to enable software development by citizen developers (Hintsch et al., 2021). Gundlapalli (2021) states that the market for low-code/no-code (LC/NC) platforms is expected to expand from \$13.2 billion in 2021 to \$45.5 billion by 2025, reflecting a remarkable compound annual growth rate of 28.1%. Because of the IT resource challenges and the increased prevalence of low-code development platforms (LCDP), companies count on citizen developers to create applications (Binzer & Winkler, 2022). Citizen developers allow business leaders to drive digital transformation initiatives without depending on limited, costly core technology and engineering resources (Carroll et al., 2021).

Gartner (n.d.) coined the term citizen developer, which is defined as “an employee who creates application capabilities for consumption by themselves or others, using tools that are not actively forbidden by IT or business units. A citizen developer is a persona, not a title or targeted role. They report to a business unit or function other than IT.” According to Lebens et al. (2021), “citizen developers are outside of the Information Technology (IT) department and are not professional programmers and create applications using low- and no-code platforms for their companies.” We define citizen developers as non-IT personnel who utilize low-code/no-code platforms to develop applications that solve challenges typically related to their functional areas to improve the efficiency of their primary responsibilities.

Companies are increasingly using citizen developers for application development. According to the forecast by Gartner (2022), individuals outside of formal IT departments will make up a minimum of 80% of the user base for low-code development tools by 2026, marking a notable increase from the 60% recorded in 2021. There are several advantages of citizen developers. Using low-code development platforms (LCDPs) and including a broader range of individuals from the business side in application development can help address software demand issues

cost-efficiently (Hoogsteen & Borgman, 2022). Citizen developers possess expertise in a specific domain and the functionalities of a system, enabling them to comprehend and articulate requirements (Rokis & Kirikova, 2021). They are subject matter experts in their fields, and they can establish software specifications by recognizing an issue and subsequently crafting a digital solution to address it (Hedlund & Johansson, 2023). Carroll and Maher (2023) highlight the role of citizen developers in driving digital transformation endeavors at an international energy company, Shell. They trained 6,500 business users as citizen developers, and over 4,000 started actively developing applications using low-code/no-code platforms with support from the IT department. The solutions Shell’s citizen developers developed to enhance workflows and processes related to their primary responsibilities saved the company millions of dollars across all lines of business, improved safety and reliability, and provided efficiency benefits (Carroll & Maher, 2023). While citizen developers require support from IT teams, they also alleviate the burden on IT by independently creating applications. The application creation by citizen developers reduces the heavy reliance on the IT department, enabling IT specialists to focus on critical projects and decreasing the volume of work they need to manage.

A systematic review of scholarly literature revealed a notable gap in the study of citizen developers’ effectiveness in creating applications using low-code/no-code (LC/NC) platforms. Our research seeks to address this void by proposing a conceptual model that advances the understanding of the factors that influence the effectiveness of citizen developers in creating applications. Companies navigating the intricate challenges of modern technological landscapes require skilled citizen developers to accelerate their digital transformation efforts. By better understanding the factors contributing to the effectiveness of citizen developers in creating applications, organizations can maximize the potential of getting more applications created by citizen developers and accelerate the digital transformation process.

Review of Research

We conducted a systematic literature review to examine scholarly publications and investigate factors contributing to citizen developers’ effectiveness in creating applications. We identified three categories of contributing factors: technological, organizational, and individual.

Technological factors: Low-code/no-code development (LC/NC) platforms have revolutionized the software development landscape by empowering citizen developers to create and deploy functional applications without extensive manual coding (Hintsch et al., 2021). These platforms offer a range of features that simplify and accelerate the development

process, making technology more accessible and cost-effective for both large and small companies. Low-code development platforms (LCDPs) facilitate citizen developers' creation and deployment of fully functional software applications through advanced graphical user interfaces (Sahay et al., 2020). LC/NC platforms enhance technological capabilities for both large and small companies by accelerating and reducing the cost of product development and launch (Lebens et al., 2021). They enable rapid translation of business requirements into applications and allow quick adjustments without extensive manual coding (Rokis & Kirikova, 2021). The simplicity of low-code platforms streamlines the app development process, empowering citizen developers to tailor the application to meet user needs instead of working on the solution from scratch (Alsaadi et al., 2021). Additionally, Low-code development platforms (LCDPs) facilitate the reuse of existing artifacts (Sahay et al., 2020) and ensure that provided services align with business requirements (Alsaadi et al., 2021). LCDPs support interoperability, allowing seamless interaction, data exchange, and collaboration with external systems and data sources (Sahay et al., 2020). LCDPs also offer a collaborative multi-tenant environment (Rokis & Kirikova, 2021) and include interactive online training to educate citizen developers on core features (Ullrich et al., 2021). The low-code/no-code platforms provide robust support for application and platform security (Sahay et al., 2020).

Organizational factors: Citizen development is a transformative approach that empowers non-technical employees to create customized software solutions using low-code/no-code platforms, significantly enhancing organizational agility and innovation (Carroll & Maher, 2023). The successful implementation and sustainability of citizen development initiatives depend on several organizational factors. Top management plays a pivotal role in adopting citizen development by actively communicating opportunities to citizen developers and providing guidance on utilizing new technologies, including training (Hoogsteen & Borgman, 2022). The success of citizen development initiatives depends on clearly defined governance standards (Carroll et al., 2021). A center of excellence focused on citizen developers aims to drive digital transformation, create a competitive advantage, and gradually normalize citizen development throughout the organization (Carroll & Maher, 2023). The Shell case study exemplifies the democratization of application development, where citizen developers quickly create custom solutions instead of adding to the IT department's backlog (Carroll & Maher, 2023). Business-IT alignment at the project level is crucial to prevent potential risks associated with citizen development (Hoogsteen & Borgman, 2022). Organizations should consider not just implementation but also the scalability and

durability of software developed by citizen developers with limited technical backgrounds. Viljoen et al. (2023) propose a citizen development scaling framework to address the software development life cycle (SDLC) challenges for citizen developers. It is essential to foster a culture where citizen developers identify with one another and feel connected to their department and the broader transformation journey to sustain a citizen development initiative and maintain interest levels (Carroll & Maher, 2023). Additionally, organizations should provide e-learning training programs for citizen developers, introducing citizen development and outlining best practices in citizen development methodologies (Carroll et al., 2021).

Individual factors: Citizen developers who use low-code/no-code platforms in modern organizations have an important role in driving digital transformation (Lebens et al., 2021). Empowering non-technical employees to create customized software solutions enhances organizational agility and fosters a culture of continuous improvement. We identified several individual factors related to citizen developers. These factors include availability for training and engagement, domain expertise, programming skills, enthusiasm for new technologies, problem-solving abilities, a self-driven attitude, and the role of change agents. Being available for training and engagement is essential, as training programs are often time-intensive and necessitate a certain level of availability from citizen developers (Hedlund et al., 2023). According to Eggers et al. (2023), these developers require time to develop an analytical mindset and familiarize themselves with development tasks. Domain expertise is also critical; Binzer and Winkler (2022) describe citizen developers as non-IT employees without formal IT education but with extensive business expertise and a deep understanding of business processes. Several other authors concur, highlighting domain expertise as a significant factor for citizen developers' effectiveness in creating applications. Programming skills are less emphasized in low-code/no-code software development, an approach that enables software creation with minimal manual coding, thus increasing the involvement of non-programmers (Rokis & Kirikova, 2021). Binzer and Winkler (2022) found that citizen developers generally have minimal to nonexistent coding knowledge. Enthusiasm for new technologies is crucial, as they can pose job security threats, making it essential for citizen developers to maintain interest and enthusiasm (Hedlund et al., 2023). Problem-solving skills are another critical attribute. Carroll et al. (2021) describe citizen developers as empowered problem-solvers who engage in rapid application development using low-code/no-code platforms. Citizen developers address their business needs by independently developing

IT solutions without involving the IT department (Hedlund & Johansson, 2023). Self-driven citizen developers drive digital transformation by leveraging low-code/no-code platforms alongside workflow automation tools such as RPA (Lebens et al., 2021). Finally, citizen developers are seen as change agents. Carroll and Maher (2023) highlight how Shell utilized citizen development to empower its employees to become change-makers throughout the transformation journey in a hyper-agile environment.

The Proposed Theory

Companies facing challenges with growing IT backlogs and shortages of software developers are increasingly turning to citizen developers for help. Citizen developers can alleviate these organizational challenges by creating applications. Our research question is: What are the essential individual, technological, and organizational factors that contribute to the effectiveness of citizen developers in creating applications using low-code/no-code platforms? To find the answer to this question, we conducted a literature review. We identified three types of contributing factors: technological, organizational, and individual. We propose a conceptual model, as shown in Figure 1, to enhance understanding of the technical, organizational, and individual factors. We base our model on the research framework proposed by Hoogsteen and Borgman (2022). Their framework discusses technological, organizational, and inter-organizational factors influencing citizen development adoption decisions. We extend their framework to include individual factors. We removed the inter-organizational context since we could not find any reference to this context from the literature for the effectiveness of citizen developers.

Applications of the Theory

The model depicted in Figure 1 highlights that the effectiveness of a citizen developer is contingent upon several technological, organizational, and individual factors. Technological factors underscore the importance of providing citizen developers with intuitive and robust technology stacks, enhancing their productivity and the quality of applications developed. Organizational factors are pivotal in creating an enabling environment for citizen developers to thrive, fostering a culture of innovation and collaboration vital for successful digital transformation initiatives. Additionally, individual factors highlight the significance of nurturing and empowering citizen developers with the requisite skills and attitude to drive impactful outcomes. By addressing these interconnected factors, companies can leverage the model to strategically develop and support citizen developers, accelerating their journey toward digital transformation and organizational success.

Discussion

Organizations utilize existing resources from non-IT departments as citizen developers to develop applications, thus lowering dependency on IT departments and maximizing efficiency to accelerate digital transformation. Building upon the literature, we identified three categories of factors contributing to citizen developers' effectiveness – technical, organizational, and individual. Future research may uncover some other categories of contributing factors. To enhance the understanding of the technical, organizational, and individual factors that contribute to the effectiveness of citizen developers in creating applications, we propose a conceptual model, as shown in Figure 1. The proposed model provides the theoretical synthesis of the literature, allowing the researchers to build upon this work by testing and validating it. We did not find details about the interdependency of factors within and across categories. Future qualitative and quantitative studies can be conducted to explore the relationships between the factors and their categories.

We identify factors that are mentioned in more than one research paper as essentials. However, we identify factors mentioned only in one research paper as non-essential. Based on the literature review, all technical factors except for the “*interactive online training*” were essential. Similarly, “*democratization of technology*” and “*citizen developer-centric culture*” were non-essential factors under the organizational factors category. “*Enthusiasm*,” “*self-driven*,” and “*change agent*” were found to be non-essentials under the individual factors category. Future research can validate essential and non-essential factors by engaging practitioners from various industries.

The model enhances the understanding of contributing factors for organizational leadership. Using the right low/no-code development platform to ensure optimal productivity, fostering a supportive culture in the organization, and developing traits and skills of citizen developers enables organizations to drive impactful digital initiatives. However, it is crucial to recognize that citizen developers are not intended to replace traditional IT professionals; they serve as accelerators, complementing existing teams and initiatives. The effectiveness of citizen developers in creating applications depends on effective collaboration between citizen developers and established IT departments, ensuring alignment with organizational goals and IT best practices. Organizations must strike a balance and synergistically leverage citizen developers and professional IT staff to effectively achieve their digital transformation objectives.

Conclusions

Citizen developers play a crucial role in accelerating organizations' digital transformation journey.

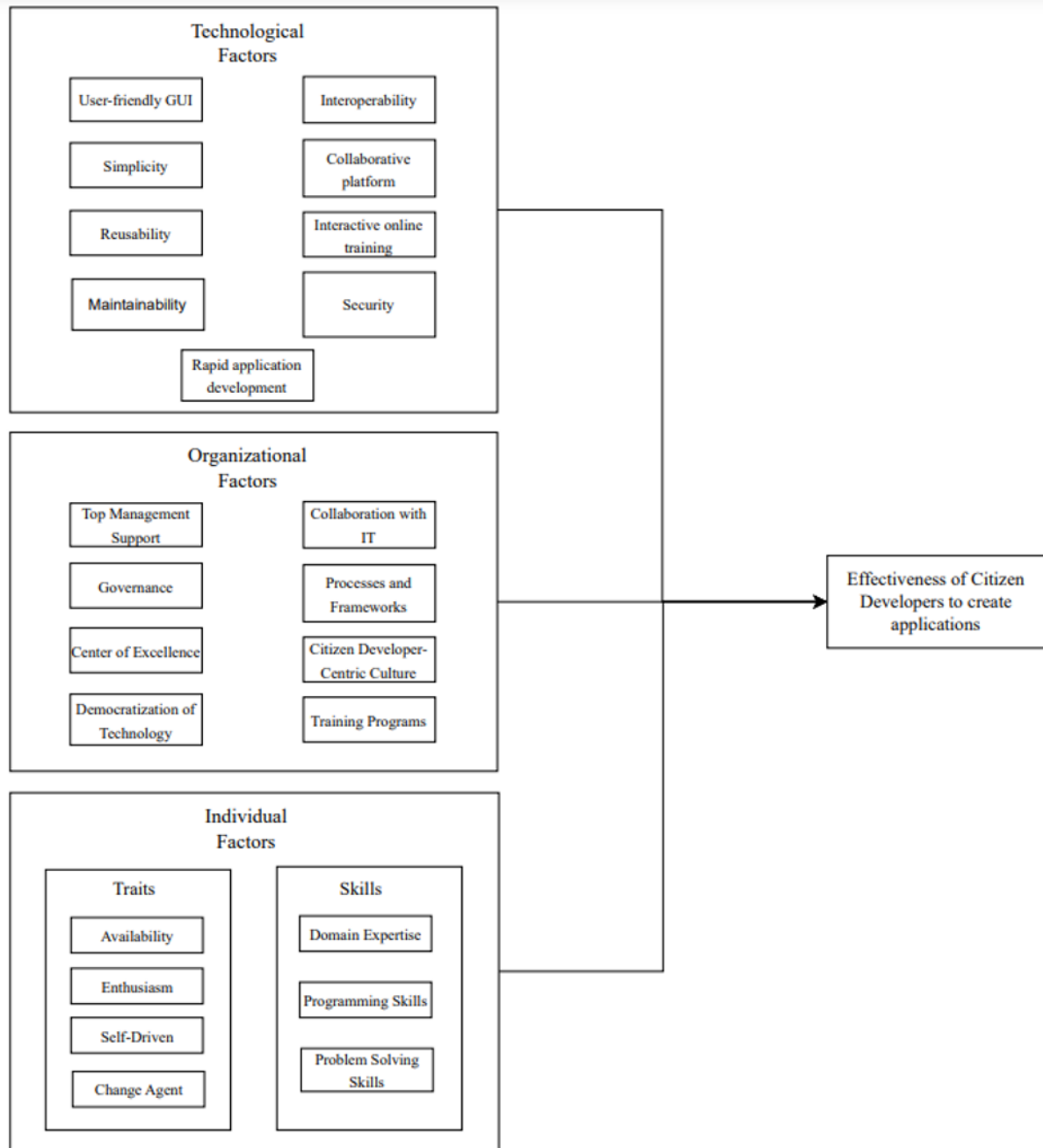


Figure 1: Conceptual model

They alleviate the workload of IT departments by independently creating applications, thus reducing the dependency of organizations on IT experts. We did an exhaustive study of peer-reviewed scholarly literature to understand factors contributing to the effectiveness of citizen developers in creating applications. We found a very limited body of work related to the topic. Our study attempts to fill this gap by proposing a conceptual model. By performing a systematic literature review (Page et al., 2021),

our research provided better insight into the technological, organizational, and individual factors contributing to citizen developers' effectiveness. We proposed a conceptual model to advance the understanding of citizen developers' effectiveness in creating applications. The model posits a foundational relationship between the effectiveness of a citizen developer and the critical technological, organizational, and individual factors identified through a systematic literature review. The model improves the

decision-makers' understanding of the factors that impact the effectiveness of citizen developers. The enhanced knowledge will help the decision-makers use the right development platform, effectively identify and develop non-IT resources to become citizen developers, and create an environment in the organization where the contributions of citizen developers are acknowledged, positioning them as vital participants in advancing cost-effective, efficient, and innovative application development for accelerated digital transformation.

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Review

This article was accepted under the **constructive peer review** option. For further details, see the descriptions at:

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