

Enlisting Citizen Developers to Deliver Digital Business Value With Generative AI & Low-Code Development Platforms

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Enterprise IT organizations face a chronic undersupply of trained programming professionals leading to an application supply-demand disequilibrium. To address this unmet need, Generative AI (GenAI) and Low-Code Development Platforms (LCDP) are maturing and making application development by non-professional programmers a viable possibility. Using GenAI and LCDPs, “Citizen Developers” can rapidly develop and deploy applications to deliver business functionality using IT-sanctioned platforms. However, several issues need to be considered before Citizen Developers can safely produce usable applications. GenAI as an application development platform is a recent phenomenon with limited experiential data as to its viability: therefore, our paper presents a case study of the five-year journey that one enterprise took to implement a LCDP, recounting the successes and challenges in adopting the platform.

Keyword: citizen developers, low-code development platform, generative AI, LCDP, end-user computing, end-user development, shadow IT

THE DIGITAL INNOVATION IMPERATIVE AND THE APPLICATION DELIVERY BACKLOG DILEMMA

Digital innovation has become the coin of the realm as companies vie for customers in the digital economy (Havakhor, et al., 2022). As enterprises rush to deliver compelling new digital applications, which are often aimed at the mobile market, many legacy product development models have given way to agile methodologies. These new customer-focused ways of developing products favor delivering minimum viable products (MVPs) to pilot test markets and making quick decisions regarding whether to continue refining or scraping a product based on user reaction. Thus, MVP experiments have supplanted long new product development (NPD) cycles and a “fail fast” approach in digitally mature companies. While many of these experiments are aimed at a firm’s external customers, the demand by employees for more consumer-like corporate applications creates internal demand as well (Negro & Mesia, 2020).

Corporate IT (CIT) organizations do not have a good track record for meeting business constituents’ demand for rapidly delivering digital technology. This leads to an application supply-demand disequilibrium and results in missed business opportunities (Sullivan et al, 2022). This disequilibrium is exacerbated in the digital economy where rapid digital innovation has become key to enterprise success (Havakhor, et al, 2022). CIOs have sought to better satisfy this need by employing various “Agile” tools and

methodologies such as Rapid Application Development (RAD) (Agarwal, R, et al., 2000) which began its evolution in the 1980s.

While RAD and other approaches have helped speed up application delivery, the demand for business applications still outstrips supply. Frustrated business unit managers have often taken matters into their own hands by embracing “Shadow IT”, defined by Gartner as “IT devices, software and services outside the ownership or control of IT organizations.” The umbrella term “Shadow IT” describes various categories of unsanctioned IT, with employees utilizing internet Software-as-a-Service (SaaS) applications such as messaging and file sharing being the most prevalent. In addition to SaaS apps, Shadow IT can include procuring hardware, standing up a website on the cloud, or synching confidential corporate information between a sanctioned device (e.g. corporate-supplied laptop) and an unsanctioned personal mobile device. This paper will focus on an area of concern to many CIOs, unsanctioned application development by non-professional programmers in business units. Often cited examples are business user-developed spreadsheets and personal databases, but this can also include the outsourcing of applications or entire systems to contractors. We will term this manifestation of Shadow IT “Shadow Development.”

BUSINESS UNIT APPLICATION DEVELOPERS

Recognizing the potential for business users to contribute to the reduction of application backlog, CIT executives have long sought viable solutions for non-professional programmers to improve the rapid delivery of applications while eliminating Shadow Development. End-User Computing (EUC), the first major wave of business unit application development efforts, emerged when personal computers (PCs) became available to the public in the 1980s and was extensively researched in the 1980s and 1990s (Rockart and Flannery, 1983). During the EUC era, many CIT organizations embraced the notion of business unit programmers. They supported their efforts with CIT-sponsored “information centers” where CIT computing specialists could assist end user developers (Brancheau, J. C., & Brown, C. V., 1993). Business and CIT stakeholders held high hopes for application development tools such as Computer-Aided Software Engineering (CASE), introduced in the 1980s, only to have these tools fail to live up to their hype. The hype surrounding CASE tools is an example of “Silver Bullet Syndrome,” the belief that new IT tools will solve all of the technology-related problems facing an organization.

As digital technologies continue to be woven into the fabric of the firm, there is broad consensus that IT consumerization in the workplace is not going away (Griffy Brown, et al., 2019; Harris, et al, 2012). A major component of IT Consumerization is the use of mobile technologies (e.g. smartphones and tablets) for business purposes, and the rapid adoption of mobile devices and applications along with Cloud SaaS applications has increased the tech-savviness of business users. This trend is expected to continue as growing numbers of Digital Natives enter the workforce. The demand for new mobile apps in particular has added yet more strain on CIT as it struggles to keep up with business application demand.

The challenges associated with application backlogs and business unit application development tensions continue to persist well into the 21st Century. A 2019 study (Dimensional Research, 2019) indicated that 77% of IT respondents and 71% of business respondents agreed with the question “our IT team has a huge pipeline of requests for new IT solutions that are not being built” and the same study found that “70% of IT thinks it’s mostly bad when the business acts on their own, 69% of business stakeholders think it’s mostly good to act outside of IT’s control and 91% of IT says it’s dangerous to build applications without understanding impacts.”

SHADOW DEVELOPMENT TENSIONS & CIT RESPONSES

When CIT cannot meet business users’ IT needs, there is good reason to think that these business users will continue to develop/source their own IT, often without informing CIT. Shadow Development applications are often developed quickly and do not incorporate data and security standards. These home-grown applications may work for a time but have limited long-term value, a phenomenon called “technical debt.” As many CIOs are painfully aware, this technical debt may no longer be sustainable (e.g. a

spreadsheet application becomes mission-critical and can't scale) and will need to be rewritten by CIT to conform to enterprise standards. The recognition of a needed rewrite of these business user-developed applications can come at the worst possible time, often when the application breaks down, requiring CIT to quickly repair the application at the cost of neglecting other projects.

Most CIOs are familiar with Shadow Development and its often-cited negative consequences where business unit developers are often characterized as “going rogue.” Unvetted applications released into the enterprise’s environment can cause various issues, including cybersecurity concerns. Gartner Group (2016) predicted that by 2020, a third of successful attacks experienced by enterprises will be on their shadow IT resources, noncompliance with regulatory requirements, duplication of existing applications, lack of IT help desk support, islands of data caused by standalone apps, user-built applications not coded to corporate standards, applications that don’t integrate, and inefficient use of the IT budget to name but a few. Unsupervised application development can also live on much longer than its developers intended, resulting in onerous “technical debt” that will need to be reworked at a later date, often at an inconvenient (or worse) time.

There are three responses to Shadow Development a CIO can take: a “Laissez Faire” approach that allows unfettered business unit development; “Elimination” where CIT tries to eliminate any non-sanctioned development; or “Management” where the CIT manages business unit application development through collaboration and oversight.

THE EMERGENCE OF CITIZEN DEVELOPERS

A response to Shadow IT that seeks to remedy the downsides of nonprofessional application development and take a “management” response is the utilization of “citizen developers.” Citizen developers differ from Shadow Developers in one key respect: they have the consent and support of corporate IT and user-friendly development tools that address many of the shortcomings of the tools used by Shadow Development. Gartner Group’s definition of “citizen developer” makes a clear distinction from that of a Shadow IT developer:

Gartner defines a citizen developer as an employee who creates applications for themselves or others using tools not actively prohibited by IT or business units. Citizen developers are business technologists who report to a business unit or function other than IT.

Citizen developers typically use low-code and no-code platforms to build internal applications, integrations, workflows, and processes. These platforms allow users to develop applications without any coding, mostly using prebuilt components and visual interfaces

Tech-savvy citizen developers can be a rich resource for rapid development within the enterprise. Importantly, these employees possess deep domain knowledge of how the business works (e.g. business rules and algorithms) that will not get garbled in translation as requirements are articulated to business analysts who then pass them on to CIT application developers. Users’ domain knowledge coupled with easy-to-use development platforms can be a true competitive advantage and help alleviate project backlog. Since business domain experts develop these systems, it is likely that they will be effective, freeing IT professionals to focus on complex systems and technologies that truly require their expertise (Davenport 2023).

The 2021 Gartner *Reimagining Technology Work Survey* claims that “on average, 41% of employees are business technologists and many use various technology creation and data and analytics tools that are low-code or even no-code” (Wong & Davis 2022).

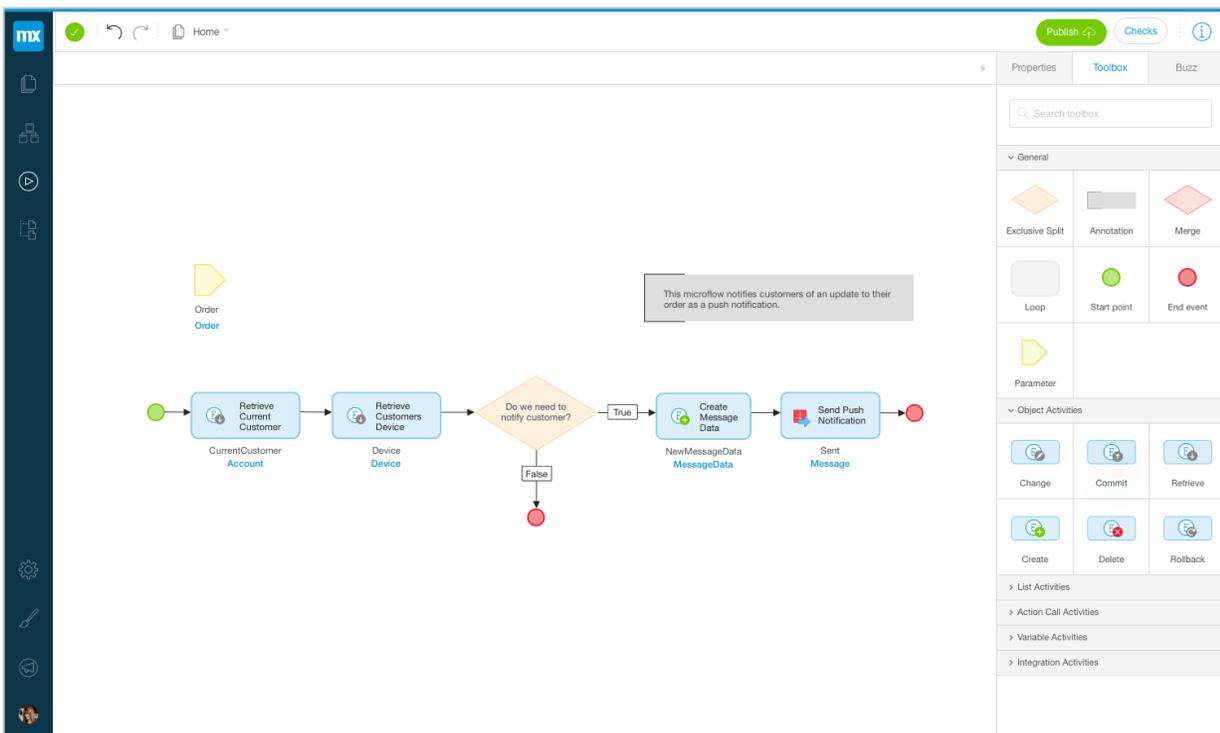
LOW-CODE DEVELOPMENT PLATFORMS ENABLE CITIZEN DEVELOPERS

While previous technologies, such as CASE tools, have not been effective in facilitating business user development, an emerging class of tools, *Low-Code Development Platforms* (LCDP), may help utilize the talents of non-professional programmers in a way that satisfies both business users and the CIT. The term “Low-Code Development Platform” was originally coined by Forrester Research in 2014 and defined as “platforms that enable rapid delivery of business applications with a minimum of hand-coding and minimal upfront investment in setup, training and deployment.”

Many major IT vendors offer LCDP platforms. The October 2024 Gartner Magic Quadrant lists Mendix, Microsoft, Out Systems, Appian, Service Now, and Pegasystems in the Leaders Quadrant. Oracle, Salesforce, and Zoho are present in the Challengers Quadrant. LCDPs are maturing rapidly and include rich features that facilitate the rapid delivery of applications. Examples of built-in LCDP capabilities include pre-built/pre-tested components and application templates, application programming interfaces (APIs), connectors that allow the LCDP to integrate with other enterprise systems and access to Cloud-based artificial intelligence (AI) services.

The most powerful LCDP feature for Citizen Developers is Model-Driven Development (MDD) through a visual interface. MDD defines application development at a higher level of abstraction and relieves the user of “hand coding” low-level code (e.g. in the “C” programming language.) LCDPs employ MDD techniques that allow Citizen Developers to build applications by dragging-and-dropping flowchart objects onto a digital canvas, much as they would when using a business process mapping tool. The flowchart is used to generate code that resides either on-premise or in the Cloud. Most LCDPs have multiple pre-built/pre-tested components and templates that speed the development process and provide rich functionality to non-professional programmers. Figure 1 shows a typical LCDP MDD screen that Citizen Developers would use.

FIGURE 1
LCDP MODEL-DRIVEN DEVELOPMENT SCREEN



Source: Mendix

As businesses roll with waves of discontinuous change, speedy time-to-market of new value-adding digital innovation is crucial, and agility in developing and deploying software is key. Most LCDP tool vendors prominently advertise their products as “agile” or “RAD” tools, acknowledging that their products need to be iterative, leverage reusable components, and present an easy-to-use interface to reach the deployment stage as early as possible. Some of the most time-consuming aspects of software development, testing and deployment activities are handled in the LCDP. The need for extensive testing is reduced due to the LCDP’s pre-built components.

LCDPs can alleviate many of the negative aspects of Shadow IT, but CIOs would be pardoned for being a bit cynical about what could initially be perceived as yet another IT “Silver Bullet.” However, before dismissing LCDPs they should consider these points:

- Shadow IT will happen unless there is a viable alternative such as LCDPs.
- LCDPs can connect to other enterprise systems and access “single source of truth” corporate data.
- LCDP-qualified Citizen Developers can help address the chronic programmer shortage by building some or all parts of an application.
- LCDPs boast collaboration features that facilitate handing-off partially built applications to professional developers who can write custom code to provide rich functionality. Citizen Developers can build prototypes or design the actual interface, reducing the time and cost of iterating with CIT programmers.
- The deep domain knowledge of Citizen Developers such as business analysts can be leveraged through the use of LCDPs. They know the process and how to map it. This saves time on requirements gathering and misunderstandings of business process nuances. Professional developers no longer need to understand all the business complexities because analysts are co-creating applications.
- LCDPs support scalability, security and reduced unit testing as LCDPs have pre-tested components to be usable out-of-the-box.
- Many LCDPs feature built-in tools to rapidly develop mobile apps

While LCDPs ameliorate many Shadow Development challenges, they are not a “Silver Bullet.” Although LCDPs can claim numerous benefits, these benefits are not realizable without significant CIT involvement: LCDPs may still expose the enterprise to risks, such as unmanaged application sprawl and mismanaged database connections. These risks can be reduced through vigilant governance from the CIT but must be addressed. Citizen Developers often require substantial CIT support, particularly at the beginning of their LCDP journey. Effective LCDP governance is crucial: even though LCDPs ameliorate many of the pitfalls associated with Shadow IT, Citizen Developers can inadvertently reveal corporate intellectual property or personally identifiable information (PII), resulting in compliance issues and lawsuits.

As CITs evaluate the viability of adopting LCDPs within their enterprise, they should consider the potential for reducing Shadow Development in conjunction with their other due-diligence activities. Table 1 presents a comparison of Shadow Development and LCDPs.

TABLE 1
COMPARISON OF SHADOW DEVELOPMENT AND LCDPS

| Area of Concern | Shadow Development | LCDP |
|---|--|--|
| Architectural consistency | None | Built-in to the platform but can be violated without proper governance. |
| Data access | Inconsistent, potentially leading to fragmentation | Built-in connectors to external databases that are managed by CIT. |
| Drag-and-drop visual logic flows | | Rich BPMN functionality. |
| Easy-to-use tools | Yes, tools such as MS Excel and MS Access | LCDPs require significant training but once trained can quickly develop apps |
| Easy handoff to professional developers | No | Yes, provided standards are followed. |
| Increases technical debt | Yes | No |
| Mobile development | No | Built in to many LCDPs |
| Scalability | No | Yes, provided standards are followed. |
| Security | Basic to None | Comprehensive |
| Speed of development | High | High |
| Starter templates and microflows | With some applications. | Yes |
| Support | Vendor support, CIT support varies by enterprise. | Supported by CIT. |

A CASE STUDY OF CITIZEN DEVELOPERS AT INSURANCECO

To better understand the successes and challenges enterprises face when adopting an LCDP, interviews were conducted with an organization that has taken a five-year journey that has begun to yield the rewards of rapid application development with an LCDP. InsuranceCo (name disguised), a Fortune 500 company in the Financials Sector, began a search for RAD platforms in 2014. Charles Weindorf, Chief Engineer at InsuranceCo, became interested in LCDPs and sought a solution for two business challenges the company faced. The first challenge was for the CIT to provide very low-cost/low overhead applications to their business constituents. Secondly, he wanted to foster better communication and collaboration between business analysts and CIT developers through the visual medium of flowcharts, for which LCDPs seemed ideal. Weindorf selected Mendix Technology B.V. as InsuranceCo’s low-code platform and began experimenting with its functionality.

Faced with a significant amount of technical debt from years of Shadow IT application development: Weindorf called this “the wasteland of apps”. Mendix was initially intended to be the platform used for consolidating the various Shadow IT applications onto a single CIT-sanctioned platform. However, after realizing the richness of Mendix’s capabilities, InsuranceCo executives decided to take a detour and use Mendix for a major project developed by their CIT. While this first project took longer than initially envisioned, the experience gained by CIT developers helped the group to acquire a great deal of facility with the tool.

CIT developers exclusively used the Mendix LCDP until 2018 when InsuranceCo held a LCDP hackathon with 200 participants, which included participants from business units. One of the four hackathon categories was won by a team comprised of business unit non-professional programmers, demonstrating that business users could successfully develop LCDP applications. After witnessing this success, InsuranceCo's chief analyst believed that the organization's business analysts and user experience experts were prepared to co-develop applications in conjunction with the CIT's engineering team.

One of InsuranceCo's first LCDP Citizen Developer initiatives endeavored to proactively address a Shadow IT concern before the Shadow systems ran into difficulty and required a "crisis mode" CIT fix. This early foray consisted of migrating data from Shadow IT systems (this data was often contained in spreadsheets) into CIT-supported relational databases and then building a Citizen Developer-built Mendix front-end to access the data. Replacing spreadsheet applications with an LCDP solution was viewed as an early "win" essential to keep the LCDP momentum moving forward.

Including Citizen Developers in the development process can reduce time and costs associated with both Waterfall and Agile methodologies. Business analysts can build part of the application instead of writing requirements documents to hand off to the CIT. One area of cost and time savings can come from removing engineers from developing user interfaces, freeing up time for them to perform more esoteric tasks that require their scarce skillset. Charles Weindorf illustrated this by relating how a project he managed avoided multiple iterations between the business and CIT teams by only involving the CIT engineering team after business analysts had finalized the page design. Citizen Developers can experiment with different iterations on the LCDP interface until they arrive at their ideal configuration and then hand off their work to CIT developers who then proceed to "wire up" the interface. Business analysts have also been effective in contributing to a mobile app's user experience by utilizing functionality built in to the LCDP.

Another savings was gleaned from a reduced need for QA review prior to deployment. Using the Mendix visual interface instead of handing spreadsheet-based text requirements to the engineering team helped all parties involved in the development process better communicate, resulting in quickly building the application correctly with fewer logic errors because "we had the conversation up-front and more-or-less desk-checked the process with a subject matter expert that's going to accept the app at the end of the day." Weindorf was quick to point out that LCDP projects actually involved more "back-and-forth" than traditional projects, but these interactions between teams are more productive than they traditionally have been, largely due to better communication via the LCDP's visual interface. He also noted that an unexpected benefit of putting business analysts through LCDP training is that these analysts have a much better understanding of the nuances of the application development process, which leads to the generation of clearer and more parsimonious requirements for projects, including non-LCDP projects.

When asked whether LCDPs will achieve the vision of significantly reducing Shadow IT or are yet another hyped up "silver bullet," Weindorf gave a positive but qualified assessment of LCDPs' potential for Shadow IT diminishment. He stated, "unfortunately, the more capable we make the design software, the easier it is to make a mess out of it – you still have to have some discipline around it." The best-suited category of applications for Citizen Developers to build with minimal help from the CIT can be characterized as "inside the firewall department-level applications with a very well-defined workflow." More complex projects that span organizational boundaries will still require more traditional development practices, although Citizen Developers can build or prototype sections of the project, particularly the user interface component.

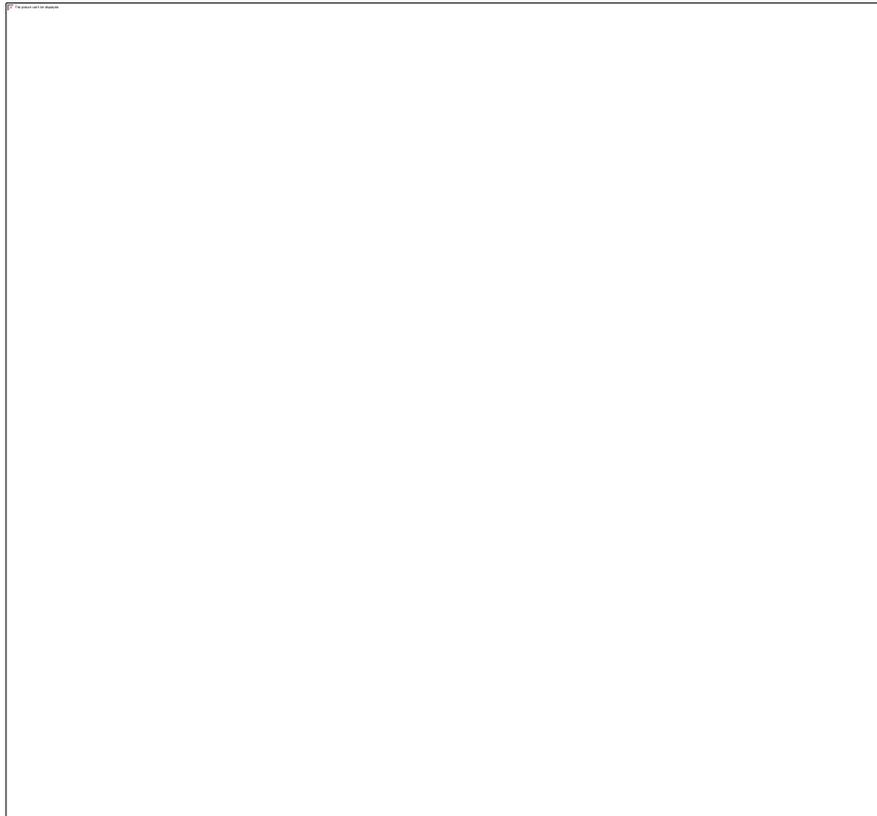
Charles Weindorf advises other IT executives considering LCDPs to be sure to ground expectations of both business and CIT enthusiasts to avoid "Silver Bullet Syndrome." He observed that it is easy for project sponsors to think that LCDPs will solve all their business problems when they sense the excitement of CIT engineers who are enamored with the capabilities of "a clever technical tool." The first consideration for acquiring LCDPs should be that the CIT can employ them to reduce application development time and foster digital innovation agility for certain fast-build applications. The CIT should first acquire expertise in using the platform before inviting Citizen Developers to participate in building applications. Getting "code junkies" (i.e. experienced software developers) to embrace LCDPs and the fast-paced RAD mindset may

require significant cultural change and can be encouraged by such mechanisms as hackathons. When it is time to invite business users in, they should be encouraged to use the LCDP in lieu of Shadow IT tools (e.g. spreadsheets and personal databases) with the rationale that:

- Applications built on the LCDP are permanent solutions as opposed to those that increase the organization's technical debt
- Business users will be able to build on a platform that provides rich tools to help them contribute to more effective applications
- LCDP applications built for business units will be less expensive than the CIT would have charged for a traditional end-to-end solution.

Once the business users begin to explore LCDPs, they may be overwhelmed by the platform's many features and capabilities and it is important for the CIT to be involved in the initial stages to help Citizen Developers focus on those features that will help them achieve early success. After Citizen Developers possess adequate facility with the platform, the organization should develop their approach to pairing business and CIT resources to effectively co-create business applications.

FIGURE 2
INSURANCECO'S LOW-CODE JOURNEY



ANALYSIS OF INSURANCECO'S LCDP JOURNEY

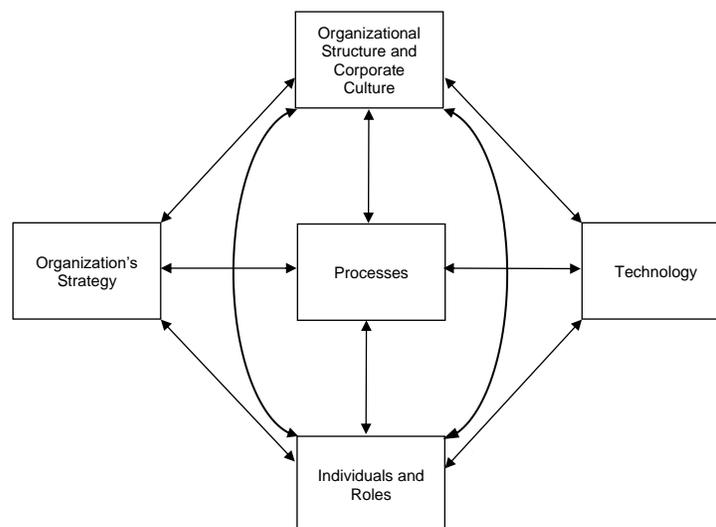
Many factors came into play as InsuranceCo integrated an LCDP into their core business. These factors included hard and soft skills and the program's success was heavily reliant on change management. Effective change management can speed implementation and deliver business benefits sooner than if the change process is not handled effectively; conversely, making change in a vacuum can be costly or even deadly.

An often-cited example of ineffective change management is the insufficient planning in a major corporate ERP implementation scenario (Nelson, 2007). Companies who embark on an ERP implementation without a comprehensive analysis of factors beside the technology component may have their implementation bogged down or even permanently halted. ERPs typically have business processes built into their platform and the firm's business processes either need to be modified to align with those built into the ERP *or* the ERP's code needs to be modified in order to conform to existing business processes: breakdowns occur when misalignments are discovered when the implementation is well underway.

In addition to business process considerations and the expected start-up activities associated with bringing new IT into the organization, business and IT executives need to think about how the LCDP will impact strategic, organization/cultural and requisite employee skills. As noted above, failure to analyze these considerations up-front may delay the expected benefits or derail the initiative altogether.

A useful framework for analyzing these factors is the Rockart-Morton Organizational Change Model (Leavitt, 1963; Rockart & Morton, 1984) (Figure 3). The model consists of five interconnected components that are key to implementing organizational change. The interconnection of these components is represented by double-headed arrows that remind the analyst that all components must be in balance with the others for the change to succeed: if one component changes, all other components must be assessed to determine whether they need to change as well. Each of the components and their interconnections is assessed below.

FIGURE 3
ROCKART-MORTON ORGANIZATIONAL CHANGE MODEL



Strategy

The steps InsuranceCo took to implement an LCDP had its genesis in business strategy. Companies in the industry desire to reduce friction in all aspects of the insurance process for their customers, particularly in the area of providing speedy efficient service. The company had succeeded in a previous digital innovation project which reduced the time to deliver insurance documents from multiple days to minutes. InsuranceCo senior management appreciated how technology can positively influence corporate strategy. Based on the success of previous IT-enabled business change, they began to seek additional opportunities to strategically exploit digital technology. The corporate strategic direction became a part of the IT strategy and InsuranceCo's CIT explored ways of speeding up the application development cycle.

Technology

Seeking to deliver on the strategic goal of speeding up the delivery of insurance products, InsuranceCo began the search for technology solutions that would support faster development and delivery of applications. Continuing to develop applications using traditional programming methodologies did not meet the company's need for a scalable rapid application delivery and required a new technology platform which ultimately led to the selection of an LCDP.

Processes

Application development processes needed to change with the new development platform. Implementing the LCDP without adapting the existing development process would forfeit many of the benefits of this technology platform. Much of the change involved moving from a more traditional development process to RAD mode, which demanded significant cultural changes. As InsuranceCo's development processes matured they were able to deliver LCDP-enabled business process optimizations such as a new quote process, which reduced the business process completion time from approximately two weeks to around five minutes.

Citizen Developers were required to embrace the more formalized LCDP governance processes that varied significantly from the way they had formerly built Shadow IT applications. While adopting the LCDP development processes resulted in more "back-and-forth" between business and CIT actors than the old process, the end result was more productive interactions once everyone used a common platform.

Organization

As the LCDP began to be used for more development projects, a Business Engineering Portfolio team was created, whose purpose was to act as the liaison between the business units and the CIT. This team, who reported to CIT management, was housed within the business units to understand their needs, answer IT-related questions, and coordinate with the CIT on development and delivery. The Business Engineering Portfolio team acted as consultants to assist Citizen Developers in building applications aligned with governance standards to make them production-ready. The CIT had final sign-off on applications that went into the production environment.

While few formal changes were made to the official organization chart, significant informal changes were made to pair business partners with the CIT at multiple levels. According to Weindorf, "our (a CIT) senior vice president has a working relationship with the senior vice presidents who make major budgetary decisions. He can promote the idea of collaboration with our business experts in Low-Code applications. We then have directors and influential managers we call 'app owners' who encourage CIT software engineers to pair with analysts. The real value has come from bringing those who 'do the work' together."

Skills

As would be expected with the introduction of any new development tool into the enterprise, LCDPs will require both professional programmers and Citizen Developers to acquire new skills. Convincing the established CIT programmers that the LCDP was enterprise-class began as a tough sell but the "code junkies" embraced this new way of working as they began to familiarize themselves with the platform's capabilities. To expedite exposure to the platform, InsuranceCo staged a 24-hour hackathon to remove programmers from their day-to-day tasks and incentivize them to discover the benefits of LCDP.

After getting InsuranceCo engineers on-board with the new platform, Citizen Developers received vendor training and began to develop prototype apps. LCDP experts from the CIT were co-located with business developers to be close at hand to support their development efforts. In addition to acquiring LCDP-specific skills, business analysts had a greater appreciation for how to communicate requirements to their CIT counterparts after participating in the application development process themselves.

LESSONS LEARNED FOR IT EXECUTIVES

Enterprises intent on adopting an LCDP must consider a number of factors that can influence the success of introducing a disruptive new technology into the organization and would be well-advised to leverage the experiences of organizations who have already “been there.” Based on the experiences of InsuranceCo, the following “lessons learned” can help guide CIT leaders on their own LCDP journey.

LESSON LEARNED #1: Get Your Professional Programmers Onboard before Bringing Citizen Developers Into the Mix

An LCDP is a development tool that can be used by both the CIT and Citizen Developers. CIT should explore the tool’s capabilities and deliver a few successful applications before attempting to bring Citizen Developers onto the platform. Charles Weindorf was clear about InsuranceCo’s first lesson learned: “We’ve learned a lot the hard way. I would present this: ' if IT gets proficient with this tool, we get a shortened delivery time of applications.” After gaining expertise with the LCDP, InsuranceCo’s CIT contacted their business developer community to invite them to join the application development effort.

LESSON LEARNED #2: CIT Should Expect to Provide Significant LCDP Support to Citizen Developers

Citizen Developers may ultimately be able to relieve some of the application backlog burden, but CIT executives should not lose sight that these non-technical business application developers will continue to require ongoing CIT support. To prepare them for LCDP development, InsuranceCo sent Citizen Developers to vendor training where they became certified on the platform. After certification, the CIT was there to help Citizen Developers navigate the sizeable number of LCDP features that initially overwhelmed them and help them to focus on those features that got them quickly productive. Wiendorf remembers inviting business developers onto the LCDP by suggesting, “rather than spending the time making your own databases and spreadsheets, why don’t you help us with your permanent solution? You’ll not only be able to spend time on a better tool, you’ll also be able to lower whatever costs IT would have charged you for the end-to-end solution.” The CIT provided infrastructure such as cloud containers and connectors to facilitate the development process. Maintaining strong relationships with business developers helped give the CIT confidence that they would not build apps harmful to the enterprise.

LESSON LEARNED #3: Governance of LCDPs Is Essential

While LCDPs provide an CIT-sanctioned platform for use by Citizen Developers, it is essential that the CIT clearly define the boundaries within which business developers may operate. Using an LCDP’s pre-built/pre-tested components and templates will speed the development process and provide rich functionality to non-professional programmers: however, Citizen Developers can still unknowingly expose the enterprise to such perils as proprietary or personal data leakage, even though low-code platforms have guardrails built in to reduce unintended missteps. Business users need to explain what they’re doing and why they’re doing it to the CIT, specifically with respect to data. To prevent inadvertent mistakes, the CIT should retain authority over controls that administer access rights to data. Additionally, the CIT should have the final sign-off before applications are released into the production environment.

LESSON LEARNED #4: Citizen Developers Need to Possess Business Process Mapping Expertise

Citizen Developers’ ability to rapidly build LCDP applications is based on using drag-and-drop interfaces to define business processes. In addition to having deep business domain knowledge, it is also important for them to possess strong business process mapping skills, particularly with the Business Process Model and Notation (BPMN) standard. Most of the major LCDPs incorporate their own implementation of BPMN and having facility with such BPMN concepts as flow objects, data objects, connecting objects and swimlanes are prerequisite skills for LCDP model-driven development. Gartner Group declared, “Business Analysts with business process modelling skills are top choices for Citizen Developers.” (Wong, 2018). While modeling skills are essential for Citizen Developers, CIT programmers can also benefit from

understanding BPMN models to clearly communicate application functionality with their business constituents.

LESSON LEARNED #5: Don't Expect to Reap LCDP Benefits Immediately

While many CIOs are dubious about another IT “Silver Bullet,” hope springs eternal for some who want to believe that a low-code platform can rapidly deliver business benefits. While the benefits of rapid application development/delivery are compelling, it may take some ramp-up time to begin to reap these benefits. In InsuranceCo’s case it took approximately three years for the CIT to be fully competent with the LCDP platform and then additional months to bring Citizen Developers into the development community. CIOs need to be prepared to weather initial resistance from their programming staff who may be set in their preferred development language/methodology ways; delays in understanding LCDP complexities, and false starts on overly-ambitious projects demanded by their business constituents who may not understand the nuances of adopting a new development platform.

CONCLUSION AND GENAI AS A DEVELOPMENT PLATFORM

Enterprise CITs have long sought a solution to Shadow IT and a viable alternative to unsanctioned IT is adopting a Low-Code Development Platform. As they reach a maturity stage recognized by the major IT consultancies, LCDPs are also being acknowledged as a development model that is gaining traction in the practitioner literature and being the theme at major developer conferences (Dimensional Research Survey, 2019). At a recent Salesforce Trailhead DX Developer Conference in 2021, the organization stated that “An urgent need for businesses and organizations to go digital faster is overwhelming resource-constrained IT departments, with 88% of IT leaders who participated in a recent survey saying their workloads have increased in the last 12 months, and 96% saying the current demand for apps isn’t sustainable. To meet this increased need, 83% of IT leaders plan to increase their use of low-code tools.”

The intuitive development tools of LCDPs combined with their built-in security capabilities and ability to scale should ease the CIT’s Shadow IT fears and encourage Citizen Developers to work within an approved framework to deliver new digital business capabilities and reduce application backlog. Software vendors are investing considerable capital to refine LCDP capabilities and offer rich functionality such as prebuilt widgets and connectors to AI services, giving Citizen Developers access to digital innovation tools formerly in the exclusive domain of professional programmers.

Having Citizen Developers building complete or partial applications on LCDPs has many business benefits, but achieving this vision will require considerable CIT participation. CIT must actively support non-professional business developers through training and consulting and actively govern LCDP usage to protect the enterprise from unintended missteps.

Generative AI is rapidly maturing, and its ease of use can accelerate the development of applications by non-professional programmers. Concerns about privacy (e.g. unintended leakage of corporate intellectual property) and security risks, such as vulnerabilities in third-party components, will require enterprises to plan, govern, and train their Citizen Developers thoroughly. But as GenAI usage continues to grow and the overall tech-savviness of business users increases, it will be difficult to hold back the desire and need for business domain experts to build their applications.

While the Citizen Development journey may be a long and winding one, the benefits that can be reaped are substantial: quicker delivery of business applications, marshaling the business domain knowledge and creativity of non-technical business people and reduction of “under-the-radar” Shadow IT projects.

REFERENCES

- Agarwal, R., Prasad, J., Tanniru, M., & Lynch, J. (2000). Risks of rapid application development. *Communications of the ACM*, 43(11).
- Brancheau, J.C., & Brown, C.V. (1993). The management of end-user computing: Status and direction. *ACM Computing Surveys (CSUR)*, 25(4), 437–482.
- Davenport, T.H., Barkin, I., & Tomak, K. (2023). We're all programmers now. *Harvard Business Review*, 101(5), 98–107.
- Dimensional Research. (n.d.). *Digital Disconnect: A Study of Business and IT Alignment in 2019*.
- Gartner. (n.d.). *Top 10 security predictions for 2016*. Retrieved from <https://www.gartner.com/smarterwithgartner/top-10-security-predictions-2016/>
- Griffy-Brown, C., Chun, M., & Lazarikos. (2019). Emerging Technologies and Cyber Risk: How do we secure the Internet of Things (IoT) environment? *Journal of Applied Business and Economics*, 21(2).
- Harris, J., Ives, B., & Junglas, I. (2012). IT Consumerization: When Gadgets Turn Into Enterprise IT Tools. *MIS Quarterly Executive*, 11(3), 99–112.
- Havakhor, T., Sabherwal, S., Sabherwal, R., & Steelman, Z. (2022, June). Evaluating Information Technology Investments: Insights From Executive's Trades. *MIS Quarterly*, 46(2), 1165–1193.
- Leavitt, H.J. (1965). Applied Organizational Change in Industry. *Handbook of Organizations*, Chapter 27. (Chicago: Rand McNally, 1965).
- Negro, A.R., & Mesia, R. (2022). The Business Intelligence and Its Influence on Decision Making. *Journal of Applied Business and Economics*, 22(2).
- Nelson, R. (2007, June). IT Project Management: Infamous Failures, Classic Mistakes and Best Practices. *MIS Quarterly Executive*, 6(2).
- Sullivan, Y.W., Davis, F., & Kohn, C.E. (2022, June). Executive Functions and Information Systems Learning. *MIS Quarterly*, 46(2), 813–880.
- Rockart, F., & Flannery, L.S. (1983). The management of end user computing. *Communications of the ACM*, 26(10), 776–784.
- Rockart, F., & Morton, M.S. (1984). *CISR*. MIT Sloan School of Management.
- Wong Survey Analysis. (2018, September). *Citizen Development Is Happening and IT Needs to Be More Engaged*. Gartner Group.
- Wong, J., & Davis, K. (2022, July). *Harness the Disruptive Powers of Low-Code: A Gartner Trend Insight Report*. Gartner Group.